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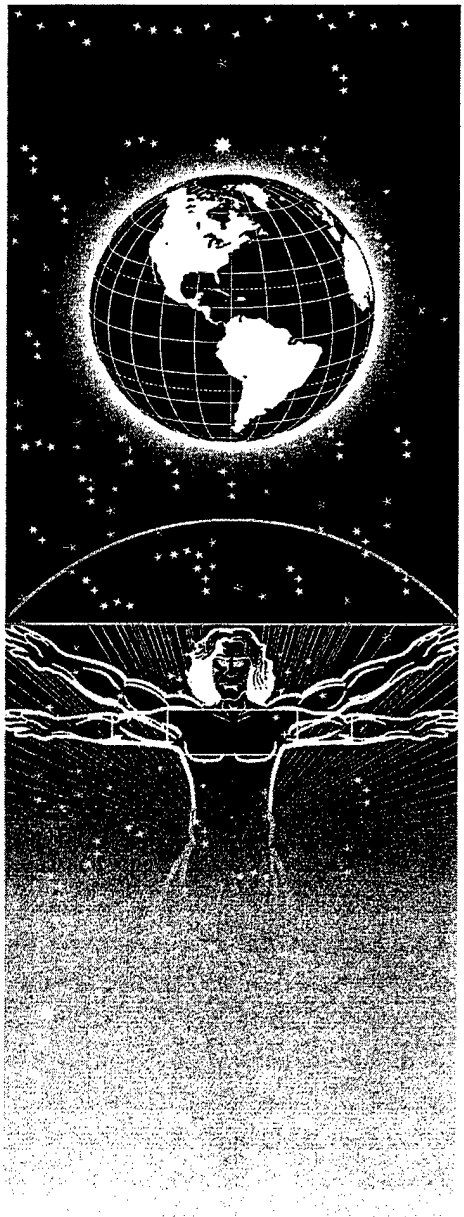

UNITED STATES AIR FORCE RESEARCH LABORATORY

TOTAL PETROLEUM HYDROCARBON CRITERIA WORKING GROUP (TPHCWG) FIELD DEMONSTRATION REPORT: ELMENDORF AIR FORCE BASE, ALASKA

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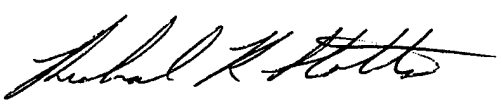

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13. ABSTRACT *(Maximum 200 words)*

A demonstration of the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) approach for assessing human health risk at weathered petroleum release sites was performed at a former underground storage tank (UST) release site at Elmendorf Air Force Base (EAFB), Alaska. The site, ST702/8, Military Airlift Command (MAC) Chalet (Building 31562), a recreational cabin, is impacted by diesel fuel. A total of ten soil samples were obtained at depths to 12 feet below the ground surface (bgs). The soil samples were analyzed for total petroleum hydrocarbons (TPH) as TPH gasoline range organics (GRO) and TPH diesel range organics (DRO), benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and petroleum fractions. Six of the ten primary soil samples contained TPH DRO concentrations above the Alaska Method Two cleanup standard for petroleum migration to groundwater (250 mg/kg). RBSLs were calculated for a recreational and a commercial exposure scenario. For the recreational scenario, only one soil sample exceeded the Tier 1 total TPH RBSL (955 mg/kg). For the commercial exposure scenario four of the site soil samples contained TPH in concentrations that exceeded the Tier 1 total TPH RBSL for the subsurface soil indoor vapor inhalation pathway. Higher tier (Tier 2) risk evaluations are recommended for select data before any remedial actions are imposed.

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PREFACE

This demonstration project was performed by Operational Technologies Corporation (OpTech) under Contract Number DAHA 90-06-D-0014, Delivery Order TG01. OpTech activities were conducted under the Project Management of Dr. Peter Lurker, 1370 North Fairfield Road, Suite A, Beavercreek, Ohio 45432. Dr. Dave Mattie of the Air Force Research Laboratory, Human Effectiveness Directorate, Operational Toxicology Branch (AFRL/HEST) at Wright-Patterson Air Force Base, Ohio, served as contract monitor.

The authors of this report gratefully acknowledge Major Wade Weisman and Airman First Class Andrea Cecetka, 3AMDS/SGPB, and Mr. John Mahaffey, 3CES/CEVQ at Elmendorf Air Force Base, Alaska, for their assistance in planning and conducting the field operations at the demonstration site. We also acknowledge the technical assistance provided by Mr. Richard Entz of Lancaster Laboratories for his guidance on analytical methods for petroleum hydrocarbons and for "walking us through" the analytical data. Our special thanks to Dr. Donna J. Vorhees of Menzie Cura & Associates for providing the spreadsheets needed to calculate Risk-Based Screening Levels (RBSLs) for the petroleum fractions. Ms. Ellen Hedfield of ENSR Corporation helped us select a drilling subcontractor. Doug, Pat Kelly, and Gary Wilson of Hughes Drilling, Soldotna, Alaska, were instrumental in providing the subsurface drilling and sampling support at the demonstration site. Without the outstanding support that was provided by all of these people this demonstration project would not have been possible.

LIST OF ACRONYMS

ADEC	Alaska Department of Environmental Conservation
3AMDS/SGPB	3rd Aerospace Medicine Squadron, Bioenvironmental Engineering Shop
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
C_{sat}	Chemical saturation concentration
3CES/CEQV	3rd Civil Engineering Squadron, Environmental Quality Branch
DRO	Diesel Range Organics
EAFB	Elmendorf Air Force Base
EC	Equivalent Carbon
ENSR	Environmental Services Corporation
GN	Grab Nonpotable
GPS	Global Positioning System
GRO	Gasoline Range Organics
GS	Grab Soil
HI	Hazard Index
HQ	Hazard Quotient
IDW	Investigation Derived Waste
kg	Kilogram
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOQ	Limits Of Quantitation
MAC	Military Airlift Command
mg	Milligram
NAPL	Non-aqueous Phase Liquid
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photoionization Detector
POC	Point Of Contact
QC	Quality Control
RBCA	Risk-Based Corrective Action
RBSL	Risk-Based Screening Level
RES	Residual Saturation
RfD	Reference Dose
RPD	Relative Percent Difference
SERA	State-Elmendorf Environmental Restoration Agreement
TPH	Total Petroleum Hydrocarbons
TPHCWG	Total Petroleum Hydrocarbon Criteria Working Group
UST	Underground Storage Tank

EXECUTIVE SUMMARY

A demonstration of the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) approach for assessing human health risk at weathered petroleum release sites was performed at a former underground storage tank (UST) release site at Elmendorf Air Force Base (EAFB), Alaska. The site, ST702/8, Military Airlift Command (MAC) Chalet (Building 31562), is a recreational cabin located approximately 500 feet from the north shore of Six Mile Lake at EAFB. The site is impacted by diesel fuel at concentrations in site soils above the Alaska Department of Environmental Conservation (ADEC) cleanup levels.

A total of ten soil samples, including one duplicate and one background sample, were obtained at depths ranging from 2 feet to approximately 12 feet below the ground surface (bgs). All samples were obtained by advancing a two inch split spoon sampler ahead of hollow-stem auger flights using a truck mounted drilling rig. All soil samples, with the exception of the background sample, were collected within the known area of contamination where concentrations of petroleum hydrocarbons were expected to be above ADEC cleanup levels. The soil samples were analyzed for total petroleum hydrocarbons (TPH) as TPH gasoline range organics (GRO) and TPH diesel range organics (DRO). The soil samples were also analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and petroleum fractions. The petroleum fractions included both aliphatic and aromatic constituents in the following ranges: C5 to C6 aliphatic (total) hydrocarbons, C6 to C7 aromatic hydrocarbons (benzene only), >C6 to C8 aliphatic hydrocarbons (total minus benzene and toluene), >C7 to C8 aromatics (toluene only), >C8 to ≤C10, >C10 to ≤C12, >C12 to ≤C16, >C16 to ≤C21, and >C21 to ≤C35.

TPH GRO concentrations ranged from <1.1 to 520 mg/kg (dry weight basis) and TPH DRO concentrations ranged from <7.2 to 1,200 mg/kg (dry weight basis). Six of the ten primary soil samples contained TPH DRO concentrations above the ADEC Method Two cleanup standard for petroleum migration to groundwater (250 mg/kg). There was also reasonably good agreement between the petroleum fraction data and TPH GRO and TPH DRO concentrations that were detected in site soils.

Overall the field screening data obtained using a photoionization detector (PID) provided a good indication of the relative concentration of petroleum hydrocarbons in site soils. Except for the total TPH detected in sample number GS000827, there was very good correlation between the PID readings and the TPH concentrations. In samples that had detectable concentrations of petroleum hydrocarbons, the petroleum fractional analysis data provided good consistency between the aliphatic and aromatic weight fractions and the respective percent DRO and GRO concentrations. The petroleum fraction "fingerprint" indicates that the TPH contamination at ST702/8 most likely came from a single source (i.e., the former diesel fuel UST).

Risk-based screening levels (RBSLs) were calculated for recreational and commercial exposure scenarios. Among the direct and indirect soil exposure pathways, the subsurface soil indoor vapor inhalation pathway consistently contained the lowest RBSLs, ranging from 955 mg/kg to

10,900 mg/kg. For this pathway one sample, sample number GS000828, contained a total TPH concentration (1,644 mg/kg) in excess of the Tier 1 total TPH RBSL (955 mg/kg) for the recreational exposure scenario. Much of the risk from this sample for this pathway is attributable to the concentration of TPH in the >C8-C10 aliphatic fraction. For the commercial exposure scenario, four of the site soil samples contained TPH in concentrations that exceeded the Tier 1 total TPH RBSL for the subsurface soil indoor vapor inhalation pathway. As in the recreational exposure scenario calculations, sample number GS000828, with a TPH concentration of 1,644 mg/kg, showed the highest risk, exceeding its RBSL value (157 mg/kg) by more than an order of magnitude. Most of the risk from the samples evaluated for this pathway can be attributed to the concentrations of TPH in the >C8-C10 and the >C10-C12 aliphatic fractions. Higher tier (Tier 2) risk evaluations are recommended for select data before any remedial actions are imposed.

1.0 INTRODUCTION

The Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG or the Working Group) is guided by a steering committee consisting of representatives from industry, government, and academia. Some of the more active participants among the more than 400 involved in the TPHCWG include the Gas Research Institute, Chevron, Exxon, British Petroleum, Shell, the American Petroleum Institute, the Association of American Railroads, several state governments (Colorado, Hawaii, Louisiana, Massachusetts, New Mexico, Texas, and Washington), the U.S. Environmental Protection Agency, the Department of Defense, the University of Massachusetts, EA Engineering, Science & Technology, and Menzie-Cura & Associates, Inc. The Working Group has developed a risk-based approach for assessing sites contaminated with weathered petroleum products, such as gasoline, jet fuel, diesel fuel, and heating oil. The approach utilizes standard site assessment and sampling techniques. It varies from standard site assessment techniques in the petroleum hydrocarbon analysis performed on site samples and the risk analysis methodology used to assess human health risk and associated clean-up requirements. The Working Group approach utilizes a direct method petroleum fraction analysis technique and assesses risks by assigning toxicity values for the various petroleum fractions. It is consistent with the current specific practice of assessing complex mixtures of chemically related constituents. This approach results in development of human health RBSLs specific to the site and contaminant composition[1].

A former UST site contaminated with weathered diesel fuel, located at Elmendorf Air Force Base, Alaska, was selected to demonstrate the TPHCWG approach because the nature and extent of petroleum contamination was well known and adequately documented. Field sampling activities at the demonstration site were conducted on September 19 and 20, 2000 in accordance with the site-specific work plan[2].

1.1 Objectives

The objectives of this project are as follows:

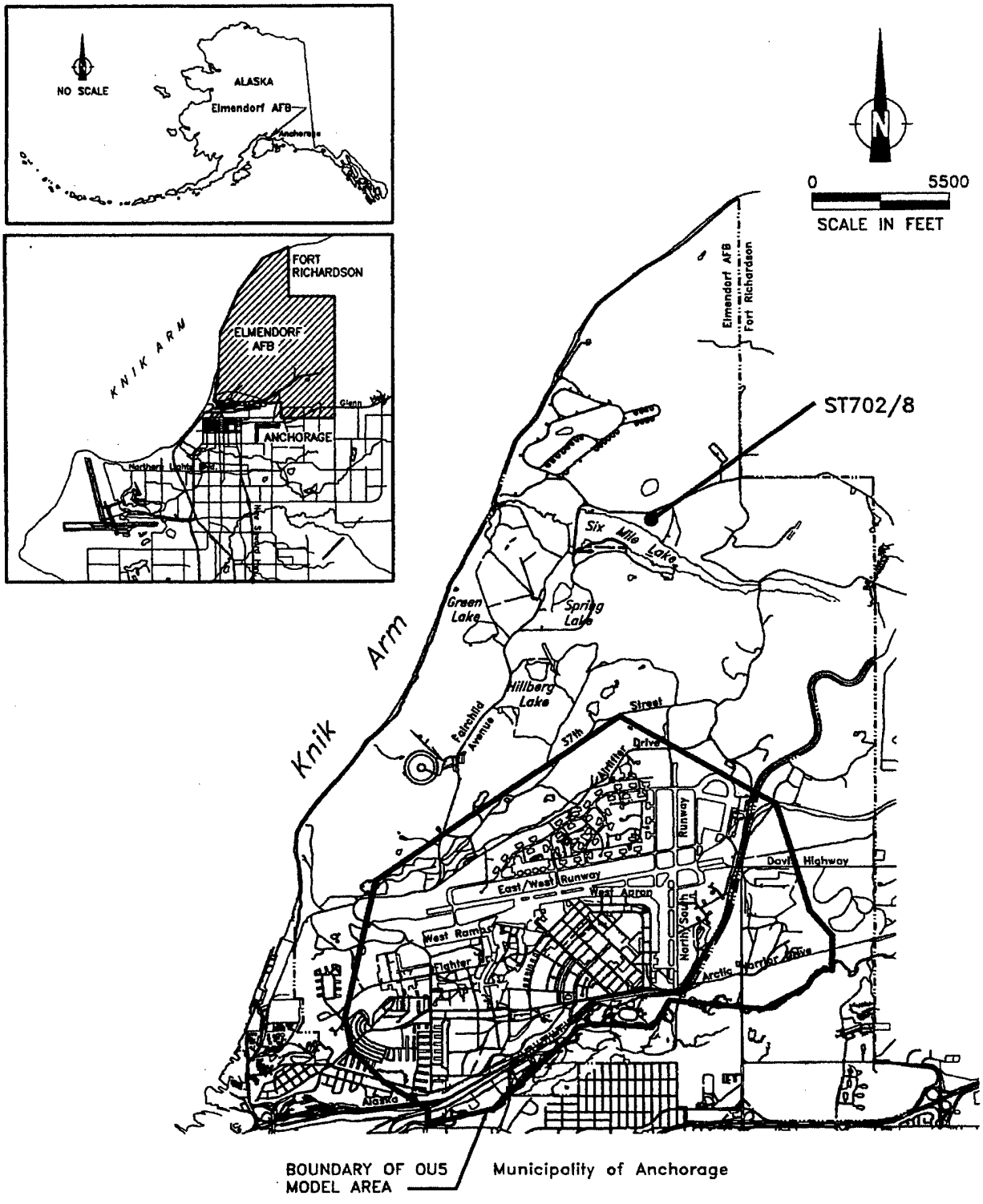
- To effectively demonstrate the utility of the TPHCWG fractional analysis approach in TPH contaminated soil, regardless of fuel type, soil type, environmental setting, or contaminant history.
- To provide additional data on the characteristics of weathered petroleum products in soil to support the development of a cost-effective site assessment program using the risk-based corrective action (RBCA) decision making process.
- To enhance regulatory agency acceptance of the TPHCWG approach for assessing human health risks at petroleum contaminated sites in the United States.

1.2 Site Background and Previous Sampling Results

Site ST702/8, MAC Chalet (Building 31562), is a recreational cabin located approximately 500 feet from the north shore of Six Mile Lake at EAFB (see Figure 1-1). In July 1997, a 1,200-gallon single-walled UST that reportedly had contained diesel fuel used for heating purposes was removed from the north side of the building. The tank excavation was approximately 12 feet long by 5 feet wide by 7 feet deep. According to the tank removal report[3], the tank was in good condition, with slight rust, but no visible holes. All piping between the tank and the building was also removed. An ADEC Category B cleanup level (i.e., DRO concentrations in site soils were above 200 mg/kg) was determined for this site at the time the tank and associated piping were removed[4].

Five primary soil samples and one duplicate were collected after the tank and piping were removed and analyzed for DRO, plus BTEX. DRO concentrations were found to be 330 mg/kg at the bottom center of the tank excavation (approximately 7 feet bgs), 240 mg/kg in the pipe trench, and 1,000 mg/kg in the contaminated soil stockpile. No benzene or toluene was detected in any of the samples. Ethylbenzene was detected at 0.039 mg/kg and total xylenes were detected at 0.28 mg/kg in the sample obtained from the contaminated soil stockpile[4].

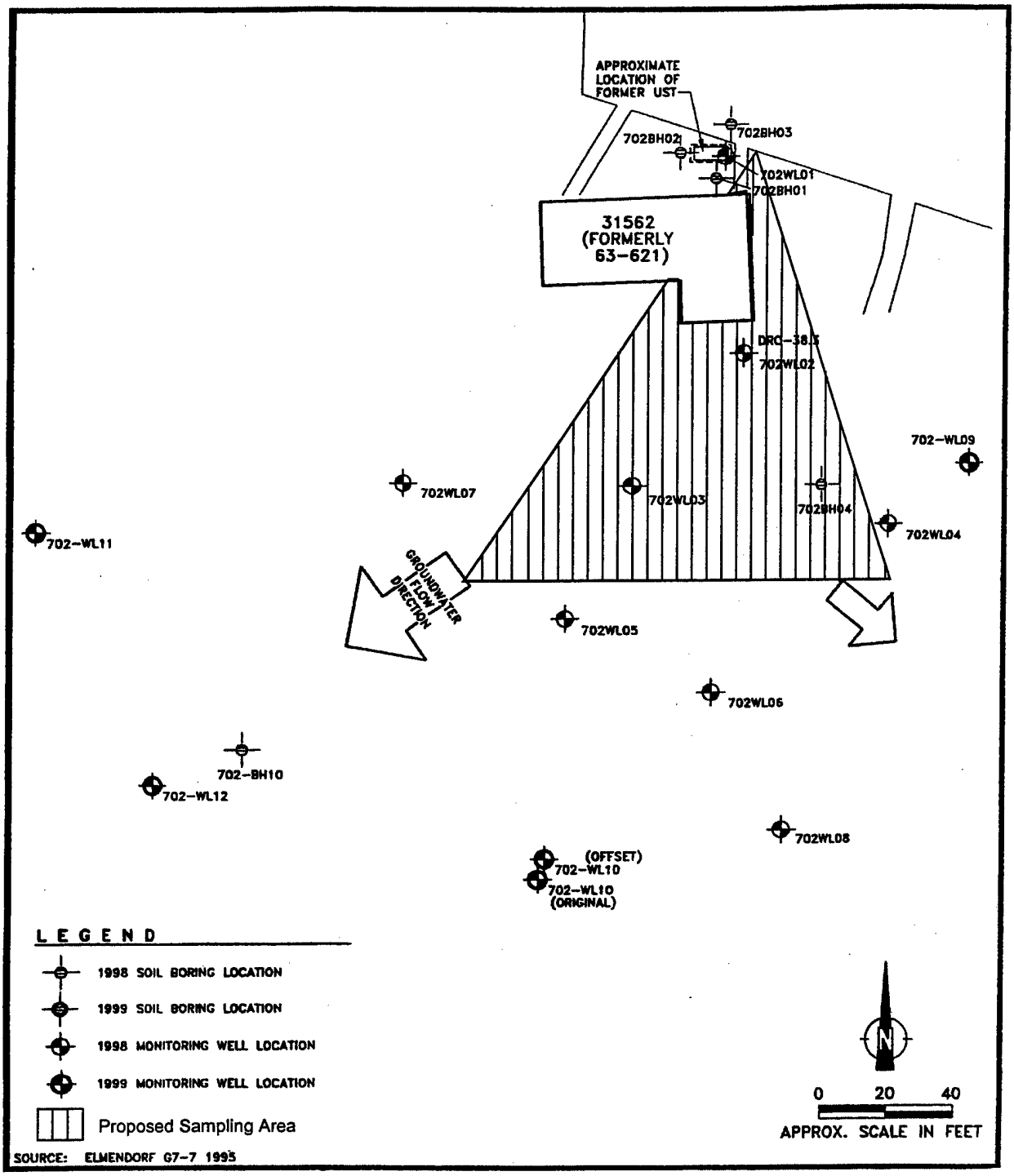
Figure 1-1: Location of ST702/8



Adapted from ENSR (2000)[5]

A release investigation was performed at the MAC Chalet site (ST702/8) under the State-Elmendorf Environmental Restoration Agreement (SERA) Phases VII and VIII in 1998 and 1999, respectively. The maximum DRO concentration detected (12,500 mg/kg) was reported for a soil sample collected at a depth of 15.5 feet bgs in boring 702BH01, located approximately in the center of the former UST footprint (see Figure 1-2). GRO was present in this area at a maximum concentration of 1,320 mg/kg and ethylbenzene was detected at a concentration of 14.1 mg/kg. Concentrations of analytes in a soil boring north of the former UST location (702BH03) were either not detected or were found to be at concentrations well below ADEC action levels. Soil contamination downgradient of the former UST site appeared to be limited to a smear zone at the water table. DRO concentrations up to 2,000 mg/kg, GRO concentrations up to 1,360 mg/kg, plus benzene and ethylbenzene at maximum concentrations of 0.242 mg/kg and 18.5 mg/kg, respectively, were detected in soil borings installed downgradient of the former UST site. Groundwater was contaminated with DRO, GRO, and benzene at concentrations above ADEC action levels. The highest concentration of DRO (131 mg/L) was detected in a sample obtained from monitoring well 702WL03 and free product was also detected in this boring during well development and sampling. Maximum GRO and benzene concentrations of 4.6 mg/L and 0.0666 mg/L, respectively, were detected in a sample obtained from monitoring well 702WL02 (see Table 1-1). Water level measurements indicated that groundwater flow was to the west/southwest, generally towards Six Mile Lake[4].

Figure 1-2: Existing Sample Locations and Proposed Sampling Area



Adapted from ENSR (2000)[5]

Table 1-1: ST702/8 Soil (DRO > 500 mg/kg) and Groundwater Sampling Results*

Sample Number	Date	Matrix	Analyte	Result	Units
702BH01SO15.5	07/06/98	Soil	DRO	12,500	mg/kg
702BH01SO15.5	07/06/98	Soil	GRO	1,320	mg/kg
702BH01SO15.5	07/06/98	Soil	BTEX	46	mg/kg
702BH01SO15.5	07/06/98	Soil	PAH	1,700	µg/kg
702WL01SO16	07/06/98	Soil	DRO	5,660	mg/kg
702WL01SO16	07/06/98	Soil	GRO	219	mg/kg
702WL01SO16	07/06/98	Soil	BTEX	9.4	mg/kg
702WL01SO16	07/06/98	Soil	PAH	10,300	µg/kg
702WL02SO12	07/17/98	Soil	DRO	2,000	mg/kg
702WL02SO12	07/17/98	Soil	GRO	327	mg/kg
702WL02SO12	07/17/98	Soil	BTEX	17	mg/kg
702WL02SO12	07/17/98	Soil	PAH	N/A	
702WL03SO08	07/17/98	Soil	DRO	1,810	mg/kg
702WL03SO08	07/17/98	Soil	GRO	159	mg/kg
702WL03SO08	07/17/98	Soil	BTEX	7.7	mg/kg
702WL03SO08	07/17/98	Soil	PAH	N/A	
702WL03SO13	07/17/98	Soil	DRO	1,630	mg/kg
702WL03SO13	07/17/98	Soil	GRO	206	mg/kg
702WL03SO13	07/17/98	Soil	BTEX	5.5	mg/kg
702WL03SO13	07/17/98	Soil	PAH	N/A	
702WL04SO10	10/20/98	Soil	DRO	1,580	mg/kg
702WL04SO10	10/20/98	Soil	GRO	169	mg/kg
702WL04SO10	10/20/98	Soil	BTEX	9.0	mg/kg
702WL04SO10	10/20/98	Soil	PAH	N/A	
702WL05SO7.5	10/20/98	Soil	DRO	1,690	mg/kg
702WL05SO7.5	10/20/98	Soil	GRO	1,360	mg/kg
702WL05SO7.5	10/20/98	Soil	BTEX	73	mg/kg
702WL05SO7.5	10/20/98	Soil	PAH	N/A	
702WL06SO5.0	10/20/98	Soil	DRO	799	mg/kg
702WL06SO5.0	10/20/98	Soil	GRO	34.3	mg/kg
702WL06SO5.0	10/20/98	Soil	BTEX	2.7	mg/kg
702WL06SO5.0	10/20/98	Soil	PAH	N/A	
702WL07SO10	10/21/98	Soil	DRO	821	mg/kg
702WL07SO10	10/21/98	Soil	GRO	110	mg/kg
702WL07SO10	10/21/98	Soil	BTEX	6.8	mg/kg
702WL07SO10	10/21/98	Soil	PAH	N/A	
702WL02WGN1	08/18/98	Groundwater	DRO	38.3	mg/L
702WL02WGN1	08/18/98	Groundwater	GRO	4.6	mg/L
702WL02WGN1	08/18/98	Groundwater	Benzene	0.067	µg/L
702WL02WGN1	08/18/98	Groundwater	Naphthalene	265	µg/L
702WL03WGN1	08/18/98	Groundwater	DRO	131	mg/L
702WL03WGN1	08/18/98	Groundwater	GRO	1.3	mg/L
702WL03WGN1	08/18/98	Groundwater	Benzene	0.0044	µg/L
702WL03WGN1	08/18/98	Groundwater	Naphthalene	334	µg/L

DRO = Diesel Range Organics
GRO = Gasoline Range Organics
BTEX = Sum of benzene, toluene, ethylbenzene, and xylenes detected in sample
PAH = Polycyclic Aromatic Hydrocarbon (naphthalene) detected in sample
* Extracted from Appendix C, ENSR (1999)[4]

The silty sand and gravel unit encountered in most of the borings and monitoring wells may be acting as a confining unit, impeding the vertical migration of water, and possibly petroleum hydrocarbons. The interval that most of the monitoring wells are screened may also be a perched water table (i.e., perched on top of the confining unit). The free product that was detected in monitoring well 702WL03 in 1998 was not observed during the 1999 investigation. However, free product was found in monitoring well 702WL07 during the 1999 investigation, suggesting that product movement may be associated with migration of a groundwater plume or fluctuations in groundwater levels in the area[5].

2.0 SITE SAMPLING AND ANALYSIS ACTIVITIES

Soil sampling activities at ST702/8 were performed on Sept. 19 and 20, 2000 under the direction of OpTech with the assistance of two 3AMDS/SGPB bioenvironmental engineering shop personnel and two technicians from Hughes Drilling, Soldatna, AK. Sampling was performed in accordance with the work plan[2], which was prepared based on previous investigations by Environmental Services Corporation (ENSR)[5] and to comply with SERA, ADEC regulations, and Elmendorf Air Force Base policies for fieldwork. Deviations from the work plan are incorporated into the following description of the field sampling methods employed.

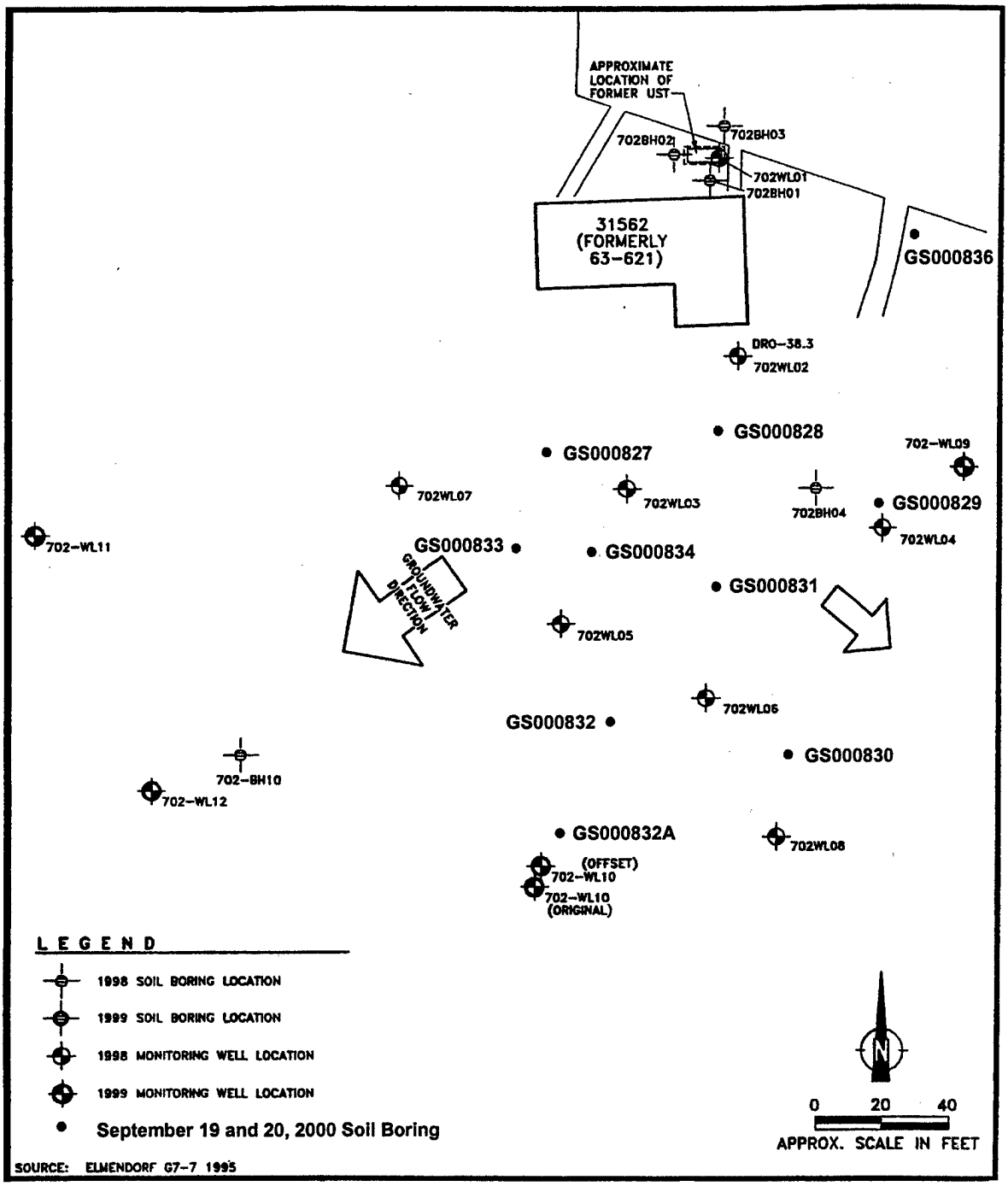
In preparation for sampling activities, drilling permits including utility clearances were obtained by 3AMDS/SGPB prior to breaking ground. MAC Chalet (currently 611 Chalet) building custodians were contacted and keys were obtained to allow access to hot water for decontamination and to restroom facilities. A photograph of the rear of the MAC Chalet and the location of sampling site number GS000827 is shown in Figure C-1, Appendix C.

2.1 Soil Sampling

A total of nine sampling locations were selected using a judgmental strategy. Two of these were surface samples located near areas of recreational activity: the sandbox and a horseshoe pit (see Figure C-2, Appendix C). Six subsurface borings were placed based on results from recent (Sept. 8, 2000) water sampling activities conducted by ENSR, judgment of the sample team leader, and accessibility of locations. One duplicate sample was submitted from these borings. A background sampling point was located upgradient from the contamination source.

Location of all boreholes was recorded using two Global Positioning System (GPS) devices with different units of measure. Positions were noted in latitude, longitude, and uncorrected universal transverse mercator coordinates (military grid); elevation was recorded in both feet and meters. Unfortunately, the GPS readings were not accurate to the scale necessary for plotting sampling points on a map. When possible, borings were triangulated with existing well casings using a 100-foot metal tape measure; if triangulation was not possible, at least two measurements from available well casings were taken. Triangulation measures were used to plot the approximate locations depicted in Figure 2-1. Borings were marked with wood pegs tied with orange marker tape to allow survey if an Alaska-registered surveyor is needed on site for other sampling efforts in the spring of 2001. Pegs were marked with the sample number using a paint pen.

Figure 2-1: ST702/8 Site Sampling Locations



Adapted from ENSR (2000)[5].

Sampling was accomplished with a truck-mounted, hollow stem auger drilling rig and a split-spoon sampler advanced ahead of auger flights. A two-foot long, two-inch inner diameter, three-inch outer diameter spoon was used with a 140-pound, 30-inch drop hammer to obtain sample cores at two-foot intervals. Although the work plan[2] stipulated five-foot sampling intervals, the

available drilling rig used shorter spoons (see Figure C-3, Appendix C). On the first five subsurface borings, samples were collected continuously from the ground surface to the water table. For the last two subsurface sampling points, continuous sampling began at two feet bgs and continued to the water table in order to help speed sampling completion. The deepest subsurface borings were 14 feet bgs. Water table depth measurements were noted "as drilled"; sufficient time was not given for water levels to fully develop.

Immediately after opening the split spoon sampler, cores were placed in new, one-gallon resealable plastic freezer bags and labeled with boring number and depth. The sample was agitated briefly and placed in a warm vehicle for an average of 11 minutes (range 5 to 18 minutes) to allow headspace vapors to develop; time of placement in the vehicle was noted in the field log. During cooler temperatures in the morning, the vehicle was left running; as the day warmed, the vehicle was shut off but remained warmer than ambient temperatures. Vehicle conditions were kept the same for all cores from a borehole. Volatile gas measurements on each core were taken using a 10.2 eV minimum ionization potential HNU Systems, Inc. DL-101 PID (serial number 268060) which had been calibrated by 3AMDS/SGPB personnel according to manufacturer's instructions on Sept. 14, 2000. The PID was field checked daily at the start of sampling to ensure that it was functioning properly.

Field screening was accomplished by removing each bag of soil from the vehicle and moving away from potential vehicle exhaust. The soil was agitated briefly within the bag and the PID sensor inserted through a minimal opening in the top of the bag. The sensor was not side-punched into the bag as indicated by the sampling plan because only the largest resealable bags would hold the entire core; the soil needed to be preserved for potential selection as a sample. Double-bagging the soil after punching through the original bag would have been difficult using the same-sized outer bag. The PID sensor was positioned approximately halfway between the top of the bag and the soil; the sensor was not allowed to contact soil. The highest reading within seconds of sampling was recorded in the field log along with the time of the reading. Staining and odor of the sample were recorded as well.

After field screening, bagged cores were placed in a cooler on freeze packs and kept at approximately 4°C prior to samples being selected. One set of samples was sent per boring for analysis. Two consecutive, non-saturated cores with the highest PID readings were composited from each boring to compose the sample. Compositing cores allowed for enough sample to fill the needed containers given the high rock and gravel content of the soil. Composited cores were homogenized in a stainless steel pail with a stainless steel scoop or spoon. Each sample set was composed of three 125-mL widemouth glass sample bottles; no preservatives were used. The sample jar pre-labeled for GRO/BTEX was filled first with minimal headspace allowed. The PAHs and Hydrocarbon Speciation jars were also filled as completely as possible. A moisture sample was collected for each boring in a 4.5 oz plastic cup. Sample jars were kept on freeze packs in a separate cooler from the core bags.

Samples were not taken from the sixth borehole (GS000832A), as there was no staining and no PID readings above background (surface) levels until the spoon reached soil saturated with groundwater and free product. This borehole was grouted with bentonite and the rig was moved upgradient to get a sample (noted as GS000832). The rig hit refusal between four and six feet

bgs on another boring. The team decided to offset this hole by 4.5 feet and drill again. The offset borehole proved successful and sample GS000833 was taken. Refusal occurred again on borehole GS000834 between four and five feet bgs; the auger was used to advance the boring to five feet and split spoon sampling resumed. The background boring was drilled to five feet and soil collected in the split spoon between five and nine feet, the average range of sample depth. Due to the high rock content, there wasn't enough soil to fill two sets of sample jars for background analysis, so the driller dropped the spoon again and sampled from seven to ten feet to collect more soil.

2.2 Field Quality Control Samples

A field duplicate sample set was collected from boring GS000833 and marked as GS000835. The duplicate was submitted blind to the laboratory to evaluate laboratory precision, accuracy, and repeatability. On three occasions, rinsate blanks were collected directly from the split spoon as it was rinsed with deionized water at the conclusion of the decontamination process. These rinsate blanks were collected to evaluate the effectiveness of equipment decontamination procedures that were used in the field. In addition, water blanks were filled directly from three different commercially purchased jugs of deionized water to ensure no volatile hydrocarbons were inadvertently introduced during sample collection activities. Water samples were collected in 40 mL glass vials preserved with hydrochloric acid; liquid samples were filled to a positive meniscus, capped, and inverted to ensure there were no bubbles. Pre-labeled trip blanks from Lancaster Laboratories accompanied samples at the site and during return shipment to the laboratory. A temperature blank prepared by Lancaster was returned with the samples to determine if the arrival temperature met the goal of $4 \pm 2°C$. A double set of soil samples was sent from the background location for matrix spike and matrix spike duplicate analyses.

2.3 Field Sample Identification

Soil samples and the boreholes from which they came were given unique sample identification codes as assigned by 3 MDS/SGPB and recorded in the bioenvironmental engineering shop register. The rinsate blank and water blank were also assigned unique numbers consistent with this code. All sample labels bore this code. On soil sample labels, the depth of the sample was recorded as a range (e.g., 4-6 ft). The 3AMDS/SGPB sample identification code deviated from the sampling plan, which assumed use of a system previously used by ENSR[2].

Sample numbers consist of two letters showing the type of sample (GS for Grab Soil or GN for Grab Nonpotable water) followed by the year (00 for 2000) and a unique four digit number for each sample. The duplicate samples were given separate, non-consecutive identification numbers (GS000833 and 0835) but were not given fictitious depths (both were marked 2 to 6 feet). Two other non-duplicate samples were taken from the same depth (GS000827 and 0828, both were sampled at 8 to 12 feet); therefore the laboratory could not have been certain which sets were duplicates.

2.4 Sample Packaging and Shipping

Samples were packed and shipped by noon of Sept. 21, 2000 and received by Lancaster Laboratories on the morning of Sept. 22. Soil sample jars were placed in individual resealable bags. Water samples were placed in a foam carrier provided by the laboratory. Bags of water ice were placed in a second large resealable bag and laid flat in the bottom of the cooler. Heavy cardboard was then placed on top. Cardboard spacers were used to keep samples away from the sides of the cooler and to allow air circulation. Samples were placed within these spacers and covered with a sheet of bubble wrap. Additional double bags of water ice were packed on top. Completed chain of custody forms were sealed in plastic bags and placed inside the cooler after noting chain of custody seal numbers. Packaging tape was wrapped around the cooler width and length. Chain of custody tape was applied at all four corners and covered with clear packaging tape. The sample cooler was shipped via Federal Express to the attention of Richard Entz, Lancaster Laboratories, 2425 New Holland Pike, Lancaster, PA 17605-2425. A copy of the shipping documents was retained for project records.

2.5 Field and Sample Custody Documentation

Field notes were recorded in a bound logbook in indelible ink. Notes included:

- PID parameters (model, type, daily field check)
- Split spoon parameters (spoon size, hammer weight)
- Borehole location (GPS readings, triangulated measurements from existing wells)
- Sample core information (blowcounts per six-inch intervals, time sample was placed in vehicle to warm, if vehicle was running, time removed from vehicle to read PID, PID reading)
- Sequence of water blanks and rinsate blanks collected
- Sample hydrocarbon odor
- Number of feet drilled
- Drilling subcontractor and contact information

OpTech took a small number of photographs. These depicted sampling activities and site conditions.

2.6 Decontamination

Sampling tools were decontaminated by first scrubbing with a brush in clean water, followed by scrubbing in an Alconox solution and rinsing in clean water. Finally, the tools were rinsed with deionized water. Tools decontaminated in this manner included the split spoons and attachments and stainless steel scoops, spoons and buckets. Personnel performing decontamination wore nitrile gloves under clean, chemical resistant waterproof gloves; the long outer glove cuffs were taped to their Tyvek suits.

Auger flights and waste soil buckets were decontaminated with high-pressure hot water before the project and at the conclusion of sampling. Auger flights were used once and stored until decontamination.

2.7 Disposition of IDW

Borehole cuttings and cores not used for sampling were collected in five 55-gallon drums and disposed of as investigation derived waste (IDW). Wash and rinsate water was contained separately in two drums filled 2/3 full to allow for expansion during freezing. All drums were labeled with permanent paint pen showing the sampling date, soil borehole numbers (or rinsate water), site name (MAC Chalet) and point of contact (POC - Mahaffey). Drums were transported to the Environmental Staging Facility; subsequent disposition of IDW will be handled by 3CES/CEVQ (John Mahaffey).

Disposable personal protection equipment (Tyvek suits, gloves) and sampling wastes (soiled resealable bags, Chemwipes) were contained in a plastic drum. This drum was sent to EAFB's Temporary Storage and Disposal Facility and was disposed of as non-hazardous waste.

3.0 WORKING GROUP APPROACH FOR TIER 1 ASSESSMENTS

3.1 Identification of Exposure Scenarios

A complete exposure scenario includes a source of contamination, a transport mechanism, an exposure pathway, and a receptor. For this project it was assumed that contaminants present in surface and subsurface soils are transported via wind erosion, by volatilization to indoor and outdoor air, and by leaching to groundwater. Because the MAC Chalet is a recreational facility, it was assumed that recreational receptors exist at the site. Commercial receptors were also assumed to exist at the site because historical activities include occasional construction and minor maintenance functions. Consequently, the following exposure scenarios were evaluated in Tier 1:

- Direct contact with surface soils by recreational and commercial receptors
- Inhalation of indoor (cabin) air by recreational and commercial receptors
- Inhalation of outdoor (on-site) air by recreational and commercial receptors
- Ingestion of groundwater (local well water) by recreational and commercial receptors

3.2 Calculation of Tier 1 RBSLs

Tier 1 RBSLs were calculated using a procedure developed by the TPHCWG, which is based upon the standard default equations and geological factors used in The American Society for Testing and Materials (ASTM) RBCA process[6]. This procedure differs from the RBCA framework in that it considers additivity of risk. Additivity of risk is usually not considered in a

Tier 1 evaluation because RBSLs are generally developed for a limited number of constituents. However, because TPH is a complex mixture, the approach used to calculate TPH RBSLs differs from that used for individual chemicals of concern. Evaluating TPH as a mixture is also important for assessing interactions between different individual chemicals or fractions that impact fate and transport modeling. The TPHCWG RBSL calculations use Raoult's Law to more accurately represent the behavior of chemicals in a mixture. For this analysis, mixture effects as defined by Raoult's Law were excluded to increase conservatism in the risk estimate[7].

To incorporate the concept of risk additivity into the calculation of a RBSL for the TPH mixture, hazard quotients (HQs) are calculated for each TPH fraction. Rather than compare each individual HQ to an acceptable value of 1.0, the sum of all the HQ values is calculated to derive the overall hazard index (HI). This HI for the entire TPH mixture (i.e., all fractions combined) is compared to the acceptable risk level of 1.0.

Another important consideration in the RBSL calculation is an upper exposure limit for cross media pathways, such as soil leaching to groundwater or volatilization to indoor or outdoor air. This upper limit, the chemical saturation concentration (C_{sat}) is the soil concentration at which the sorption limits of the soil particles, the solubility limits of the soil pore water, and the saturation limit of the soil pore air have been reached. C_{sat} is not equivalent to the concentration at which free product is observed; it is an upper limit for transport of petroleum fractions in cross-media pathways. A similar and related term is residual saturation (RES). When calculating RBSLs, a value of RES means that the selected risk level (e.g., HI = 1.0) could not be reached or exceeded for the pathway and scenario given the constituents present, regardless of the contaminant concentration. The value of RES is attained at the TPH concentration at which the C_{sat} of the mixture is reached (i.e., each fraction has reached C_{sat}). When calculating the whole TPH RBSL, a value of RES indicates that even if the concentration of each fraction is set equal to C_{sat} for that fraction and pathway, the combined risk associated with each fraction still does not yield a HI of 1.0. It is important to note that C_{sat} is not an appropriate constraint for the direct contact pathway because the exposure is to the contaminated soil and not to a medium to which the soil contamination has been transferred. Although C_{sat} may limit exposure for this pathway, not using C_{sat} to limit exposure increases conservatism in the risk calculation[7].

3.3 RBSL Calculation Procedures

As stated above, RBSLs for each TPH fraction and each pathway are calculated using standard ASTM RBCA default equations[6]. The fraction-specific fate and transport data are presented in Table 3-1 below, and the toxicity data are presented in Table 3-2. The procedure for calculating TPH RBSLs for cross-media pathways based upon summing the risk from each fraction is somewhat more complex[7].

Table 3-1: Hydrocarbon Fractions and Associated Properties

TPH Fractions	Solubility (mg/L)	Henry's Constant (dimensionless)	Vapor Pressure (atm)	Log K_{oc} (c/c)	BP (°C)	MW (g/mole)
Aliphatic						
EC5-6	28	33	0.5	2.9	51	81
EC>6-8	4.2	50	0.85	3.6	96	100
EC>8-10	0.33	80	0.0081	4.5	150	130
EC>10-12	0.026	120	7.8E-4[c]	5.4	200	160
EC>12-16	5.9E-4	520	3.5E-5	6.7	260	200
EC>16-21	1.0E-6	4,900	1.7E-6	8.8	320	270
Aromatic						
EC5-7[a]	18	0.23	0.13	1.9	80	78
EC>7-8[b]	520	0.27	0.038	2.4	110	92
EC>8-10	65	0.48	0.0081	3.2	150	120
EC>10-12	25	0.14	7.8E-4	3.4	200	130
EC>12-16	5.8	0.053	3.5E-5	3.7	260	150
EC>16-21	0.51	0.013	1.7E-6	4.2	320	190
EC>21-35	0.0066	6.7E-4	7.9E-9	5.1	340	240

[a] (Benzene)
[b] (Toluene)
[c] (scientific notation, 7.8×10^{-4})
BP = boiling point
EC = equivalent carbon number
K_{oc} = octanol-water partition coefficient
MW = molecular weight
Note: Values are based on pure compounds; behavior may differ in complex mixtures.

Table 3-2: TPHCWG Toxicity Fraction-Specific Reference Doses (RfDs) (mg/kg/day) and Reference Concentrations (RfCs) (mg/m^3)

Carbon Range	Aromatic	Critical Effect	Aliphatic	Critical Effect
EC5-6 EC7-8	0.2 – Oral 0.1 – Inhalation	Hepatotoxicity, Nephrotoxicity	5 – Oral 5 – Inhalation	Neurotoxicity
EC9-10 EC11-12 EC13-16	0.04 – Oral 0.05 – Inhalation	Decreased body weight	0.1 – Oral 0.3 – Inhalation	Hepatic and hematological changes
EC17-21 EC22-34	0.03	Nephrotoxicity	1	Hepatic (foreign body reaction) granuloma

For leaching and volatilization pathways, transport and therefore exposure are maximized at C_{sat} for specific fractions. Using this basis, the HQ for each fraction is calculated as the minimum of two values: (1) the weight percentage of the fraction times the whole TPH RBSL, divided by the fraction RBSL, or (2) C_{sat} for the fraction, divided by the fraction RBSL. The HI is defined as the sum of the HQs for each fraction. Using these calculations, the whole TPH RBSL can be

calculated iteratively, under the constraint that the sum of the weight fractions does not exceed 1.0[7].

For direct exposure routes such as soil ingestion, dermal absorption, and particulate inhalation, the exposure is not limited by C_{sat} because intake will continue to increase linearly with soil loading beyond C_{sat}. (Note: The presence of non-aqueous phase liquid (NAPL) in the soil is not an issue in a direct contact pathway because the receptor is already directly exposed to the contaminated soil.) In this case, the HQ for each fraction is defined as the weight percentage of the fraction times the whole TPH RBSL, divided by the fraction RBSL. The sum of all HQs is equal to the HI for the mixture, which must be less than 1.0 to meet the target risk level[7]. The equations used to calculate the TPH fraction RBSLs and the whole TPH RBSL (C_{TPH}) are provided in Appendix B.

4.0 ANALYTICAL RESULTS

4.1 Analytical Data Summary

A summary of the analytical data for the eight primary soil samples, the one duplicate, and the one background soil sample collected at site ST702/8 is shown in Table 4-1. The approximate locations where the soil samples were collected and their respective sample numbers are shown in Figure 2-1. All soil samples were analyzed for BTEX, PAHs, TPH-GRO, TPH-DRO, and the TPHCWG aliphatic and aromatic fractions.

4.2 BTEX and TPH Analysis by Standard Methods

As shown in Table 4-1, no benzene or toluene concentrations were above method detection limits in any of the samples. Ethylbenzene was detected in sample numbers GS000828 and GS000834 at concentrations of 870 µg/kg and 92 µg/kg, respectively. Xylene was also found in these samples at concentrations of 4,400 µg/kg and 240 µg/kg, respectively. Naphthalene was detected in sample number GS000828 at a concentration of 1,700 µg/kg. No other PAHs were above method detection limits in any of the other samples. TPH GRO concentrations ranged from less than 1 mg/kg to 520 mg/kg. TPH DRO concentrations ranged from less than 7.2 mg/kg to 1,200 mg/kg. Sample number GS000828 contained the highest concentrations of both TPH GRO and TPH DRO. This sample was collected downgradient of monitoring well number 702WL02 at a depth of approximately 10 feet bgs. This sampling location was closer to the MAC Chalet and to the former location of the UST than the other sample locations. Both surface soil samples and the background soil sample contained no detected levels of any of the target compounds listed in Table 4-1. Six of the seven subsurface soil samples, including one duplicate, were found to contain TPH DRO concentrations above the ADEC Method Two cleanup level of 250 mg/kg for the migration to groundwater pathway.

4.3 TPH Aliphatic and Aromatic Fractions by the Direct Method

All soil samples, including the background sample, were analyzed for aliphatic and aromatic petroleum fractions, as shown in Table 4-1. The highest concentrations of petroleum hydrocarbons were detected in the >C12-C16 aliphatic fraction. These results were consistent with the TPH GRO and TPH DRO analytical data, which indicated that most of the detectable TPH constituents were in the DRO range. The sum of the petroleum fraction concentrations was also reasonably comparable to the sum of the TPH GRO and DRO concentrations for those samples containing detectable levels of petroleum hydrocarbons. Measured concentrations of TPH fractions (i.e., with all non-detects set to zero) ranged from 68 percent to 147 percent of the total TPH (GRO + DRO), with an overall average of 98 percent for the six samples, including one duplicate, containing detectable TPH concentrations.

4.4 Comparison of Analytical Results with Field Screening Data

The field screening data obtained by performing an ambient temperature headspace analysis of soil samples using a PID are shown in Table 4-1. The PID readings provided a good indication of the relative concentration of petroleum hydrocarbons in site soils. The highest PID reading (155 ppm) was detected for the sample that contained the highest TPH concentration. Similarly, the second highest PID reading (152 ppm) was obtained from the sample that held the second highest TPH concentration. With the exception of sample number GS000827, there was generally very good agreement between the PID reading and the total TPH concentration detected in the soil samples collected for this demonstration project.

Table 4-1: Analytical Data Summary, MAC Chalet Site ST702/8
TPHCWG Demonstration Project

	Field Sample Numbers									
	GS000827	GS000828	GS000829	GS000830	GS000831	GS000832	GS000833	GS000834	GS000835[1]	GS000836[2]
Depth (feet bgs)	8 to 12	8 to 12	4 to 8	0 to 2	0 to 2	4 to 8	2 to 6	5 to 9	2 to 6	5 to 10
PID reading (highest in ppm)	136	155	127	3.4	1.6	51	146	152	146	4.8
Moisture (% by weight)	8.5	7.67	4.12	18.4	11.9	8.45	3.57	6.08	4.77	3.24
VOCs (ug/kg)										
benzene	<27	<680	<26	<6	<6	<5	<26	<27	<26	<5
toluene	<27	<680	<26	<6	<6	<5	<26	<27	<26	<5
ethylbenzene	<27	870	<26	<6	<6	<5	<26	92	<26	<5
xylene	<27	4,400	<26	<6	<6	<5	<26	240	<26	<5
PAHs (ug/kg)										
acenaphthene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
pyrene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
naphthalene	<360	1,700	<340	<400	<370	<360	<340	<350	<350	<340
acenaphthylene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
fluorene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
phenanthrene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
anthracene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
fluoranthene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
benzo(a)anthracene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
chrsyene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
benzo(b)fluoranthene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
benzo(k)fluoranthene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
benzo(a)pyrene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
indeno(1,2,3-cd)pyrene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
dibenz(a,h)anthracene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
benzo(g,h,i)perylene	<360	<360	<340	<400	<370	<360	<340	<350	<350	<340
TPH-GRO (mg/kg)	19	520	13	<1.2	<1.1	<1.1	35	110	27	<1.0
TPH-DRO (mg/kg)	690	1,200	440	25	23	9.8	300	1,000	310	<7.2
Total TPH (GRO+DRO) (mg/kg)	709	1720	453	26	24	11	335	1110	337	8
Total TPH Fractions (mg/kg)[3]	588	1682	534	134	120	116	449	828	570	111
HYDROCARBON FRACTIONS (Dry Weight Data) (mg/kg)										
Volatile Range 1	<0.22	<4.3	<0.21	<0.25	<0.23	<0.22	<0.21	<2.13	<0.21	<0.21
Volatile Range 2	<0.22	13.5	<0.21	<0.25	<0.23	<0.22	<0.21	<2.13	<0.21	<0.21
Aliphatics										
>C8 - <=C10	26.8	196.3	<8.3	<10	<9.1	<8.7	10.8	62.1	13.7	<8.3
>C10 - <=C12	165.9	515.4	143.5	<10	<9.1	<8.7	135.1	243	188.6	<8.3
>C12 - <=C16	252	518	274	<25	<23	<22	180	305	245	<21
>C16 - <=C21	<22	<22	<21	<25	<23	<22	<21	<21	<21	<21
>C21 - <=C35	<55	<54	<52	<61	<57	<55	<52	<53	<53	<52
Aromatics										
>C8 - <=C10	<4.4	29.1	<4.2	<9.8	<4.5	<4.4	<4.1	6.2	<4.2	<4.1
>C10 - <=C12	9.1	125.2	<8.3	<10	<9.1	<8.7	13.2	44.8	11.6	<8.3
>C12 - <=C16	54	206	32	<25	<23	<22	34	91	35	<21
>C16 - <=C21	<22	<22	<21	<25	<23	<22	<21	<21	<21	<21
>C21 - <=C35	<55	<54	<52	<61	<57	<55	<52	<53	<53	<52
Total TPH Fractions (mg/kg)[3]	588	1682	534	134	120	116	449	828	570	111

Note 1 - duplicate soil sample; Note 2 - background soil sample
Note 3 - Total TPH fraction concentrations include values set to 1/2 the detection limit for fractions that were not detected (i.e., for quantities indicated by < in the table)
Volatile Range 1 = C5 to C6 aliphatic (total) hydrocarbons; C6 to C7 aromatic hydrocarbons (benzene only)
Volatile Range 2 = >C6 to C8 aliphatic (total minus benzene and toluene) hydrocarbons; >C7 to C8 aromatics (toluene only)

4.5 Fingerprint Analysis of TPH Fractions

The analytical data described above were subjected to a first order "fingerprint" analysis as shown in Table 4-2. This first order "fingerprint" analysis summarizes the weight fraction of aliphatic and aromatic compounds that were detected in each sample. With the exception of the samples containing no detectable concentrations of petroleum hydrocarbons (i.e., sample numbers GS000830 through GS000832, and sample number GS000836), the "fingerprint" data indicated good consistency between the aliphatic and aromatic weight fractions and their respective percent DRO and GRO concentrations. For all six samples with detectable levels of petroleum compounds (i.e., 0827, 0828, 0829, 0833, 0834, and 0835), the weight percent of

aliphatic fractions ranged from 75.48% to 85.22% and the weight percent of the aromatic fractions ranged from 14.78% to 24.52%. Although this limited analysis is not conclusive, it does indicate that the petroleum contamination detected in site soils most likely came from the same source (i.e., the diesel fuel stored in the former UST).

Table 4-2: TPHCWG Demonstration, MAC Chalet, Site ST702/8
"Fingerprint" Analysis

Sample Numbers →	GS000827	GS000828	GS000829	GS000830	GS000831	GS000832	GS000833	GS000834	GS000835[1]	GS000836[2]
TPH Fractions ↓	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.	Wt. Frac.
	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg	mg/kg/mg/kg
>C5-C6 Aliphatics	2.00E-04	1.30E-03	2.10E-04	1.20E-03	1.30E-03	1.30E-03	2.50E-04	1.30E-03	1.90E-04	1.30E-03
>C6-C8 Aliphatics	2.00E-04	8.20E-03	2.10E-04	1.20E-03	1.30E-03	1.30E-03	2.50E-04	1.30E-03	1.90E-04	1.30E-03
>C8-C10 Aliphatics	4.90E-02	1.20E-01	8.20E-03	5.00E-02	5.00E-02	5.00E-02	2.60E-02	7.70E-02	2.50E-02	5.00E-02
>C10-C12 Aliphatics	3.00E-01	3.10E-01	2.80E-01	5.00E-02	5.00E-02	5.00E-02	3.20E-01	3.00E-01	3.50E-01	5.00E-02
>C12-C16 Aliphatics	4.60E-01	3.20E-01	5.40E-01	1.20E-01	1.30E-01	1.30E-01	4.30E-01	3.80E-01	4.50E-01	1.30E-01
>C16-C21 Aliphatics	2.00E-04	6.70E-05	2.10E-02	1.20E-01	1.30E-01	1.30E-01	2.50E-02	1.30E-02	1.90E-02	1.30E-01
>C5-C7 Aromatics	4.60E-06	3.30E-05	4.90E-06	3.00E-05	3.30E-05	2.90E-05	5.90E-06	3.30E-05	4.60E-06	3.00E-05
>C7-C8 Aromatics	4.60E-06	3.30E-05	4.90E-06	3.00E-05	3.30E-05	2.90E-05	5.90E-06	3.30E-05	4.60E-06	3.00E-05
>C8-C10 Aromatics	4.00E-03	1.80E-02	4.10E-03	4.90E-02	2.50E-02	2.50E-02	4.90E-03	7.70E-03	3.90E-03	2.50E-02
>C10-C12 Aromatics	1.70E-02	7.60E-02	8.20E-03	5.00E-02	5.00E-02	5.00E-02	3.10E-02	5.60E-02	2.10E-02	5.00E-02
>C12-C16 Aromatics	9.80E-02	1.30E-01	6.30E-02	1.20E-01	1.30E-01	1.30E-01	8.00E-02	1.10E-01	6.40E-02	1.30E-01
>C16-C21 Aromatics	2.00E-02	6.70E-03	2.10E-02	1.20E-01	1.30E-01	1.30E-01	2.50E-02	1.30E-02	1.90E-02	1.30E-01
>C21-C35 Aromatics	5.00E-02	1.60E-02	5.10E-02	3.00E-01	3.10E-01	3.20E-01	6.20E-02	3.30E-02	4.90E-02	3.10E-01
Total	9.99E-01	1.01E+00	9.97E-01	9.81E-01	1.01E+00	1.02E+00	1.00E+00	9.92E-01	1.00E+00	1.01E+00
Aliphatics	81.07%	75.48%	85.22%	34.89%	35.98%	35.63%	79.80%	77.85%	84.33%	35.98%
Aromatics	18.93%	24.52%	14.78%	65.11%	64.02%	64.37%	20.20%	22.15%	15.67%	64.02%
>C10-C12 Aliphatics	30.00	30.80	28.10	5.10	5.00	4.90	31.90	30.20	35.00	5.00
>C12-C16 Aliphatics	46.10	31.80	54.20	12.20	12.90	12.80	42.80	38.30	44.90	12.90
>C16-C21 Aliphatics	0.02	0.01	2.11	12.23	12.9	12.77	2.49	1.31	1.9	12.9
>C12-C16 Aromatics	9.8136	12.9182	6.3194	12.2267	12.9011	12.7744	7.9649	11.0846	6.3918	12.9012
>C16-C21 Aromatics	2.0028	0.6658	2.1065	12.2267	12.9011	12.7744	2.489	1.31	1.8976	12.9012
% of Total Fractions	87.94	76.19	92.84	53.98	56.60	56.02	87.64	82.20	90.09	56.60
DRO (% of Total TPH)	97.3	69.8	97.1	96.2	95.8	90	92.3	90.1	92	87.8
>C5-C6 Aliphatics	0.02	0.13	0.02	0.12	0.13	0.13	0.02	0.13	0.02	0.13
>C6-C8 Aliphatics	0.02	0.81	0.02	0.12	0.13	0.13	0.02	0.13	0.02	0.13
>C5-C7 Aromatics	0.0005	0.0033	0.0005	0.0031	0.0033	0.0028	0.0006	0.0033	0.0005	0.003
>C7-C8 Aromatics	0.0005	0.0033	0.0005	0.0031	0.0033	0.0028	0.0006	0.0033	0.0005	0.003
>C8-C10 Aromatics	0.4006	1.7887	0.4113	4.9926	2.481	2.4566	0.4878	0.7759	0.3895	2.481
>C10-C12 Aromatics	1.7024	7.5522	0.8225	5.0945	4.962	4.9132	3.0864	5.6431	2.0973	4.962
% of Total Fractions	2.144	10.2875	1.2748	10.3333	7.7096	7.6354	3.6154	6.6856	2.5278	7.709
GRO (% of Total TPH)	2.7	30.2	2.9	3.8	4.2	10	7.7	9.9	8	11.2

Note 1 - duplicate soil sample
Note 2 - background soil sample

A further review of the analytical data and the "fingerprint" analysis showed that sample number GS000828 contained a higher amount of the aromatic fractions in the GRO range in comparison to the other samples collected at ST702/8. Although this difference suggests a possible second source of petroleum contamination, the elevated TPH GRO concentrations and >C10-C12 and >C12-C16 aromatic fraction concentrations are probably due to site-specific factors identified during previous investigations[4,5]. These factors include the presence of free product floating on the water table, fluctuations in groundwater elevations that create a smear zone in the area, and the presence of fill material at the sampling location that may preferentially trap some of the lighter petroleum fractions in the soil.

4.6 Field Sampling and Laboratory Quality Control

Field quality control (QC) measures included the collection of a rinsate blank, a deionized water blank, and a laboratory-prepared trip blank that accompanied the sample bottles from the laboratory to the field and from the field to the laboratory. These water samples were analyzed for BTEX. No BTEX was detected above method detection limits in any of these field QC samples.

Laboratory QC measures included the collection and submission of one "blind" field blank and two matrix spike/matrix spike duplicate samples collected from a background sampling location. Internal laboratory QC measures included the preparation and analysis of laboratory control samples (LCS) and laboratory control sample duplicates (LCSDs) to assess the degree to which analytical data met limits of quantitation (LOQ) and relative percent difference (RPD) goals specified for each method. Poor surrogate recoveries were observed for some soil samples indicating a significant matrix effect. Poor surrogate recoveries for a few soil samples were also attributable to the dilution needed to perform the analysis. However, very good agreement was obtained between the primary and duplicate soil samples. Consequently, the overall quality assurance objectives for the project were met.

5.0 TIER 1 RBSLs CALCULATED FROM TPH FRACTIONAL ANALYSIS DATA

5.1 RBSLs for Recreational Exposure Scenario

Recreational Tier 1 RBSLs are presented in Tables A-1 through A-10 located in Appendix A. Among the direct and indirect soil exposure pathways, the subsurface soil indoor vapor inhalation pathway consistently contained the lowest RBSLs, ranging from 955 mg/kg to 10,900 mg/kg. For this pathway one sample, GS000828, contained a total TPH concentration (1,644 mg/kg) in excess of the Tier 1 total TPH RBSL (955 mg/kg). Much of the risk from this sample and pathway is attributable to the concentration of TPH in the >C8-C10 aliphatic fraction, as shown in Table 5-1. None of the other samples obtained from the site contained TPH in concentrations approaching their respective Tier 1 RBSLs for this pathway. With the exception of the groundwater indoor vapor inhalation pathway, all other Tier 1 total TPH RBSLs were more than an order of magnitude above the TPH concentrations detected in site soils (Tables A-1 through A-10). The groundwater indoor vapor inhalation pathway was not evaluated as water sampling and analysis activities were not included in this demonstration project.

Table 5-1: RBSLs for Recreational Exposure Scenario
MAC Chalet, Site ST702/8

	aliphatics (mg/kg)						*aromatics (mg/kg)*							Total TPH	Total TPH RBSL*
Sample #	C>5-C6	C>6-C8	C>8-C10	C>10-C12	C>12-C16	C>16-C21	C>5-C7	C>7-C8	C>8-C10	C>10-C12	C>12-C16	C>16-C21	C>21-C35	(mg/kg)	(mg/kg)
827	0.11	0.11	26.8	165.9	252	0.11	0.003	0.003	2.2	9.1	54	11	27.5	549	2,520
828	2.15	13.5	196.3	515.4	518	0.11	0.055	0.055	29.1	125.2	206	11	27	1644	955
829	0.105	0.105	4.15	143.5	274	10.5	0.003	0.003	2.1	4.15	32	10.5	26	507	10,900
830	0.125	0.125	5	5	12.5	12.5	0.003	0.003	4.9	5	12.5	12.5	30.5	101	1,550
831	0.115	0.115	4.55	4.55	11.5	11.5	0.003	0.003	2.25	4.55	11.5	11.5	28.5	91	1,800
832	0.11	0.11	4.35	4.35	11	11	0.003	0.003	2.2	4.35	11	11	27.5	87	1,810
833	0.105	0.105	10.8	135.1	180	10.5	0.003	0.003	2.05	13.2	34	10.5	26	422	4,090
834	1.065	1.065	62.1	243	305	10.5	0.027	0.027	6.2	44.8	91	10.5	26.5	802	1,480
835[a]	0.105	0.105	13.7	188.6	245	10.5	0.003	0.003	2.1	11.6	35	10.5	26.5	544	4,400
836[b]	0.105	0.105	4.15	4.15	10.5	10.5	0.003	0.003	2.05	4.15	10.5	10.5	26	83	1,810
RBSL*	280	680	160	820	3,700	No RfC	1.6	160	260	1,400	7,400	No RfC	No RfC		

* - Subsurface soil indoor vapor inhalation (mg/kg)
[a] - duplicate soil sample
[b] - background soil sample

5.2 RBSLs for Commercial Exposure Scenario

Commercial Tier 1 RBSLs are presented in Tables A-11 through A-20 (see Appendix A). For the commercial exposure scenario, four of the site soil samples contained TPH in concentrations that exceeded the Tier 1 total TPH RBSL for the subsurface soil indoor vapor inhalation pathway. As shown in Table 5-2, total TPH concentrations in sample numbers GS000827, GS000828, GS000834, and GS000835 exceeded their respective RBSLs. Sample number GS000835, with a TPH concentration of 544 mg/kg, just slightly exceeded its RBSL value of 501 mg/kg. Sample number GS000828, with a TPH concentration of 1,644 mg/kg, exceeded its RBSL value (157 mg/kg) by more than an order of magnitude. Most of the risk from these samples for this pathway is attributable to the concentrations of TPH in the >C8-C10 and the >C10-C12 aliphatic fractions. Like the recreational exposure scenario, all other direct and indirect soil exposure pathway RBSLs were considerably higher than the TPH concentrations detected in site soils.

Table 5-2: RBSLs for Commercial Exposure Scenario
MAC Chalet, Site ST702/8

	aliphatics (mg/kg)						*aromatics (mg/kg)*							Total TPH	Total TPH RBSL*
Sample :	C>5-C6	C>6-C8	C>8-C10	C>10-C12	C>12-C16	C>16-C21	C>5-C7	C>7-C8	C>8-C10	C>10-C12	C>12-C16	C>16-C21	C>21-C35	(mg/kg)	(mg/kg)
827	0.11	0.11	26.8	165.9	252	0.11	0.003	0.0025	2.2	9.1	54	11	27.5	**549**	287
828	2.15	13.5	**196.3**	**515.4**	518	0.11	0.055	0.055	29.1	125.2	206	11	27	**1644**	157
829	0.105	0.105	4.15	143.5	274	10.5	0.003	0.0025	2.1	4.15	32	10.5	26	507	1,170
830	0.125	0.125	5	5	12.5	12.5	0.003	0.003	4.9	5	12.5	12.5	30.5	101	323
831	0.115	0.115	4.55	4.55	11.5	11.5	0.003	0.003	2.25	4.55	11.5	11.5	28.5	91	372
832	0.11	0.11	4.35	4.35	11	11	0.003	0.0025	2.2	4.35	11	11	27.5	87	374
833	0.105	0.105	10.8	135.1	180	10.5	0.003	0.0025	2.05	13.2	34	10.5	26	422	463
834	1.065	1.065	**62.1**	**243**	305	10.5	0.027	0.0265	6.2	44.8	91	10.5	26.5	**802**	212
835[a]	0.105	0.105	13.7	**188.6**	245	10.5	0.003	0.0025	2.1	11.6	35	10.5	26.5	**544**	501
836[b]	0.105	0.105	4.15	4.15	10.5	10.5	0.003	0.0025	2.05	4.15	10.5	10.5	26	83	374
RBSL*	61	150	34	180	810	No RfC	0.35	34	56	300	1,600	No RfC	No RfC		

* - Subsurface soil indoor vapor inhalation (mg/kg)
[a] - duplicate soil sample
[b] - background soil sample

It is interesting to note that the concentration of >C10 – C12 aliphatic hydrocarbons is greater in sample GS000835 (the duplicate) than it is in sample GS000833 (the primary). This difference results in the former exceeding its fraction-specific RBSL while the later is found to be below the fraction-specific RBSL. The total TPH concentration in the duplicate sample also exceeds the total TPH RBSL while the total TPH concentration in the primary sample falls below the total TPH RBSL. There is also a significant difference in the concentration of >C12 – C16 aliphatic hydrocarbons between the duplicate and primary soil samples that was reported by the laboratory. Despite these apparent differences, the total TPH (GRO + DRO) detected in the duplicate soil sample and in the primary soil sample are nearly identical (337 mg/kg vs. 335 mg/kg). The close agreement in TPH (GRO + DRO) between the two samples suggests that the concentrations of petroleum fractions should be similar. However, it is evident that the laboratory reports some variability in fractional analysis data between a primary sample and its duplicate sample.

5.3 Calculation of RBSLs with Non-Detects Set to Zero

Tier 1 RBSLs were calculated using one-half the detection limit for TPH fractions that were not present at concentrations above laboratory limits of quantitation. To assess the effect of this protocol on Tier 1 RBSLs, the calculations were repeated for sample number GS000828 with all non-detects set equal to zero for the commercial exposure scenario (worst case). The recalculated RBSLs were slightly higher for some of the low risk pathways. However, for the highest risk pathway (i.e., subsurface soil indoor vapor inhalation), the recalculated RBSL was essentially unchanged (it actually decreased from 157 mg/kg to 156 mg/kg). For this demonstration project, the use of one-half of the detection limit concentrations in the Tier 1 RBSL calculations appears to have negligible effect on the overall risk results.

5.4 Consideration of Site-Specific Factors in RBSL Calculations

It is important to note that the Tier 1 RBSLs are very conservative. For the subsurface soil indoor vapor inhalation pathway, the Tier 1 RBSL value is calculated under the following assumptions: (1) a constant chemical concentration in subsurface soils; (2) linear equilibrium partitioning within the soil matrix between sorbed, dissolved, and vapor phases, where the partitioning is a function of constant chemical- and soil-specific parameters; (3) steady-state vapor- and liquid-phase diffusion through the vadose zone and foundation cracks; (4) no loss of chemicals as they diffuse towards the ground surface (i.e., no biodegradation); and (5) well-mixed atmospheric dispersion of the emanating vapors within the enclosed space (i.e., within the MAC Chalet). In addition, the Tier 1 RBSL for this pathway is calculated under the assumption that one percent of the foundation area is cracked through the total foundation thickness. Because the MAC Chalet is of modular construction with the foundation (floor) elevated above ground level, there is an air gap between the ground surface and the Chalet floor. Although it is possible for some petroleum vapor transport through the air gap and the Chalet floor, the Tier 1 RBSL assumptions listed above do not hold for this site. Consequently, a site-specific assessment of risk (e.g., a modified Tier 1 risk evaluation) may be needed to properly assess recreational or commercial exposure risk for this indirect pathway.

5.5 Case for a Higher Tier Risk Evaluation

A higher Tier risk evaluation may be appropriate under circumstances where Tier 1 RBSLs are exceeded but the need for remedial action is not warranted because of certain site-specific conditions such as those discussed above. For the MAC Chalet site, a modified Tier 1 risk evaluation could be performed by calculating Tier 1 RBSLs using site-specific parameters that may be readily available. These site-specific parameters may include total soil porosity, soil bulk density, depth to subsurface soil contamination, fraction of organic carbon in soil, wind speed above ground surface in ambient mixing zone, ambient air mixing zone height, and areal fraction of foundation cracks. Because many other Tier 1 default values would be needed to complete the modified Tier 1 RBSL calculations, the results would still be conservative. However, the modified Tier 1 RBSLs for the highest risk pathway (i.e., subsurface soil indoor vapor inhalation pathway) are likely to be significantly higher than those calculated without site-specific data.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Field screening of soil samples with a PID provided a good indication of petroleum contamination levels and greatly assisted the field team in selecting the sampling interval (depth bgs) where TPH (GRO and DRO) concentrations were at maximum values. TPH GRO and TPH DRO concentrations detected in site soils using standard analytical methods correlated well with TPH aliphatic and TPH aromatic fractions that were detected using the direct method. A first order "fingerprint" analysis of the analytical data indicated that the petroleum contamination in site soils contains a mix of aliphatic and aromatic hydrocarbon fractions in a ratio (by weight) of approximately four to one, respectively. The consistency in the "fingerprint" across all samples

with detectable levels of petroleum hydrocarbons indicates a single source of contamination (i.e., the diesel fuel contained in the former UST).

The concentrations of BTEX detected in the soil samples collected for this demonstration were significantly lower than the BTEX concentrations that were measured during earlier investigations of the site. Overall, TPH GRO and TPH DRO concentrations also appear to be declining when compared to earlier sampling data[4]. Differences in sampling locations, sampling depths, sampling techniques, and laboratory analyses between the samples collected for this demonstration and previous sampling activities could completely account for the difference in TPH (GRO and DRO) concentrations. However, the apparent decline in TPH (GRO and DRO) levels could also be attributable to local weathering effects.

With the exception of groundwater ingestion risk, which was only indirectly evaluated via the subsurface soil leaching to groundwater ingestion pathway, the concentrations of TPH aliphatic and aromatic fractions measured in ST702/8 site soils exceed Tier 1 RBSLs only for the subsurface soil indoor vapor inhalation pathway. One sample under a recreational exposure scenario and four samples under a commercial exposure scenario contained TPH aliphatic fractions at concentrations above the RBSL for this pathway. However, because the floor of the MAC Chalet is elevated above the ground surface, the assumptions used to calculate RBSLs for the indoor air inhalation pathway (i.e., direct contact between contaminated soil and the foundation with cracks in one percent of the foundation surface) do not hold. Consequently, a higher Tier risk evaluation involving the use of readily available site-specific parameters is needed to more accurately assess the risk for this pathway using both recreational and commercial exposure factors.

The TPH DRO concentrations that have been detected in soil in the vicinity of the MAC Chalet have been compared to ADEC cleanup levels. These comparisons have concluded that TPH DRO concentrations in site soils exceed the ADEC Method Two cleanup level of 250 mg/kg for migration to groundwater[4]. Although there is some evidence that TPH (GRO and DRO) concentrations in site soils are declining[4,5], TPH (DRO) soil concentration data collected within the past year[5], including the data collected for this demonstration, clearly indicate that ADEC Method Two cleanup levels are exceeded in a number of locations across the site. Five of the six subsurface soil samples, plus a subsurface duplicate soil sample collected for this demonstration, contained TPH DRO concentrations above the ADEC Method Two cleanup level. On this basis alone, some level of cleanup involving the excavation and removal of site soils is indicated. However, when the risk posed by the TPH (GRO and DRO) contamination in site soils was assessed using TPH fractional analysis data under a recreational exposure scenario, only one location for a single pathway exceeded the RBSL. Because it would be inappropriate to impose a remedy on the basis of this single finding, further investigation of TPH (GRO and DRO) concentrations in site soils is indicated.

The relatively good agreement between TPH GRO, TPH DRO, and TPH fractional analysis data provides a "fingerprint" that can be used to further delineate the extent of TPH contamination in site soils. Because the limited soil sampling that was performed for this demonstration project was not sufficient to adequately characterize the nature and extent of TPH GRO and TPH DRO contamination across the site, a larger sampling effort is needed. Up to 100 additional

subsurface soil samples should be collected using a systematic sampling approach that covers the known areal extent of contamination. PID field screening data should be used to select sampling intervals (i.e., depth bgs) that contain the highest TPH (GRO and DRO) levels. Subsequent analysis of these samples using conventional TPH GRO and TPH DRO methods should be performed and the results converted to TPH aliphatic and aromatic fractions according to the petroleum hydrocarbon "fingerprint" shown in Table 4-2. A modified Tier 1 risk assessment should be performed using site-specific parameters for cross-media RBSL calculations (e.g., wind speed above ground surface in ambient mixing zone (U_{air}), ambient air mixing zone height (δ_{air}), depth to subsurface soil sources (L_s), areal fraction of cracks in foundations/walls (η), and enclosed-space foundation or wall thickness (L_{crack})). Comparison of the converted data to modified Tier 1 RBSLs should be made to provide a more site-specific risk evaluation for the site. These additional data should provide the information needed to more effectively evaluate remedial action alternatives and to select the appropriate remedy for this site. If TPH fraction concentrations in site soils exceed the modified Tier 1 RBSLs, a higher Tier (Tier 2) risk evaluation should be performed before any remedial actions are imposed.

The TPHCWG approach, as demonstrated at Site ST702/8, provides a higher level of understanding of the composition of petroleum hydrocarbon releases than is available through conventional TPH GRO and TPH DRO analysis. The Working Group approach provides both aliphatic and aromatic fractional analysis data that can be used to assess human health risk at weathered petroleum release sites under a modified ASTM RBCA process. This approach provides risk assessors and remedial action decision makers with better insight into the risk the petroleum hydrocarbon contamination poses to potential human receptors relative to the amount of weathering that has occurred in environmental media. It also provides a more scientific basis for imposing a remedy at a given site than the somewhat arbitrary application of cleanup levels that are based upon conventional TPH GRO and TPH DRO analyses of site soils.

7.0 REFERENCES

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APPENDIX A

TPH FRACTION RBSLs AND ASSOCIATED COMPOSITION DATA FOR RECREATIONAL AND COMMERCIAL EXPOSURE SCENARIOS

TPHCWG Demonstration
MAC Chalet, Site ST702/8
Elmendorf AFB, Alaska

EPA RISK SPREADSHEET
Exposure Assumptions

TPHCWG Demonstration, MAC Chalet, Site ST702/8
Figure A-1

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000827

Parameter	Chronic	Cancer	Units
Soil Ingestion	1.06E-07	#DIV/0!	1/d
Soil Dermal Contact	3.34E-06	#DIV/0!	1/d
Air Inhalation (outdoor)	4.23E-02	#DIV/0!	m^3/kg-d
Air Inhalation (indoor)	4.23E-02	#DIV/0!	m^3/kg-d
Drinking Water Ingestion	1.06E-04	#DIV/0!	L/kg-d

Exposure Parameters for

Pathways:	Inhalation	Dermal Contact	etc...		
Scenario:	Future	Current			
Exposed Population:	Commercial	Recreational Receptor			
Variable	Subchronic Hazard Index Calculations [S = Subchronic	Chronic Hazard Index Calculations C = Chronic	Excess Lifetime Cancer Risk Calculations CA = Cancer]	Units	Notes & References
GENERAL INFO:					
Age	6 to 30	6 to 30	6 to 30	years	
Bodyweight	70	70	70	kg	
INGESTION OF SOIL (IS):					
Ingestion Rate (IR)		50		mg soil/day	
Conversion Factor (CF)		1.00E-06		kg/mg	
Fraction Ingested (FI)		1		unitless	
Exposure Frequency (EF)		45		days/year	
Exposure Duration (ED)		30		years	
Averaging Time (AT)		25		years	
DERMAL CONTACT WITH SOIL/SEDIMENT (DC):					
Conversion Factor (CF)		1.00E-06		kg/mg	
Skin Surface Area (SA)		3160		cm^2/day	Assumes 1 day
Head					
Trunk					
Upper Extremities					
Arms					
Upper Arms					
Forearms					
Hands					
Lower Extremities					
Legs					
Thighs					
Lower Legs					
Feet					
Soil Adherence Factor (SAF)		0.5		mg/cm^2	
Head					
Trunk					
Upper Extremities					
Arms					
Upper Arms					
Forearms					
Hands					
Lower Extremities					
Legs					
Thighs					
Lower Legs					
Feet					
Absorption Factor (AF)				unitless	
Exposure Frequency (EF)		45		days/year	
Exposure Duration (ED)		30		years	
Averaging Time (AT)		25		years	

TPH-CWG Demonstration, MAC Chalet, Site ST702/8
Figure A-1 (cont'd)

INHALATION OF PARTICULATES/VAPORS (I):

Inhalation rate (outdoor) (INR)		20		m^3/day
Exposure Frequency (EF)		45		days/year
Exposure Duration (ED)		30		years
Averaging Time (AT)		25		years

INHALATION OF VAPORS (Indoor Air) (IA)

Inhalation rate (indoor) (IHR)		20		m^3/day
Exposure Frequency (EF)		45		days/year
Exposure Duration (ED)		30		years
Averaging Time (AT)		25		years

INGESTION OF DRINKING WATER OR GROUNDWATER (DW)

Ingestion Rate (IR)		0.05		liters/day
Exposure Frequency (EF)		45		days/year
Exposure Duration (ED)		30		years
Averaging Time (AT)		25		years

* Note: Absorption is incorporated in RBSL calculation on the exposure assumptions page.

(LOCATION): GS000827

Table A-1: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)	Groundwater Indoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	1.9E+04	2.8E+02	7.5E+06	4.8E+04	6.5E+01
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	4.5E+04	6.8E+02	2.7E+07	3.2E+04	4.3E+01
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+04	1.6E+02	3.8E+06	1.1E+03	1.5E+00
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	5.5E+04	8.2E+02	2.9E+07	7.2E+02	9.7E-01
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	2.5E+05	3.7E+03	5.8E+08	1.7E+02	2.2E-01
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	1.4E+12	No RfC	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.1E+02	1.6E+00	1.1E+02	2.4E+03	3.9E+00
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	1.1E+04	1.6E+02	5.6E+04	9.8E+04	1.5E+02
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	1.7E+04	2.6E+02	7.3E+04	2.8E+04	4.1E+01
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	9.4E+04	1.4E+03	1.2E+05	6.5E+04	1.1E+02
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	4.9E+05	7.4E+03	2.3E+05	1.1E+05	2.4E+02
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	5.5E+05	No RfC	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	4.3E+06	No RfC	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.0E-04	3.0E-06	3.0E-06	7.7E-06	2.3E-05	3.2E-06	2.5E-02	1.8E-03	6.3E-05	7.5E-04	1.2E-02
>6-8 Aliphatics	2.0E-04	3.0E-06	3.0E-06	7.7E-06	1.2E-05	3.2E-06	5.6E-03	7.4E-04	9.4E-06	1.7E-04	1.9E-02
>8-10 Aliphatics	4.9E-02	3.6E-02	3.6E-02	3.5E-02	1.3E-04	3.6E-02	1.3E-02	7.7E-01	3.8E-05	4.0E-04	2.9E-01
>10-12 Aliphatics	3.0E-01	2.3E-01	2.3E-01	2.2E-01	7.6E-05	2.3E-01	1.6E-03	1.1E-01	3.0E-06	4.7E-05	3.5E-02
>12-16 Aliphatics	4.8E-01	3.4E-01	3.4E-01	3.3E-01	3.4E-05	3.4E-01	1.5E-04	1.0E-02	6.6E-08	4.6E-06	3.4E-03
>16-21 Aliphatics	2.0E-04	7.5E-06	7.5E-06	0.0E+00	0.0E+00	7.1E-06	0.0E+00	0.0E+00	1.1E-11	0.0E+00	0.0E+00
>5-7 Aromatics	4.6E-06	3.4E-04	3.4E-04	3.6E-04	1.6E-01	3.4E-04	8.8E-01	7.1E-03	9.8E-01	7.4E-01	4.7E-03
>7-8 Aromatics	4.6E-06	1.7E-06	1.7E-06	8.1E-06	2.8E-03	2.0E-06	8.9E-03	7.2E-05	1.8E-03	5.2E-03	1.2E-04
>8-10 Aromatics	4.0E-03	7.5E-03	7.5E-03	1.4E-02	4.6E-03	7.8E-03	6.0E-02	3.9E-02	1.4E-02	2.3E-03	3.8E-01
>10-12 Aromatics	1.7E-02	3.1E-02	3.1E-02	5.9E-02	2.8E-03	3.2E-02	6.7E-03	3.0E-02	5.5E-03	3.8E-04	2.2E-01
>12-16 Aromatics	9.8E-02	1.8E-01	1.8E-01	3.5E-01	9.9E-04	1.9E-01	5.9E-04	3.4E-02	1.3E-03	5.5E-05	2.5E-02
>16-21 Aromatics	2.0E-02	5.0E-02	5.0E-02	0.0E+00	0.0E+00	4.8E-02	0.0E+00	0.0E+00	1.9E-04	0.0E+00	0.0E+00
>21-35 Aromatics	5.0E-02	1.2E-01	1.2E-01	0.0E+00	0.0E+00	1.2E-01	0.0E+00	0.0E+00	1.9E-06	0.0E+00	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	1.0E+00	7.5E-01	1.0E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/L)
Total TPH (mg/kg)		7.05E+05	4.46E+04	2.09E+12	5.01E+08	4.01E+04	2.09E+07	2.52E+03	2.25E+07	8.68E+08	3.97E+03
RBSL(C_{TPH}) (mg/kg)		700000	40000	2E+12	>Csat	40000	20000000	3000	20000000	>S	4000

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000827

Table A-1 (cont'd): Composition Data

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.73E-03	3.50E-05	6.15E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	3.28E-02	1.44E-04	2.52E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	3.28E-02	1.44E-04	2.52E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	3.28E-02	1.18E-04	2.07E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	3.28E-02	1.19E-04	2.09E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.22	0.11	2.00E-02	2.47E-04	4.34E-02
	C>6-C8 aliphatics	1.00E+02	<	0.22	0.11	2.00E-02	2.00E-04	3.52E-02
	C>8-C10 aliphatics	1.30E+02		26.8	26.8	4.88E+00	3.76E-02	6.59E+00
	C>10-C12 aliphatics	1.60E+02		165.9	165.9	3.02E+01	1.89E-01	3.32E+01
	C>12-C16 aliphatics	2.00E+02		252	252	4.59E+01	2.30E-01	4.03E+01
	C >16-C21aliphatics	2.70E+02	<	0.22	0.11	2.00E-02	7.42E-05	1.30E-02
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.56E-04	5.84E-06	1.03E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.56E-04	4.95E-06	8.68E-04
	C >8 - C10 aromatics	1.20E+02	<	4.4	2.2	4.01E-01	3.34E-03	5.86E-01
	C>10-C12 aromatics	1.30E+02		9.1	9.1	1.66E+00	1.28E-02	2.24E+00
	C>12-C16 aromatics	1.50E+02		54	54	9.84E+00	6.56E-02	1.15E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	2.00E+00	1.05E-02	1.85E+00
	C>21-C35 aromatics	2.40E+02	<	55	27.5	5.01E+00	2.09E-02	3.66E+00

Total TPH fractions		*Sum of weight %*	5.70E-01
aliphatics	445.03	100	
aromatics	103.805		
Total	548.835		

(LOCATION): GS000828

Table A-2: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{ius} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+05	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+06	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)				**Hazard Quotients (HQ $_i$) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**						
>5-6 Aliphatics	1.3E-03	1.9E-05	1.9E-05	3.8E-05	2.3E-05	2.0E-05	2.3E-05	2.5E-02	4.4E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	8.2E-03	1.2E-04	1.2E-04	2.4E-04	1.2E-05	1.3E-04	1.2E-05	5.6E-03	1.2E-02	9.4E-06	1.7E-04
>8-10 Aliphatics	1.2E-01	8.7E-02	8.7E-02	6.5E-02	1.3E-04	8.6E-02	1.3E-04	1.3E-02	7.2E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	3.1E-01	2.3E-01	2.3E-01	1.7E-01	7.6E-05	2.3E-01	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	3.2E-01	2.3E-01	2.3E-01	1.7E-01	3.4E-05	2.3E-01	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	6.7E-05	2.4E-08	2.4E-08	0.0E+00	0.0E+00	2.3E-06	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	3.3E-05	2.4E-03	2.4E-03	2.0E-03	1.6E-01	2.4E-03	1.6E-01	8.8E-01	2.0E-02	9.6E-01	7.4E-01
>7-8 Aromatics	3.3E-05	1.2E-05	1.2E-05	4.5E-05	2.8E-03	1.4E-05	2.8E-03	8.9E-03	2.0E-04	1.8E-03	5.2E-03
>8-10 Aromatics	1.8E-02	3.2E-02	3.2E-02	4.8E-02	4.6E-03	3.3E-02	4.6E-03	6.0E-02	6.5E-02	1.4E-02	2.3E-03
>10-12 Aromatics	7.6E-02	1.4E-01	1.4E-01	2.1E-01	2.8E-03	1.4E-01	2.8E-03	6.7E-03	5.2E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.3E-01	2.3E-01	2.3E-01	3.4E-01	9.9E-04	2.3E-01	9.9E-04	5.9E-04	1.6E-02	1.3E-03	5.5E-05
>16-21 Aromatics	6.7E-03	1.6E-02	1.6E-02	0.0E+00	0.0E+00	1.5E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	1.6E-02	4.0E-02	4.0E-02	0.0E+00	0.0E+00	3.7E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ $_i$)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
						TPH Risk Based Screening Levels					
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		6.87E+05	4.35E+04	1.59E+12	5.01E+08	3.85E+04	5.01E+08	2.84E+06	9.55E+02	3.07E+08	6.68E+08
RBSL(C_{TPH}) (mg/kg)		700000	40000	2E+12	>Csat	40000	>Csat	3000000	1000	3000000	>S
#Significant Figures	1										
Use Raoult's Law (Yes/No?)	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-2 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000828

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.68	0.34	2.07E-02	2.65E-04	4.26E-02
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	1.09E-02	4.80E-05	7.71E-03
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	1.09E-02	4.80E-05	7.71E-03
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	1.09E-02	3.94E-05	6.33E-03
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	1.09E-02	3.97E-05	6.37E-03
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	4.3	2.15	1.31E-01	1.61E-03	2.59E-01
	C>6-C8 aliphatics	1.00E+02		13.5	13.5	8.21E-01	8.21E-03	1.32E+00
	C>8-C10 aliphatics	1.30E+02		196.3	196.3	1.19E+01	9.19E-02	1.48E+01
	C>10-C12 aliphatics	1.60E+02		515.4	515.4	3.14E+01	1.96E-01	3.15E+01
	C>12-C16 aliphatics	2.00E+02		518	518	3.15E+01	1.58E-01	2.53E+01
	C >16-C21aliphatics	2.70E+02	<	0.22	0.11	6.69E-03	2.48E-05	3.98E-03
	C>5-C7 aromatics	7.80E+01	<	0.11	0.055	3.35E-03	4.29E-05	6.89E-03
	C>7-C8 aromatics	9.21E+01	<	0.11	0.055	3.35E-03	3.63E-05	5.84E-03
	C >8 - C10 aromatics	1.20E+02		29.1	29.1	1.77E+00	1.48E-02	2.37E+00
	C>10-C12 aromatics	1.30E+02		125.2	125.2	7.62E+00	5.86E-02	9.41E+00
	C>12-C16 aromatics	1.50E+02		206	206	1.25E+01	8.35E-02	1.34E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	6.69E-01	3.52E-03	5.66E-01
	C>21-C35 aromatics	2.40E+02	<	54	27	1.64E+00	6.84E-03	1.10E+00

Total TPH fractions		*Sum of weight %*	6.23E-01
aliphatics	1245.46	100	
aromatics	398.41		
Total	1643.87		

(LOCATION): GS000829

Table A-3: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.1E-04	3.3E-06	3.3E-06	9.3E-06	2.3E-05	3.6E-06	2.3E-05	2.5E-02	8.0E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	2.1E-04	3.3E-06	3.3E-06	9.3E-06	1.2E-05	3.6E-06	1.2E-05	5.6E-03	3.3E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	8.2E-03	6.5E-03	6.5E-03	6.8E-03	1.3E-04	6.5E-03	1.3E-04	1.3E-02	5.6E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	2.8E-01	2.2E-01	2.2E-01	2.3E-01	7.6E-05	2.3E-01	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	5.4E-01	4.3E-01	4.3E-01	4.5E-01	3.4E-05	4.3E-01	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	2.1E-02	8.2E-04	8.2E-04	0.0E+00	0.0E+00	7.9E-04	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	4.9E-06	3.9E-04	3.9E-04	4.5E-04	1.6E-01	3.9E-04	1.6E-01	8.8E-01	3.3E-02	9.8E-01	7.4E-01
>7-8 Aromatics	4.9E-06	2.0E-06	2.0E-06	1.0E-05	2.8E-03	2.3E-06	2.8E-03	8.9E-03	3.4E-04	1.8E-03	5.2E-03
>8-10 Aromatics	4.1E-03	8.2E-03	8.2E-03	1.7E-02	4.6E-03	8.6E-03	4.6E-03	6.0E-02	1.7E-01	1.4E-02	2.3E-03
>10-12 Aromatics	8.2E-03	1.6E-02	1.6E-02	3.4E-02	2.8E-03	1.7E-02	2.8E-03	6.7E-03	6.4E-02	5.5E-03	3.8E-04
>12-16 Aromatics	6.3E-02	1.3E-01	1.3E-01	2.6E-01	9.9E-04	1.3E-01	9.9E-04	5.9E-04	4.0E-02	1.3E-03	5.5E-05
>16-21 Aromatics	2.1E-02	5.5E-02	5.5E-02	0.0E+00	0.0E+00	5.2E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	5.1E-02	1.4E-01	1.4E-01	0.0E+00	0.0E+00	1.3E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		7.50E+05	4.75E+04	2.43E+12	5.01E+08	4.27E+04	5.01E+08	1.93E+07	1.09E+04	2.08E+07	8.68E+08
RBSL(C_{TPH}) (mg/kg)		800000	50000	2E+12	>Csat	40000	>Csat	20000000	10000	20000000	>S
#Significant Figures	1										
Use Raoult's Law (Yes/No	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-3 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000829

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.96E-03	3.79E-05	6.95E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	3.35E-02	1.47E-04	2.70E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	3.35E-02	1.47E-04	2.70E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	3.35E-02	1.21E-04	2.21E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.34	0.17	3.35E-02	1.21E-04	2.23E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	2.07E-02	2.56E-04	4.69E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	2.07E-02	2.07E-04	3.80E-02
	C>8-C10 aliphatics	1.30E+02	<	8.3	4.15	8.18E-01	6.30E-03	1.15E+00
	C>10-C12 aliphatics	1.60E+02		143.5	143.5	2.83E+01	1.77E-01	3.24E+01
	C>12-C16 aliphatics	2.00E+02		274	274	5.40E+01	2.70E-01	4.95E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	2.07E+00	7.67E-03	1.41E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.93E-04	6.32E-06	1.16E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.93E-04	5.35E-06	9.81E-04
	C >8 - C10 aromatics	1.20E+02	<	4.2	2.1	4.14E-01	3.45E-03	6.33E-01
	C>10-C12 aromatics	1.30E+02	<	8.3	4.15	8.18E-01	6.30E-03	1.15E+00
	C>12-C16 aromatics	1.50E+02		32	32	6.31E+00	4.21E-02	7.71E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	2.07E+00	1.09E-02	2.00E+00
	C>21-C35 aromatics	2.40E+02	<	52	26	5.13E+00	2.14E-02	3.92E+00

Total TPH fractions		*Sum of weight %*	5.46E-01
aliphatics	432.36	100	
aromatics	74.755		
Total	507.115		

(LOCATION): GS000830

Table A-4: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.2E-03	1.1E-05	1.1E-05	5.0E-05	2.3E-05	1.2E-05	2.3E-05	2.5E-02	6.8E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	1.2E-03	1.1E-05	1.1E-05	5.0E-05	1.2E-05	1.2E-05	1.2E-05	5.6E-03	2.8E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	5.0E-02	2.2E-02	2.2E-02	3.7E-02	1.3E-04	2.3E-02	1.3E-04	1.3E-02	4.8E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	5.0E-02	2.2E-02	2.2E-02	3.7E-02	7.6E-05	2.3E-02	7.6E-05	1.6E-03	9.4E-02	3.0E-06	4.7E-05
>12-16 Aliphatics	1.2E-01	5.6E-02	5.6E-02	9.3E-02	3.4E-05	5.7E-02	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.2E-01	2.8E-03	2.8E-03	0.0E+00	0.0E+00	2.7E-03	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	3.0E-05	1.3E-03	1.3E-03	2.5E-03	1.6E-01	1.4E-03	1.6E-01	8.8E-01	2.9E-02	9.8E-01	7.4E-01
>7-8 Aromatics	3.0E-05	6.7E-06	6.7E-06	5.6E-05	2.8E-03	8.2E-06	2.8E-03	8.9E-03	2.9E-04	1.8E-03	5.2E-03
>8-10 Aromatics	4.9E-02	5.5E-02	5.5E-02	1.8E-01	4.6E-03	5.9E-02	4.6E-03	6.0E-02	2.9E-01	1.4E-02	2.3E-03
>10-12 Aromatics	5.0E-02	5.6E-02	5.6E-02	1.9E-01	2.8E-03	6.0E-02	2.8E-03	6.7E-03	5.5E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.2E-01	1.4E-01	1.4E-01	4.6E-01	9.9E-04	1.5E-01	9.9E-04	5.9E-04	2.6E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.2E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.8E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	3.0E-01	4.6E-01	4.6E-01	0.0E+00	0.0E+00	4.4E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		4.28E+05	2.71E+04	2.19E+12	5.01E+08	2.48E+04	5.01E+08	3.19E+06	1.55E+03	3.44E+06	8.68E+08
RBSL(C_{TPH}) (mg/kg)		400000	30000	2E+12	>Csat	20000	>Csat	3000000	2000	3000000	>S
#Significant Figures	1										
Use Raoult's Law (Yes/No)	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-4 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000830

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.006	0.003	2.98E-03	3.82E-05	7.16E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.4	0.2	1.99E-01	8.71E-04	1.63E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
218-01-9	Chrysene	2.28E+02	<	0.4	0.2	1.99E-01	8.71E-04	1.63E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.4	0.2	1.99E-01	7.15E-04	1.34E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.4	0.2	1.99E-01	7.20E-04	1.35E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.25	0.125	1.24E-01	1.53E-03	2.87E-01
	C>6-C8 aliphatics	1.00E+02	<	0.25	0.125	1.24E-01	1.24E-03	2.33E-01
	C>8-C10 aliphatics	1.30E+02	<	10	5	4.97E+00	3.82E-02	7.16E+00
	C>10-C12 aliphatics	1.60E+02	<	10	5	4.97E+00	3.10E-02	5.82E+00
	C>12-C16 aliphatics	2.00E+02	<	25	12.5	1.24E+01	6.21E-02	1.16E+01
	C >16-C21aliphatics	2.70E+02	<	25	12.5	1.24E+01	4.60E-02	8.62E+00
	C>5-C7 aromatics	7.80E+01	<	0.006	0.003	2.98E-03	3.82E-05	7.16E-03
	C>7-C8 aromatics	9.21E+01	<	0.006	0.003	2.98E-03	3.24E-05	6.07E-03
	C >8 - C10 aromatics	1.20E+02	<	9.8	4.9	4.87E+00	4.06E-02	7.61E+00
	C>10-C12 aromatics	1.30E+02	<	10	5	4.97E+00	3.82E-02	7.16E+00
	C>12-C16 aromatics	1.50E+02	<	25	12.5	1.24E+01	8.28E-02	1.55E+01
	C>16-C21 aromatics	1.90E+02	<	25	12.5	1.24E+01	6.54E-02	1.23E+01
	C>21-C35 aromatics	2.40E+02	<	61	30.5	3.03E+01	1.26E-01	2.37E+01

Total TPH fractions		*Sum of weight %*	5.33E-01
aliphatics	35.25	100	
aromatics	65.406		
Total	100.656		

(LOCATION): GS000831

Table A-5: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (l) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	2.3E-05	1.3E-05	2.3E-05	2.5E-02	8.1E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	1.2E-05	1.3E-05	1.2E-05	5.6E-03	3.4E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	1.3E-04	2.3E-02	1.3E-04	1.3E-02	5.7E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	7.6E-05	2.3E-02	7.6E-05	1.6E-03	1.1E-04	3.0E-06	4.7E-05
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	3.4E-05	5.9E-02	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	3.3E-05	1.5E-03	1.5E-03	3.0E-03	1.6E-01	1.5E-03	1.6E-01	8.8E-01	3.7E-02	9.8E-01	7.4E-01
>7-8 Aromatics	3.3E-05	7.5E-06	7.5E-06	6.7E-05	2.8E-03	9.1E-06	2.8E-03	8.9E-03	3.7E-04	1.8E-03	5.2E-03
>8-10 Aromatics	2.5E-02	2.8E-02	2.8E-02	1.0E-01	4.6E-03	3.0E-02	4.6E-03	6.0E-02	1.7E-01	1.4E-02	2.3E-03
>10-12 Aromatics	5.0E-02	5.7E-02	5.7E-02	2.0E-01	2.8E-03	6.1E-02	2.8E-03	6.7E-03	6.5E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	9.9E-04	1.5E-01	9.9E-04	5.9E-04	3.1E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	3.1E-01	4.7E-01	4.7E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		4.28E+05	2.71E+04	2.37E+12	5.01E+08	2.48E+04	5.01E+08	2.87E+06	1.80E+03	3.10E+06	8.68E+08
RBSL(C_{TPH}) (mg/kg)		400000	30000	2E+12	>Csat	20000	>Csat	3000000	2000	3000000	>S

#Significant Figures 1
Use Raoult's Law (Yes/No' no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-5 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000831

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.006	0.003	3.31E-03	4.24E-05	8.08E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.37	0.185	2.04E-01	8.95E-04	1.71E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
218-01-9	Chrysene	2.28E+02	<	0.37	0.185	2.04E-01	8.95E-04	1.71E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.37	0.185	2.04E-01	7.34E-04	1.40E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.37	0.185	2.04E-01	7.40E-04	1.41E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.23	0.115	1.27E-01	1.57E-03	2.98E-01
	C>6-C8 aliphatics	1.00E+02	<	0.23	0.115	1.27E-01	1.27E-03	2.42E-01
	C>8-C10 aliphatics	1.30E+02	<	9.1	4.55	5.02E+00	3.86E-02	7.36E+00
	C>10-C12 aliphatics	1.60E+02	<	9.1	4.55	5.02E+00	3.14E-02	5.98E+00
	C>12-C16 aliphatics	2.00E+02	<	23	11.5	1.27E+01	6.34E-02	1.21E+01
	C >16-C21aliphatics	2.70E+02	<	23	11.5	1.27E+01	4.70E-02	8.95E+00
	C>5-C7 aromatics	7.80E+01	<	0.006	0.003	3.31E-03	4.24E-05	8.08E-03
	C>7-C8 aromatics	9.21E+01	<	0.006	0.003	3.31E-03	3.59E-05	6.85E-03
	C >8 - C10 aromatics	1.20E+02	<	4.5	2.25	2.48E+00	2.07E-02	3.94E+00
	C>10-C12 aromatics	1.30E+02	<	9.1	4.55	5.02E+00	3.86E-02	7.36E+00
	C>12-C16 aromatics	1.50E+02	<	23	11.5	1.27E+01	8.46E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	23	11.5	1.27E+01	6.68E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	57	28.5	3.14E+01	1.31E-01	2.50E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	32.33	100	
aromatics	58.306		
Total	90.636		

(LOCATION): GS000832

Table A-6: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{leat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.5E-05	2.3E-05	1.3E-05	2.3E-05	2.5E-02	8.1E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.5E-05	1.2E-05	1.3E-05	1.2E-05	5.8E-03	3.4E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	1.3E-04	2.3E-02	1.3E-04	1.3E-02	5.7E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	7.6E-05	2.3E-02	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	3.4E-05	5.8E-02	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	2.9E-05	1.3E-03	1.3E-03	2.6E-03	1.6E-01	1.3E-03	1.6E-01	8.8E-01	3.2E-02	9.8E-01	7.4E-01
>7-8 Aromatics	2.9E-05	6.5E-06	6.5E-06	5.8E-05	2.8E-03	7.9E-06	2.8E-03	8.9E-03	3.3E-04	1.8E-03	5.2E-03
>8-10 Aromatics	2.5E-02	2.9E-02	2.9E-02	1.0E-01	4.6E-03	3.1E-02	4.6E-03	6.0E-02	1.8E-01	1.4E-02	2.3E-03
>10-12 Aromatics	5.0E-02	5.6E-02	5.6E-02	2.0E-01	2.8E-03	6.1E-02	2.8E-03	6.7E-03	6.5E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	9.9E-04	1.5E-01	9.9E-04	5.9E-04	3.1E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	3.2E-01	4.8E-01	4.8E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		4.27E+05	2.70E+04	2.37E+12	5.01E+08	2.48E+04	5.01E+08	3.31E+06	1.81E+03	3.57E+06	8.68E+08
RBSL(C_{TPH}) (mg/kg)		400000	30000	2E+12	>Csat	20000	>Csat	3000000	2000	4000000	>S
#Significant Figures	1										
Use Raoult's Law (Yes/No'	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-6 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000832

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.005	0.0025	2.87E-03	3.69E-05	7.02E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	2.07E-01	9.08E-04	1.73E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	2.07E-01	9.08E-04	1.73E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	2.07E-01	7.44E-04	1.42E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	2.07E-01	7.50E-04	1.43E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.22	0.11	1.26E-01	1.56E-03	2.97E-01
	C>6-C8 aliphatics	1.00E+02	<	0.22	0.11	1.26E-01	1.26E-03	2.41E-01
	C>8-C10 aliphatics	1.30E+02	<	8.7	4.35	5.00E+00	3.85E-02	7.33E+00
	C>10-C12 aliphatics	1.60E+02	<	8.7	4.35	5.00E+00	3.13E-02	5.96E+00
	C>12-C16 aliphatics	2.00E+02	<	22	11	1.26E+01	6.32E-02	1.20E+01
	C >16-C21aliphatics	2.70E+02	<	22	11	1.26E+01	4.68E-02	8.92E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	2.87E-03	3.69E-05	7.02E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	2.87E-03	3.12E-05	5.95E-03
	C >8 - C10 aromatics	1.20E+02	<	4.4	2.2	2.53E+00	2.11E-02	4.02E+00
	C>10-C12 aromatics	1.30E+02	<	8.7	4.35	5.00E+00	3.85E-02	7.33E+00
	C>12-C16 aromatics	1.50E+02	<	22	11	1.26E+01	8.43E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	1.26E+01	6.66E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	55	27.5	3.16E+01	1.32E-01	2.51E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	30.92	100	
aromatics	56.055		
Total	86.975		

(LOCATION): GS000833

Table A-7: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.5E-04	3.7E-06	3.7E-06	1.0E-05	2.3E-05	4.0E-06	2.3E-05	2.5E-02	3.6E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	2.5E-04	3.7E-06	3.7E-06	1.0E-05	1.2E-05	4.0E-06	1.2E-05	5.6E-03	1.5E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	2.6E-02	1.9E-02	1.9E-02	1.9E-02	1.3E-04	1.9E-02	1.3E-04	1.3E-02	6.6E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	3.2E-01	2.4E-01	2.4E-01	2.4E-01	7.6E-05	2.4E-01	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	4.3E-01	3.1E-01	3.1E-01	3.1E-01	3.4E-05	3.2E-01	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	2.5E-02	9.2E-04	9.2E-04	0.0E+00	0.0E+00	8.8E-04	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	5.9E-06	4.4E-04	4.4E-04	4.9E-04	1.6E-01	4.4E-04	1.6E-01	8.8E-01	1.5E-02	9.8E-01	7.4E-01
>7-8 Aromatics	5.9E-06	2.2E-06	2.2E-06	1.1E-05	2.8E-03	2.6E-06	2.8E-03	8.9E-03	1.5E-04	1.8E-03	5.2E-03
>8-10 Aromatics	4.9E-03	9.0E-03	9.0E-03	1.8E-02	4.6E-03	9.4E-03	4.6E-03	6.0E-02	7.7E-02	1.4E-02	2.3E-03
>10-12 Aromatics	3.1E-02	5.8E-02	5.8E-02	1.2E-01	2.8E-03	6.1E-02	2.8E-03	6.7E-03	9.1E-02	5.5E-03	3.8E-04
>12-16 Aromatics	8.0E-02	1.5E-01	1.5E-01	3.0E-01	9.9E-04	1.5E-01	9.9E-04	5.9E-04	4.0E-02	1.3E-03	5.5E-05
>16-21 Aromatics	2.5E-02	6.1E-02	6.1E-02	0.0E+00	0.0E+00	5.9E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	6.2E-02	1.5E-01	1.5E-01	0.0E+00	0.0E+00	1.4E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		6.99E+05	4.43E+04	2.17E+12	5.01E+08	3.98E+04	5.01E+08	1.61E+07	4.09E+03	1.73E+07	8.68E+08
RBSL(C_{TPH}) (mg/kg)		700000	40000	2E+12	>Csat	40000	>Csat	20000000	4000	20000000	>S

#Significant Figures	1
Use Raoult's Law (Yes/No'	no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-7 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000833

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	3.55E-03	4.55E-05	8.09E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	4.02E-02	1.77E-04	3.14E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	4.02E-02	1.77E-04	3.14E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	4.02E-02	1.45E-04	2.57E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.34	0.17	4.02E-02	1.46E-04	2.59E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	2.49E-02	3.07E-04	5.45E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	2.49E-02	2.49E-04	4.42E-02
	C>8-C10 aliphatics	1.30E+02		10.8	10.8	2.56E+00	1.97E-02	3.49E+00
	C>10-C12 aliphatics	1.60E+02		135.1	135.1	3.20E+01	2.00E-01	3.55E+01
	C>12-C16 aliphatics	2.00E+02		180	180	4.26E+01	2.13E-01	3.79E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	2.49E+00	9.21E-03	1.64E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	5.92E-04	7.59E-06	1.35E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	5.92E-04	6.43E-06	1.14E-03
	C >8 - C10 aromatics	1.20E+02	<	4.1	2.05	4.85E-01	4.04E-03	7.19E-01
	C>10-C12 aromatics	1.30E+02		13.2	13.2	3.13E+00	2.40E-02	4.27E+00
	C>12-C16 aromatics	1.50E+02		34	34	8.05E+00	5.37E-02	9.53E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	2.49E+00	1.31E-02	2.32E+00
	C>21-C35 aromatics	2.40E+02	<	52	26	6.16E+00	2.56E-02	4.56E+00

Total TPH fractions		*Sum of weight %*	5.63E-01
aliphatics	336.61	100	
aromatics	85.755		
Total	422.365		

(LOCATION): GS000834

Table A-8: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{soil} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	2.0E-05	2.0E-05	4.4E-05	2.3E-05	2.1E-05	2.3E-05	2.5E-02	6.9E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	1.3E-03	2.0E-05	2.0E-05	4.4E-05	1.2E-05	2.1E-05	1.2E-05	5.6E-03	2.9E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	7.7E-02	5.7E-02	5.7E-02	4.7E-02	1.3E-04	5.7E-02	1.3E-04	1.3E-02	7.2E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	3.0E-01	2.2E-01	2.2E-01	1.8E-01	7.6E-05	2.2E-01	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	3.8E-01	2.8E-01	2.8E-01	2.3E-01	3.4E-05	2.8E-01	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.3E-02	4.8E-04	4.8E-04	0.0E+00	0.0E+00	4.6E-04	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	3.3E-05	2.4E-03	2.4E-03	2.2E-03	1.6E-01	2.4E-03	1.6E-01	8.8E-01	3.0E-02	9.8E-01	7.4E-01
>7-8 Aromatics	3.3E-05	1.2E-05	1.2E-05	5.0E-05	2.8E-03	1.4E-05	2.8E-03	8.9E-03	3.1E-04	1.8E-03	5.2E-03
>8-10 Aromatics	7.7E-03	1.4E-02	1.4E-02	2.3E-02	4.6E-03	1.5E-02	4.6E-03	6.0E-02	4.4E-02	1.4E-02	2.3E-03
>10-12 Aromatics	5.6E-02	1.0E-01	1.0E-01	1.7E-01	2.8E-03	1.1E-01	2.8E-03	6.7E-03	5.9E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.1E-01	2.1E-01	2.1E-01	3.4E-01	9.9E-04	2.1E-01	9.9E-04	5.9E-04	2.3E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.3E-02	3.2E-02	3.2E-02	0.0E+00	0.0E+00	3.0E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	3.3E-02	8.1E-02	8.1E-02	0.0E+00	0.0E+00	7.7E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		6.95E+05	4.40E+04	1.78E+12	5.01E+08	3.92E+04	5.01E+08	2.88E+06	1.48E+03	3.11E+06	8.68E+08
RBSL(C_{TPH}) (mg/kg)		700000	40000	2E+12	>Csat	40000	>Csat	3000000	1000	3000000	>S

#Significant Figures	1
Use Raoult's Law (Yes/No'	no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-8 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000834

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	1.87E-03	2.40E-05	4.05E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.35	0.175	2.18E-02	9.57E-05	1.61E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
218-01-9	Chrysene	2.28E+02	<	0.35	0.175	2.18E-02	9.57E-05	1.61E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.35	0.175	2.18E-02	7.85E-05	1.32E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.35	0.175	2.18E-02	7.91E-05	1.33E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	2.13	1.065	1.33E-01	1.64E-03	2.77E-01
	C>6-C8 aliphatics	1.00E+02	<	2.13	1.065	1.33E-01	1.33E-03	2.24E-01
	C>8-C10 aliphatics	1.30E+02		62.1	62.1	7.75E+00	5.96E-02	1.00E+01
	C>10-C12 aliphatics	1.60E+02		243	243	3.03E+01	1.89E-01	3.20E+01
	C>12-C16 aliphatics	2.00E+02		305	305	3.80E+01	1.90E-01	3.21E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.31E+00	4.85E-03	8.18E-01
	C>5-C7 aromatics	7.80E+01	<	0.053	0.0265	3.31E-03	4.24E-05	7.15E-03
	C>7-C8 aromatics	9.21E+01	<	0.053	0.0265	3.31E-03	3.59E-05	6.05E-03
	C >8 - C10 aromatics	1.20E+02		6.2	6.2	7.73E-01	6.44E-03	1.09E+00
	C>10-C12 aromatics	1.30E+02		44.8	44.8	5.59E+00	4.30E-02	7.25E+00
	C>12-C16 aromatics	1.50E+02		91	91	1.13E+01	7.57E-02	1.28E+01
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.31E+00	6.89E-03	1.16E+00
	C>21-C35 aromatics	2.40E+02	<	53	26.5	3.31E+00	1.38E-02	2.32E+00

Total TPH fractions		*Sum of weight %*	5.93E-01
aliphatics	622.73	100	
aromatics	179.053		
Total	801.783		

(LOCATION): GS000835

Table A-9: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{ilsat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.9E-04	3.0E-06	3.0E-06	8.3E-06	2.3E-05	3.3E-06	2.3E-05	2.5E-02	3.0E-03	8.3E-05	7.5E-04
>6-8 Aliphatics	1.9E-04	3.0E-06	3.0E-06	8.3E-06	1.2E-05	3.3E-06	1.2E-05	5.6E-03	1.3E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	2.5E-02	2.0E-02	2.0E-02	2.0E-02	1.3E-04	2.0E-02	1.3E-04	1.3E-02	7.0E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	3.5E-01	2.7E-01	2.7E-01	2.7E-01	7.6E-05	2.7E-01	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	4.5E-01	3.5E-01	3.5E-01	3.5E-01	3.4E-05	3.5E-01	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.9E-02	7.6E-04	7.6E-04	0.0E+00	0.0E+00	7.2E-04	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	4.6E-06	3.6E-04	3.6E-04	4.0E-04	1.6E-01	3.6E-04	1.6E-01	8.8E-01	1.3E-02	9.8E-01	7.4E-01
>7-8 Aromatics	4.6E-06	1.8E-06	1.8E-06	9.0E-06	2.8E-03	2.2E-06	2.8E-03	8.9E-03	1.3E-04	1.8E-03	5.2E-03
>8-10 Aromatics	3.9E-03	7.6E-03	7.6E-03	1.5E-02	4.6E-03	8.0E-03	4.6E-03	6.0E-02	6.6E-02	1.4E-02	2.3E-03
>10-12 Aromatics	2.1E-02	4.2E-02	4.2E-02	8.4E-02	2.8E-03	4.4E-02	2.8E-03	6.7E-03	6.7E-02	5.5E-03	3.8E-04
>12-16 Aromatics	6.4E-02	1.3E-01	1.3E-01	2.5E-01	9.9E-04	1.3E-01	9.9E-04	5.9E-04	3.9E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.9E-02	5.0E-02	5.0E-02	0.0E+00	0.0E+00	4.8E-02	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	4.9E-02	1.3E-01	1.3E-01	0.0E+00	0.0E+00	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		7.42E+05	4.70E+04	2.31E+12	5.01E+08	4.22E+04	5.01E+08	2.07E+07	4.40E+03	2.23E+07	8.68E+08
RBSL(C_{TPH}) (mg/kg)		700000	50000	2E+12	>Csat	40000	>Csat	20000000	4000	20000000	>S
#Significant Figures	1										
Use Raoult's Law (Yes/No)	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-9 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000835

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.76E-03	3.54E-05	6.29E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.35	0.175	3.22E-02	1.41E-04	2.51E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
218-01-9	Chrysene	2.28E+02	<	0.35	0.175	3.22E-02	1.41E-04	2.51E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.35	0.175	3.22E-02	1.16E-04	2.06E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.35	0.175	3.22E-02	1.17E-04	2.07E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	1.93E-02	2.38E-04	4.24E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	1.93E-02	1.93E-04	3.44E-02
	C>8-C10 aliphatics	1.30E+02		13.7	13.7	2.52E+00	1.94E-02	3.45E+00
	C>10-C12 aliphatics	1.60E+02		188.6	188.6	3.47E+01	2.17E-01	3.86E+01
	C>12-C16 aliphatics	2.00E+02		245	245	4.51E+01	2.25E-01	4.01E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.93E+00	7.15E-03	1.27E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.60E-04	5.89E-06	1.05E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.60E-04	4.99E-06	8.88E-04
	C >8 - C10 aromatics	1.20E+02	<	4.2	2.1	3.86E-01	3.22E-03	5.73E-01
	C>10-C12 aromatics	1.30E+02		11.6	11.6	2.13E+00	1.64E-02	2.92E+00
	C>12-C16 aromatics	1.50E+02		35	35	6.44E+00	4.29E-02	7.63E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.93E+00	1.02E-02	1.81E+00
	C>21-C35 aromatics	2.40E+02	<	53	26.5	4.87E+00	2.03E-02	3.61E+00

Total TPH fractions		*Sum of weight %*	5.62E-01
aliphatics	458.01	100	
aromatics	85.705		
Total	543.715		

(LOCATION): GS000836

Table A-10: TPH Fraction Risk-Based Screening Levels (RBSLs)
Recreational Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	1.9E+04	2.8E+02	7.5E+06	4.8E+04
>6-8 Aliphatics	2.6E+02	4.7E+07	3.0E+06	5.4E+13	2.1E+07	2.5E+06	2.1E+07	4.5E+04	6.8E+02	2.7E+07	3.2E+04
>8-10 Aliphatics	1.4E+02	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	1.1E+04	1.6E+02	3.8E+06	1.1E+03
>10-12 Aliphatics	8.6E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	5.5E+04	8.2E+02	2.9E+07	7.2E+02
>12-16 Aliphatics	3.8E+01	9.5E+05	6.0E+04	2.9E+12	1.1E+06	5.4E+04	1.1E+06	2.5E+05	3.7E+03	5.8E+08	1.7E+02
>16-21 Aliphatics	1.6E+01	1.9E+07	1.2E+06	No RfC	No RfC	1.1E+06	No RfC	No RfC	No RfC	1.4E+12	No RfC
>5-7 Aromatics	1.6E+03	9.5E+03	6.0E+02	2.6E+10	1.0E+04	5.3E+02	1.0E+04	1.1E+02	1.6E+00	1.1E+02	2.4E+03
>7-8 Aromatics	1.3E+03	1.9E+06	1.2E+05	1.2E+12	4.5E+05	9.0E+04	4.5E+05	1.1E+04	1.6E+02	5.6E+04	9.8E+04
>8-10 Aromatics	1.0E+03	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	1.7E+04	2.6E+02	7.3E+04	2.8E+04
>10-12 Aromatics	6.3E+02	3.8E+05	2.4E+04	5.9E+11	2.3E+05	2.0E+04	2.3E+05	9.4E+04	1.4E+03	1.2E+05	6.5E+04
>12-16 Aromatics	2.9E+02	3.8E+05	2.4E+04	5.9E+11	3.0E+05	2.1E+04	3.0E+05	4.9E+05	7.4E+03	2.3E+05	1.1E+05
>16-21 Aromatics	1.0E+02	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	5.5E+05	No RfC
>21-35 Aromatics	8.3E+00	2.8E+05	1.8E+04	No RfC	No RfC	1.7E+04	No RfC	No RfC	No RfC	4.3E+06	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	2.3E-05	1.3E-05	2.3E-05	2.5E-02	8.1E-03	6.3E-05	7.5E-04
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	1.2E-05	1.3E-05	1.2E-05	5.6E-03	3.4E-03	9.4E-06	1.7E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	1.3E-04	2.3E-02	1.3E-04	1.3E-02	5.7E-01	3.8E-05	4.0E-04
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	7.6E-05	2.3E-02	7.6E-05	1.6E-03	1.1E-01	3.0E-06	4.7E-05
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	3.4E-05	5.9E-02	3.4E-05	1.5E-04	1.0E-02	6.6E-08	4.6E-06
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.1E-11	0.0E+00
>5-7 Aromatics	3.0E-05	1.4E-03	1.4E-03	2.7E-03	1.6E-01	1.4E-03	1.6E-01	8.8E-01	3.4E-02	9.8E-01	7.4E-01
>7-8 Aromatics	3.0E-05	6.8E-06	6.8E-06	6.1E-05	2.8E-03	8.3E-06	2.8E-03	8.9E-03	3.4E-04	1.8E-03	5.2E-03
>8-10 Aromatics	2.5E-02	2.8E-02	2.8E-02	1.0E-01	4.6E-03	3.0E-02	4.6E-03	6.0E-02	1.7E-01	1.4E-02	2.3E-03
>10-12 Aromatics	5.0E-02	5.7E-02	5.7E-02	2.0E-01	2.8E-03	6.1E-02	2.8E-03	6.7E-03	6.5E-02	5.5E-03	3.8E-04
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	9.9E-04	1.5E-01	9.9E-04	5.9E-04	3.1E-02	1.3E-03	5.5E-05
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00
>21-35 Aromatics	3.1E-01	4.7E-01	4.7E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	1.7E-01	1.0E+00	1.7E-01	1.0E+00	1.0E+00	1.0E+00	7.5E-01
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		**4.28E+05**	**2.71E+04**	**2.37E+12**	**5.01E+08**	**2.48E+04**	**5.01E+08**	**3.15E+06**	**1.81E+03**	**3.40E+06**	**8.68E+08**
RBSL(C_{TPH}) (mg/kg)		**400000**	**30000**	**2E+12**	**>Csat**	**20000**	**>Csat**	**3000000**	**2000**	**3000000**	**>S**
#Significant Figures	1										
Use Raoult's Law (Yes/No'	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-10 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000836

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.005	0.0025	3.02E-03	3.87E-05	7.38E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	2.06E-01	9.01E-04	1.72E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	2.06E-01	9.01E-04	1.72E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	2.06E-01	7.39E-04	1.41E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.34	0.17	2.06E-01	7.45E-04	1.42E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	1.27E-01	1.57E-03	2.99E-01
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	1.27E-01	1.27E-03	2.42E-01
	C>8-C10 aliphatics	1.30E+02	<	8.3	4.15	5.02E+00	3.86E-02	7.35E+00
	C>10-C12 aliphatics	1.60E+02	<	8.3	4.15	5.02E+00	3.14E-02	5.97E+00
	C>12-C16 aliphatics	2.00E+02	<	21	10.5	1.27E+01	6.35E-02	1.21E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.27E+01	4.70E-02	8.96E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	3.02E-03	3.87E-05	7.38E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	3.02E-03	3.28E-05	6.25E-03
	C >8 - C10 aromatics	1.20E+02	<	4.1	2.05	2.48E+00	2.07E-02	3.93E+00
	C>10-C12 aromatics	1.30E+02	<	8.3	4.15	5.02E+00	3.86E-02	7.35E+00
	C>12-C16 aromatics	1.50E+02	<	21	10.5	1.27E+01	8.46E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.27E+01	6.68E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	52	26	3.14E+01	1.31E-01	2.49E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	29.51	100	
aromatics	53.205		
Total	82.715		

EPA RISK SPREADSHEET
Exposure Assumptions

TPHCWG Demonstration, MAC Chalet, Site ST702/8
Figure A-2

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000827

Parameter	Chronic	Cancer	Units
Soil Ingestion	4.89E-07	#DIV/0!	1/d
Soil Dermal Contact	1.55E-05	#DIV/0!	1/d
Air Inhalation (outdoor)	1.96E-01	#DIV/0!	m^3/kg-d
Air Inhalation (indoor)	1.96E-01	#DIV/0!	m^3/kg-d
Drinking Water Ingestion	9.78E-03	#DIV/0!	L/kg-d

Exposure Parameters for

Pathways:	Inhalation	Dermal Contact	etc...		
Scenario:	Future	Current			
Exposed Population:	Commercial	Commercial Receptor			
Variable	Subchronic Hazard Index Calculations [S = Subchronic	Chronic Hazard Index Calculations C = Chronic	Excess Lifetime Cancer Risk Calculations CA = Cancer]	Units	Notes & References
GENERAL INFO:					
Age	6 to 30	6 to 30	6 to 30	years	
Bodyweight	70	70	70	kg	
INGESTION OF SOIL (IS):					
Ingestion Rate (IR)		50		mg soil/day	
Conversion Factor (CF)		1.00E-06		kg/mg	
Fraction Ingested (FI)		1		unitless	
Exposure Frequency (EF)		250		days/year	
Exposure Duration (ED)		25		years	
Averaging Time (AT)		25		years	
DERMAL CONTACT WITH SOIL/SEDIMENT (DC):					
Conversion Factor (CF)		1.00E-06		kg/mg	
Skin Surface Area (SA)		3160		cm^2/day	Assumes 1 day
Head					
Trunk					
Upper Extremities					
Arms					
Upper Arms					
Forearms					
Hands					
Lower Extremities					
Legs					
Thighs					
Lower Legs					
Feet					
Soil Adherence Factor (SAF)		0.5		mg/cm^2	
Head					
Trunk					
Upper Extremities					
Arms					
Upper Arms					
Forearms					
Hands					
Lower Extremities					
Legs					
Thighs					
Lower Legs					
Feet					
Absorption Factor (AF)				unitless	
Exposure Frequency (EF)		250		days/year	
Exposure Duration (ED)		25		years	
Averaging Time (AT)		25		years	

TPHCWG Demonstration, MAC Chalet, Site ST702/8
Figure A-2 (cont'd)

INHALATION OF PARTICULATES/VAPORS (I):

Inhalation rate (outdoor) (INR)		20		m^3/day
Exposure Frequency (EF)		250		days/year
Exposure Duration (ED)		25		years
Averaging Time (AT)		25		years

INHALATION OF VAPORS (Indoor Air) (IA)

Inhalation rate (indoor) (IHR)		20		m^3/day
Exposure Frequency (EF)		250		days/year
Exposure Duration (ED)		25		years
Averaging Time (AT)		25		years

INGESTION OF DRINKING WATER OR GROUNDWATER (DW)

Ingestion Rate (IR)		1		liters/day
Exposure Frequency (EF)		250		days/year
Exposure Duration (ED)		25		years
Averaging Time (AT)		25		years

* Note: Absorption is incorporated in RBSL calculation on the exposure assumptions page.

(LOCATION): GS000827

Table A-11: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (l) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	6.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	8.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.8E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.0E-04	3.0E-06	3.0E-06	7.7E-06	1.0E-04	3.2E-06	1.0E-04	1.2E-01	9.4E-04	9.7E-05	3.5E-03
>6-8 Aliphatics	2.0E-04	3.0E-06	3.0E-06	7.7E-06	5.7E-05	3.2E-06	5.7E-05	2.6E-02	3.9E-04	2.7E-05	7.9E-04
>8-10 Aliphatics	4.9E-02	3.6E-02	3.6E-02	3.5E-02	5.8E-04	3.6E-02	5.8E-04	6.1E-02	4.1E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	3.0E-01	2.3E-01	2.3E-01	2.2E-01	3.5E-04	2.3E-01	3.5E-04	7.3E-03	4.9E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	4.6E-01	3.4E-01	3.4E-01	3.3E-01	1.6E-04	3.4E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	2.0E-04	7.5E-06	7.5E-06	0.0E+00	0.0E+00	7.1E-06	0.0E+00	0.0E+00	0.0E+00	5.0E-10	0.0E+00
>5-7 Aromatics	4.6E-06	3.4E-04	3.4E-04	3.6E-04	7.4E-01	3.4E-04	7.4E-01	4.7E-01	3.7E-03	1.6E-01	3.4E+00
>7-8 Aromatics	4.6E-06	1.7E-06	1.7E-06	8.1E-06	1.3E-02	2.0E-06	1.3E-02	4.8E-03	3.8E-05	2.9E-04	2.4E-02
>8-10 Aromatics	4.0E-03	7.5E-03	7.5E-03	1.4E-02	2.1E-02	7.8E-03	2.1E-02	2.8E-01	2.1E-02	2.0E-01	1.1E-02
>10-12 Aromatics	1.7E-02	3.1E-02	3.1E-02	5.9E-02	1.3E-02	3.2E-02	1.3E-02	3.1E-02	1.6E-02	5.0E-01	1.8E-03
>12-16 Aromatics	9.8E-02	1.8E-01	1.8E-01	3.5E-01	4.6E-03	1.9E-01	4.6E-03	2.7E-03	1.8E-02	1.2E-01	2.5E-04
>16-21 Aromatics	2.0E-02	5.0E-02	5.0E-02	0.0E+00	0.0E+00	4.8E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	5.0E-02	1.2E-01	1.2E-01	0.0E+00	0.0E+00	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.52E+05	9.64E+03	4.52E+11	5.01E+08	8.65E+03	5.01E+08	2.43E+06	2.87E+02	3.92E+04	8.68E+08
RBSL(C_{TPH}) (mg/kg)		200000	10000	5E+11	>Csat	9000	>Csat	2000000	300	40000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No)	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-11 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000827

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.73E-03	3.50E-05	6.15E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	3.28E-02	1.44E-04	2.52E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	3.28E-02	1.30E-04	2.28E-02
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	3.28E-02	1.44E-04	2.52E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	3.28E-02	1.18E-04	2.07E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	3.28E-02	1.19E-04	2.09E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.22	0.11	2.00E-02	2.47E-04	4.34E-02
	C>6-C8 aliphatics	1.00E+02	<	0.22	0.11	2.00E-02	2.00E-04	3.52E-02
	C>8-C10 aliphatics	1.30E+02		26.8	26.8	4.88E+00	3.76E-02	6.59E+00
	C>10-C12 aliphatics	1.60E+02		165.9	165.9	3.02E+01	1.89E-01	3.32E+01
	C>12-C16 aliphatics	2.00E+02		252	252	4.59E+01	2.30E-01	4.03E+01
	C >16-C21aliphatics	2.70E+02	<	0.22	0.11	2.00E-02	7.42E-05	1.30E-02
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.56E-04	5.84E-06	1.03E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.56E-04	4.95E-06	8.68E-04
	C >8 - C10 aromatics	1.20E+02	<	4.4	2.2	4.01E-01	3.34E-03	5.86E-01
	C>10-C12 aromatics	1.30E+02		9.1	9.1	1.66E+00	1.28E-02	2.24E+00
	C>12-C16 aromatics	1.50E+02		54	54	9.84E+00	6.56E-02	1.15E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	2.00E+00	1.05E-02	1.85E+00
	C>21-C35 aromatics	2.40E+02	<	55	27.5	5.01E+00	2.09E-02	3.66E+00

Total TPH fractions		*Sum of weight %*	5.70E-01
aliphatics	445.03	100	
aromatics	103.805		
Total	548.835		

(LOCATION): GS000828

Table A-12: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.9E-05	1.9E-05	3.8E-05	1.0E-04	2.0E-05	1.0E-04	1.1E-01	3.4E-03	1.2E-04	3.5E-03
>6-8 Aliphatics	8.2E-03	1.2E-04	1.2E-04	2.4E-04	5.7E-05	1.3E-04	5.7E-05	2.6E-02	8.8E-03	2.2E-04	7.9E-04
>8-10 Aliphatics	1.2E-01	8.7E-02	8.7E-02	6.5E-02	5.8E-04	8.6E-02	5.8E-04	6.1E-02	5.4E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	3.1E-01	2.3E-01	2.3E-01	1.7E-01	3.5E-04	2.3E-01	3.5E-04	7.3E-03	2.8E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	3.2E-01	2.3E-01	2.3E-01	1.7E-01	1.6E-04	2.3E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	6.7E-05	2.4E-06	2.4E-06	0.0E+00	0.0E+00	2.3E-06	0.0E+00	0.0E+00	0.0E+00	3.3E-11	0.0E+00
>5-7 Aromatics	3.3E-05	2.4E-03	2.4E-03	2.0E-03	7.4E-01	2.4E-03	7.4E-01	4.8E-01	1.5E-02	2.3E-01	3.4E+00
>7-8 Aromatics	3.3E-05	1.2E-05	1.2E-05	4.5E-05	1.3E-02	1.4E-05	1.3E-02	4.9E-03	1.5E-04	4.2E-04	2.4E-02
>8-10 Aromatics	1.8E-02	3.2E-02	3.2E-02	4.8E-02	2.1E-02	3.3E-02	2.1E-02	2.8E-01	5.0E-02	1.7E-01	1.1E-02
>10-12 Aromatics	7.6E-02	1.4E-01	1.4E-01	2.1E-01	1.3E-02	1.4E-01	1.3E-02	3.1E-02	4.0E-02	4.7E-01	1.8E-03
>12-16 Aromatics	1.3E-01	2.3E-01	2.3E-01	3.4E-01	4.6E-03	2.3E-01	4.6E-03	2.7E-03	1.2E-02	1.2E-01	2.5E-04
>16-21 Aromatics	6.7E-03	1.6E-02	1.6E-02	0.0E+00	0.0E+00	1.5E-02	0.0E+00	0.0E+00	0.0E+00	8.8E-03	0.0E+00
>21-35 Aromatics	1.6E-02	4.0E-02	4.0E-02	0.0E+00	0.0E+00	3.7E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.48E+05	9.40E+03	3.43E+11	5.01E+08	8.32E+03	5.01E+08	3.36E+05	1.57E+02	7.70E+03	8.68E+08
RBSL(C_{TPH}) (mg/kg)		100000	9000	3E+11	>Csat	8000	>Csat	300000	200	8000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No'	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000828

Table A-12 (cont'd): Composition Data

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.68	0.34	2.07E-02	2.65E-04	4.26E-02
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	1.09E-02	4.80E-05	7.71E-03
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	1.09E-02	4.35E-05	6.98E-03
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	1.09E-02	4.80E-05	7.71E-03
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	1.09E-02	3.94E-05	6.33E-03
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	1.09E-02	3.97E-05	6.37E-03
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	4.3	2.15	1.31E-01	1.61E-03	2.59E-01
	C>6-C8 aliphatics	1.00E+02		13.5	13.5	8.21E-01	8.21E-03	1.32E+00
	C>8-C10 aliphatics	1.30E+02		196.3	196.3	1.19E+01	9.19E-02	1.48E+01
	C>10-C12 aliphatics	1.60E+02		515.4	515.4	3.14E+01	1.96E-01	3.15E+01
	C>12-C16 aliphatics	2.00E+02		518	518	3.15E+01	1.58E-01	2.53E+01
	C >16-C21aliphatics	2.70E+02	<	0.22	0.11	6.69E-03	2.48E-05	3.98E-03
	C>5-C7 aromatics	7.80E+01	<	0.11	0.055	3.35E-03	4.29E-05	6.89E-03
	C>7-C8 aromatics	9.21E+01	<	0.11	0.055	3.35E-03	3.63E-05	5.84E-03
	C >8 - C10 aromatics	1.20E+02		29.1	29.1	1.77E+00	1.48E-02	2.37E+00
	C>10-C12 aromatics	1.30E+02		125.2	125.2	7.62E+00	5.86E-02	9.41E+00
	C>12-C16 aromatics	1.50E+02		206	206	1.25E+01	8.35E-02	1.34E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	6.69E-01	3.52E-03	5.66E-01
	C>21-C35 aromatics	2.40E+02	<	54	27	1.64E+00	6.84E-03	1.10E+00

Total TPH fractions		*Sum of weight %*	6.23E-01
aliphatics	1245.46	100	
aromatics	398.41		
Total	1643.87		

(LOCATION): GS000829

Table A-13: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{ilest} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	8.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.1E-04	3.3E-06	3.3E-06	9.3E-06	1.0E-04	3.6E-06	1.0E-04	1.1E-01	4.0E-03	1.4E-04	3.5E-03
>6-8 Aliphatics	2.1E-04	3.3E-06	3.3E-06	9.3E-06	5.7E-05	3.6E-06	5.7E-05	2.6E-02	1.7E-03	3.8E-05	7.9E-04
>8-10 Aliphatics	8.2E-03	6.5E-03	6.5E-03	6.8E-03	5.8E-04	6.5E-03	5.8E-04	6.1E-02	2.8E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	2.8E-01	2.2E-01	2.2E-01	2.3E-01	3.5E-04	2.3E-01	3.5E-04	7.3E-03	4.9E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	5.4E-01	4.3E-01	4.3E-01	4.5E-01	1.6E-04	4.3E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	2.1E-02	8.2E-04	8.2E-04	0.0E+00	0.0E+00	7.9E-04	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	4.9E-06	3.9E-04	3.9E-04	4.5E-04	7.4E-01	3.9E-04	7.4E-01	4.7E-01	1.7E-02	2.3E-01	3.4E+00
>7-8 Aromatics	4.9E-06	2.0E-06	2.0E-06	1.0E-05	1.3E-02	2.3E-06	1.3E-02	4.8E-03	1.7E-04	4.3E-04	2.4E-02
>8-10 Aromatics	4.1E-03	8.2E-03	8.2E-03	1.7E-02	2.1E-02	8.6E-03	2.1E-02	2.8E-01	8.7E-02	2.8E-01	1.1E-02
>10-12 Aromatics	8.2E-03	1.6E-02	1.6E-02	3.4E-02	1.3E-02	1.7E-02	1.3E-02	3.1E-02	3.2E-02	3.5E-01	1.8E-03
>12-16 Aromatics	6.3E-02	1.3E-01	1.3E-01	2.6E-01	4.6E-03	1.3E-01	4.6E-03	2.7E-03	4.7E-02	1.2E-01	2.5E-04
>16-21 Aromatics	2.1E-02	5.5E-02	5.5E-02	0.0E+00	0.0E+00	5.2E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	5.1E-02	1.4E-01	1.4E-01	0.0E+00	0.0E+00	1.3E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.62E+05	1.03E+04	5.25E+11	5.01E+08	9.23E+03	5.01E+08	2.25E+06	1.17E+03	5.34E+04	8.66E+08
RBSL(C_{TPH}) (mg/kg)		200000	10000	5E+11	>Csat	9000	>Csat	2000000	1000	50000	900000000

#Significant Figures 1
Use Raoult's Law (Yes/No) no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-13 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000829

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.96E-03	3.79E-05	6.95E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	3.35E-02	1.47E-04	2.70E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	3.35E-02	1.33E-04	2.44E-02
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	3.35E-02	1.47E-04	2.70E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	3.35E-02	1.21E-04	2.21E-02
193-39-5	Indeno(1,2,3-cd)pyrene	2.76E+02	<	0.34	0.17	3.35E-02	1.21E-04	2.23E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	2.07E-02	2.56E-04	4.69E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	2.07E-02	2.07E-04	3.80E-02
	C>8-C10 aliphatics	1.30E+02	<	8.3	4.15	8.18E-01	6.30E-03	1.15E+00
	C>10-C12 aliphatics	1.60E+02		143.5	143.5	2.83E+01	1.77E-01	3.24E+01
	C>12-C16 aliphatics	2.00E+02		274	274	5.40E+01	2.70E-01	4.95E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	2.07E+00	7.67E-03	1.41E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.93E-04	6.32E-06	1.16E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.93E-04	5.35E-06	9.81E-04
	C >8 - C10 aromatics	1.20E+02	<	4.2	2.1	4.14E-01	3.45E-03	6.33E-01
	C>10-C12 aromatics	1.30E+02	<	8.3	4.15	8.18E-01	6.30E-03	1.15E+00
	C>12-C16 aromatics	1.50E+02		32	32	6.31E+00	4.21E-02	7.71E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	2.07E+00	1.09E-02	2.00E+00
	C>21-C35 aromatics	2.40E+02	<	52	26	5.13E+00	2.14E-02	3.92E+00

Total TPH fractions		*Sum of weight %*	5.46E-01
aliphatics	432.36	100	
aromatics	74.755		
Total	507.115		

(LOCATION): GS000830

Table A-14: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{lost} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.2E-03	1.1E-05	1.1E-05	5.0E-05	1.0E-04	1.2E-05	1.0E-04	1.1E-01	6.6E-03	1.0E-04	3.5E-03
>6-8 Aliphatics	1.2E-03	1.1E-05	1.1E-05	5.0E-05	5.7E-05	1.2E-05	5.7E-05	2.6E-02	2.7E-03	2.9E-05	7.9E-04
>8-10 Aliphatics	5.0E-02	2.2E-02	2.2E-02	3.7E-02	5.8E-04	2.3E-02	5.8E-04	6.1E-02	4.7E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	5.0E-02	2.2E-02	2.2E-02	3.7E-02	3.5E-04	2.3E-02	3.5E-04	7.3E-03	9.1E-02	2.7E-04	2.2E-04
>12-16 Aliphatics	1.2E-01	5.6E-02	5.6E-02	9.3E-02	1.6E-04	5.7E-02	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.2E-01	2.8E-03	2.8E-03	0.0E+00	0.0E+00	2.7E-03	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	3.0E-05	1.3E-03	1.3E-03	2.5E-03	7.4E-01	1.4E-03	7.4E-01	4.7E-01	2.8E-02	1.8E-01	3.4E+00
>7-8 Aromatics	3.0E-05	6.7E-06	6.7E-06	5.6E-05	1.3E-02	8.2E-06	1.3E-02	4.8E-03	2.8E-04	3.3E-04	2.4E-02
>8-10 Aromatics	4.9E-02	5.5E-02	5.5E-02	1.8E-01	2.1E-02	5.9E-02	2.1E-02	2.8E-01	2.8E-01	4.2E-01	1.1E-02
>10-12 Aromatics	5.0E-02	5.6E-02	5.6E-02	1.9E-01	1.3E-02	6.0E-02	1.3E-02	3.1E-02	5.3E-02	2.7E-01	1.8E-03
>12-16 Aromatics	1.2E-01	1.4E-01	1.4E-01	4.6E-01	4.6E-03	1.5E-01	4.6E-03	2.7E-03	2.5E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.2E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.8E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	3.0E-01	4.6E-01	4.6E-01	0.0E+00	0.0E+00	4.4E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		9.24E+04	5.85E+03	4.74E+11	5.01E+08	5.35E+03	5.01E+08	3.73E+05	3.23E+02	6.75E+03	8.68E+08
RBSL(C_{TPH}) (mg/kg)		90000	6000	5E+11	>Csat	5000	>Csat	400000	300	7000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No'	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-14 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000830

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.006	0.003	2.98E-03	3.82E-05	7.16E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.4	0.2	1.99E-01	8.71E-04	1.63E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.4	0.2	1.99E-01	7.88E-04	1.48E-01
218-01-9	Chrysene	2.28E+02	<	0.4	0.2	1.99E-01	8.71E-04	1.63E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.4	0.2	1.99E-01	7.15E-04	1.34E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.4	0.2	1.99E-01	7.20E-04	1.35E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.25	0.125	1.24E-01	1.53E-03	2.87E-01
	C>6-C8 aliphatics	1.00E+02	<	0.25	0.125	1.24E-01	1.24E-03	2.33E-01
	C>8-C10 aliphatics	1.30E+02	<	10	5	4.97E+00	3.82E-02	7.16E+00
	C>10-C12 aliphatics	1.60E+02	<	10	5	4.97E+00	3.10E-02	5.82E+00
	C>12-C16 aliphatics	2.00E+02	<	25	12.5	1.24E+01	6.21E-02	1.16E+01
	C >16-C21aliphatics	2.70E+02	<	25	12.5	1.24E+01	4.60E-02	8.62E+00
	C>5-C7 aromatics	7.80E+01	<	0.006	0.003	2.98E-03	3.82E-05	7.16E-03
	C>7-C8 aromatics	9.21E+01	<	0.006	0.003	2.98E-03	3.24E-05	6.07E-03
	C >8 - C10 aromatics	1.20E+02	<	9.8	4.9	4.87E+00	4.06E-02	7.61E+00
	C>10-C12 aromatics	1.30E+02	<	10	5	4.97E+00	3.82E-02	7.16E+00
	C>12-C16 aromatics	1.50E+02	<	25	12.5	1.24E+01	8.28E-02	1.55E+01
	C>16-C21 aromatics	1.90E+02	<	25	12.5	1.24E+01	6.54E-02	1.23E+01
	C>21-C35 aromatics	2.40E+02	<	61	30.5	3.03E+01	1.26E-01	2.37E+01

Total TPH fractions		*Sum of weight %*	5.33E-01
aliphatics	35.25	100	
aromatics	65.406		
Total	100.656		

(LOCATION): GS000831

Table A-15: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{leat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	1.0E-04	1.3E-05	1.0E-04	1.1E-01	7.7E-03	1.3E-04	3.5E-03
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	5.7E-05	1.3E-05	5.7E-05	2.6E-02	3.2E-03	3.7E-05	7.9E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	5.8E-04	2.3E-02	5.8E-04	6.1E-02	5.4E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	3.5E-04	2.3E-02	3.5E-04	7.3E-03	1.1E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	1.6E-04	5.9E-02	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	3.3E-05	1.5E-03	1.5E-03	3.0E-03	7.4E-01	1.5E-03	7.4E-01	4.8E-01	3.5E-02	2.5E-01	3.4E+00
>7-8 Aromatics	3.3E-05	7.5E-06	7.5E-06	6.7E-05	1.3E-02	9.1E-06	1.3E-02	4.9E-03	3.6E-04	4.7E-04	2.4E-02
>8-10 Aromatics	2.5E-02	2.8E-02	2.8E-02	1.0E-01	2.1E-02	3.0E-02	2.1E-02	2.8E-01	1.7E-01	2.7E-01	1.1E-02
>10-12 Aromatics	5.0E-02	5.7E-02	5.7E-02	2.0E-01	1.3E-02	6.1E-02	1.3E-02	3.1E-02	6.2E-02	3.4E-01	1.8E-03
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	4.6E-03	1.5E-01	4.6E-03	2.7E-03	3.0E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	3.1E-01	4.7E-01	4.7E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.6E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		9.24E+04	5.85E+03	5.12E+11	5.01E+08	5.37E+03	5.01E+08	3.41E+05	3.72E+02	8.55E+03	8.68E+08
RBSL(C_{TPH}) (mg/kg)		90000	6000	5E+11	>Csat	5000	>Csat	300000	400	9000	900000000

#Significant Figures 1
Use Raoult's Law (Yes/No) no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-15 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000831

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.006	0.003	3.31E-03	4.24E-05	8.08E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.37	0.185	2.04E-01	8.95E-04	1.71E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.37	0.185	2.04E-01	8.10E-04	1.54E-01
218-01-9	Chrysene	2.28E+02	<	0.37	0.185	2.04E-01	8.95E-04	1.71E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.37	0.185	2.04E-01	7.34E-04	1.40E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.37	0.185	2.04E-01	7.40E-04	1.41E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.23	0.115	1.27E-01	1.57E-03	2.98E-01
	C>6-C8 aliphatics	1.00E+02	<	0.23	0.115	1.27E-01	1.27E-03	2.42E-01
	C>8-C10 aliphatics	1.30E+02	<	9.1	4.55	5.02E+00	3.86E-02	7.36E+00
	C>10-C12 aliphatics	1.60E+02	<	9.1	4.55	5.02E+00	3.14E-02	5.98E+00
	C>12-C16 aliphatics	2.00E+02	<	23	11.5	1.27E+01	6.34E-02	1.21E+01
	C >16-C21aliphatics	2.70E+02	<	23	11.5	1.27E+01	4.70E-02	8.95E+00
	C>5-C7 aromatics	7.80E+01	<	0.006	0.003	3.31E-03	4.24E-05	8.08E-03
	C>7-C8 aromatics	9.21E+01	<	0.006	0.003	3.31E-03	3.59E-05	6.85E-03
	C >8 - C10 aromatics	1.20E+02	<	4.5	2.25	2.48E+00	2.07E-02	3.94E+00
	C>10-C12 aromatics	1.30E+02	<	9.1	4.55	5.02E+00	3.86E-02	7.36E+00
	C>12-C16 aromatics	1.50E+02	<	23	11.5	1.27E+01	8.46E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	23	11.5	1.27E+01	6.68E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	57	28.5	3.14E+01	1.31E-01	2.50E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	32.33	100	
aromatics	58.306		
Total	90.636		

(LOCATION): GS000832

Table A-16: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.5E-05	1.0E-04	1.3E-05	1.0E-04	1.2E-01	7.8E-03	1.4E-04	3.5E-03
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.5E-05	5.7E-05	1.3E-05	5.7E-05	2.6E-02	3.2E-03	3.8E-05	7.9E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	5.8E-04	2.3E-02	5.8E-04	6.1E-02	5.4E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	3.5E-04	2.3E-02	3.5E-04	7.3E-03	1.1E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	1.6E-04	5.8E-02	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	2.9E-05	1.3E-03	1.3E-03	2.6E-03	7.4E-01	1.3E-03	7.4E-01	4.7E-01	3.1E-02	2.2E-01	3.4E+00
>7-8 Aromatics	2.9E-05	6.5E-06	6.5E-06	5.8E-05	1.3E-02	7.9E-06	1.3E-02	4.8E-03	3.1E-04	4.2E-04	2.4E-02
>8-10 Aromatics	2.5E-02	2.9E-02	2.9E-02	1.0E-01	2.1E-02	3.1E-02	2.1E-02	2.8E-01	1.7E-01	2.8E-01	1.1E-02
>10-12 Aromatics	5.0E-02	5.6E-02	5.6E-02	2.0E-01	1.3E-02	6.1E-02	1.3E-02	3.1E-02	6.2E-02	3.5E-01	1.8E-03
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	4.6E-03	1.5E-01	4.6E-03	2.7E-03	3.0E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	3.2E-01	4.8E-01	4.8E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		9.22E+04	5.84E+03	5.12E+11	5.01E+08	5.36E+03	5.01E+08	3.85E+05	3.74E+02	8.84E+03	8.68E+08
RBSL(C_{TPH}) (mg/kg)		90000	6000	5E+11	>Csat	5000	>Csat	400000	400	9000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-16 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000832

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.005	0.0025	2.87E-03	3.69E-05	7.02E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.36	0.18	2.07E-01	9.08E-04	1.73E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.36	0.18	2.07E-01	8.21E-04	1.56E-01
218-01-9	Chrysene	2.28E+02	<	0.36	0.18	2.07E-01	9.08E-04	1.73E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.36	0.18	2.07E-01	7.44E-04	1.42E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.36	0.18	2.07E-01	7.50E-04	1.43E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.22	0.11	1.26E-01	1.56E-03	2.97E-01
	C>6-C8 aliphatics	1.00E+02	<	0.22	0.11	1.26E-01	1.26E-03	2.41E-01
	C>8-C10 aliphatics	1.30E+02	<	8.7	4.35	5.00E+00	3.85E-02	7.33E+00
	C>10-C12 aliphatics	1.60E+02	<	8.7	4.35	5.00E+00	3.13E-02	5.96E+00
	C>12-C16 aliphatics	2.00E+02	<	22	11	1.26E+01	6.32E-02	1.20E+01
	C >16-C21aliphatics	2.70E+02	<	22	11	1.26E+01	4.68E-02	8.92E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	2.87E-03	3.69E-05	7.02E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	2.87E-03	3.12E-05	5.95E-03
	C >8 - C10 aromatics	1.20E+02	<	4.4	2.2	2.53E+00	2.11E-02	4.02E+00
	C>10-C12 aromatics	1.30E+02	<	8.7	4.35	5.00E+00	3.85E-02	7.33E+00
	C>12-C16 aromatics	1.50E+02	<	22	11	1.26E+01	8.43E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	22	11	1.26E+01	6.66E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	55	27.5	3.16E+01	1.32E-01	2.51E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	30.92	100	
aromatics	56.055		
Total	86.975		

(LOCATION): GS000833

Table A-17: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	2.5E-04	3.7E-06	3.7E-06	1.0E-05	1.0E-04	4.0E-06	1.0E-04	1.1E-01	1.9E-03	9.7E-05	3.5E-03
>6-8 Aliphatics	2.5E-04	3.7E-06	3.7E-06	1.0E-05	5.7E-05	4.0E-06	5.7E-05	2.6E-02	7.9E-04	2.7E-05	7.9E-04
>8-10 Aliphatics	2.6E-02	1.9E-02	1.9E-02	1.9E-02	5.8E-04	1.9E-02	5.8E-04	6.1E-02	3.4E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	3.2E-01	2.4E-01	2.4E-01	2.4E-01	3.5E-04	2.4E-01	3.5E-04	7.3E-03	4.9E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	4.3E-01	3.1E-01	3.1E-01	3.1E-01	1.6E-04	3.2E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	2.5E-02	9.2E-04	9.2E-04	0.0E+00	0.0E+00	8.8E-04	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	5.9E-06	4.4E-04	4.4E-04	4.9E-04	7.4E-01	4.4E-04	7.4E-01	4.7E-01	7.8E-03	1.6E-01	3.4E+00
>7-8 Aromatics	5.9E-06	2.2E-06	2.2E-06	1.1E-05	1.3E-02	2.6E-06	1.3E-02	4.8E-03	7.9E-05	3.1E-04	2.4E-02
>8-10 Aromatics	4.9E-03	9.0E-03	9.0E-03	1.8E-02	2.1E-02	9.4E-03	2.1E-02	2.8E-01	4.0E-02	1.9E-01	1.1E-02
>10-12 Aromatics	3.1E-02	5.8E-02	5.8E-02	1.2E-01	1.3E-02	6.1E-02	1.3E-02	3.1E-02	4.8E-02	5.0E-01	1.8E-03
>12-16 Aromatics	8.0E-02	1.5E-01	1.5E-01	3.0E-01	4.8E-03	1.5E-01	4.6E-03	2.7E-03	2.3E-02	1.2E-01	2.5E-04
>16-21 Aromatics	2.5E-02	6.1E-02	6.1E-02	0.0E+00	0.0E+00	5.9E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	6.2E-02	1.5E-01	1.5E-01	0.0E+00	0.0E+00	1.4E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.51E+05	9.56E+03	4.68E+11	5.01E+08	8.59E+03	5.01E+08	1.87E+06	4.63E+02	3.14E+04	8.68E+08
RBSL(C_{TPH}) (mg/kg)		200000	10000	5E+11	>Csat	9000	>Csat	2000000	500	30000	900000000

#Significant Figures	1
Use Raoult's Law (Yes/No'	no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-17 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000833

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	3.55E-03	4.55E-05	8.09E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	4.02E-02	1.77E-04	3.14E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	4.02E-02	1.60E-04	2.84E-02
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	4.02E-02	1.77E-04	3.14E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	4.02E-02	1.45E-04	2.57E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.34	0.17	4.02E-02	1.46E-04	2.59E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	2.49E-02	3.07E-04	5.45E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	2.49E-02	2.49E-04	4.42E-02
	C>8-C10 aliphatics	1.30E+02		10.8	10.8	2.56E+00	1.97E-02	3.49E+00
	C>10-C12 aliphatics	1.60E+02		135.1	135.1	3.20E+01	2.00E-01	3.55E+01
	C>12-C16 aliphatics	2.00E+02		180	180	4.26E+01	2.13E-01	3.79E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	2.49E+00	9.21E-03	1.64E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	5.92E-04	7.59E-06	1.35E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	5.92E-04	6.43E-06	1.14E-03
	C >8 - C10 aromatics	1.20E+02	<	4.1	2.05	4.85E-01	4.04E-03	7.19E-01
	C>10-C12 aromatics	1.30E+02		13.2	13.2	3.13E+00	2.40E-02	4.27E+00
	C>12-C16 aromatics	1.50E+02		34	34	8.05E+00	5.37E-02	9.53E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	2.49E+00	1.31E-02	2.32E+00
	C>21-C35 aromatics	2.40E+02	<	52	26	6.16E+00	2.56E-02	4.56E+00

Total TPH fractions		*Sum of weight %*	5.63E-01
aliphatics	336.61	100	
aromatics	85.755		
Total	422.365		

(LOCATION): GS000834

Table A-18: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (l) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	6.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	2.0E-05	2.0E-05	4.4E-05	1.0E-04	2.1E-05	1.0E-04	1.1E-01	4.6E-03	1.7E-04	3.5E-03
>6-8 Aliphatics	1.3E-03	2.0E-05	2.0E-05	4.4E-05	5.7E-05	2.1E-05	5.7E-05	2.6E-02	1.9E-03	4.6E-05	7.9E-04
>8-10 Aliphatics	7.7E-02	5.7E-02	5.7E-02	4.7E-02	5.8E-04	5.7E-02	5.8E-04	6.1E-02	4.8E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	3.0E-01	2.2E-01	2.2E-01	1.8E-01	3.5E-04	2.2E-01	3.5E-04	7.3E-03	3.6E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	3.8E-01	2.8E-01	2.8E-01	2.3E-01	1.6E-04	2.8E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.3E-02	4.8E-04	4.8E-04	0.0E+00	0.0E+00	4.6E-04	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	3.3E-05	2.4E-03	2.4E-03	2.2E-03	7.4E-01	2.4E-03	7.4E-01	4.8E-01	2.0E-02	3.0E-01	3.4E+00
>7-8 Aromatics	3.3E-05	1.2E-05	1.2E-05	5.0E-05	1.3E-02	1.4E-05	1.3E-02	4.8E-03	2.0E-04	5.6E-04	2.4E-02
>8-10 Aromatics	7.7E-03	1.4E-02	1.4E-02	2.3E-02	2.1E-02	1.5E-02	2.1E-02	2.8E-01	2.9E-02	1.0E-01	1.1E-02
>10-12 Aromatics	5.6E-02	1.0E-01	1.0E-01	1.7E-01	1.3E-02	1.1E-01	1.3E-02	3.1E-02	3.9E-02	4.6E-01	1.8E-03
>12-16 Aromatics	1.1E-01	2.1E-01	2.1E-01	3.4E-01	4.6E-03	2.1E-01	4.6E-03	2.7E-03	1.5E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.3E-02	3.2E-02	3.2E-02	0.0E+00	0.0E+00	3.0E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	3.3E-02	8.1E-02	8.1E-02	0.0E+00	0.0E+00	7.7E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.50E+05	9.50E+03	3.85E+11	5.01E+08	8.47E+03	5.01E+08	3.38E+05	2.12E+02	1.03E+04	8.68E+08
RBSL(C_{TPH}) (mg/kg)		200000	10000	4E+11	>Csat	8000	>Csat	300000	200	10000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No'	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-18 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000834

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	1.87E-03	2.40E-05	4.05E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.35	0.175	2.18E-02	9.57E-05	1.61E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.35	0.175	2.18E-02	8.66E-05	1.46E-02
218-01-9	Chrysene	2.28E+02	<	0.35	0.175	2.18E-02	9.57E-05	1.61E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.35	0.175	2.18E-02	7.85E-05	1.32E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.35	0.175	2.18E-02	7.91E-05	1.33E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	2.13	1.065	1.33E-01	1.64E-03	2.77E-01
	C>6-C8 aliphatics	1.00E+02	<	2.13	1.065	1.33E-01	1.33E-03	2.24E-01
	C>8-C10 aliphatics	1.30E+02		62.1	62.1	7.75E+00	5.96E-02	1.00E+01
	C>10-C12 aliphatics	1.60E+02		243	243	3.03E+01	1.89E-01	3.20E+01
	C>12-C16 aliphatics	2.00E+02		305	305	3.80E+01	1.90E-01	3.21E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.31E+00	4.85E-03	8.18E-01
	C>5-C7 aromatics	7.80E+01	<	0.053	0.0265	3.31E-03	4.24E-05	7.15E-03
	C>7-C8 aromatics	9.21E+01	<	0.053	0.0265	3.31E-03	3.59E-05	6.05E-03
	C >8 - C10 aromatics	1.20E+02		6.2	6.2	7.73E-01	6.44E-03	1.09E+00
	C>10-C12 aromatics	1.30E+02		44.8	44.8	5.59E+00	4.30E-02	7.25E+00
	C>12-C16 aromatics	1.50E+02		91	91	1.13E+01	7.57E-02	1.28E+01
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.31E+00	6.89E-03	1.16E+00
	C>21-C35 aromatics	2.40E+02	<	53	26.5	3.31E+00	1.38E-02	2.32E+00

Total TPH fractions		*Sum of weight %*	5.93E-01
aliphatics	622.73	100	
aromatics	179.053		
Total	801.783		

(LOCATION): GS000835

Table A-19: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{sat} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.9E-04	3.0E-06	3.0E-06	8.3E-06	1.0E-04	3.3E-06	1.0E-04	1.1E-01	1.6E-03	9.5E-05	3.5E-03
>6-8 Aliphatics	1.9E-04	3.0E-06	3.0E-06	8.3E-06	5.7E-05	3.3E-06	5.7E-05	2.6E-02	6.6E-04	2.6E-05	7.9E-04
>8-10 Aliphatics	2.5E-02	2.0E-02	2.0E-02	2.0E-02	5.8E-04	2.0E-02	5.8E-04	6.1E-02	3.7E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	3.5E-01	2.7E-01	2.7E-01	2.7E-01	3.5E-04	2.7E-01	3.5E-04	7.3E-03	4.9E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	4.5E-01	3.5E-01	3.5E-01	3.5E-01	1.6E-04	3.5E-01	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.9E-02	7.6E-04	7.6E-04	0.0E+00	0.0E+00	7.2E-04	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	4.6E-06	3.6E-04	3.6E-04	4.0E-04	7.4E-01	3.6E-04	7.4E-01	4.7E-01	6.6E-03	1.6E-01	3.4E+00
>7-8 Aromatics	4.6E-06	1.8E-06	1.8E-06	9.0E-06	1.3E-02	2.2E-06	1.3E-02	4.8E-03	6.7E-05	3.0E-04	2.4E-02
>8-10 Aromatics	3.9E-03	7.6E-03	7.6E-03	1.5E-02	2.1E-02	8.0E-03	2.1E-02	2.8E-01	3.5E-02	1.9E-01	1.1E-02
>10-12 Aromatics	2.1E-02	4.2E-02	4.2E-02	8.4E-02	1.3E-02	4.4E-02	1.3E-02	3.1E-02	3.5E-02	5.0E-01	1.8E-03
>12-16 Aromatics	6.4E-02	1.3E-01	1.3E-01	2.5E-01	4.6E-03	1.3E-01	4.6E-03	2.7E-03	2.0E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.9E-02	5.0E-02	5.0E-02	0.0E+00	0.0E+00	4.8E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	4.9E-02	1.3E-01	1.3E-01	0.0E+00	0.0E+00	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		1.60E+05	1.01E+04	4.99E+11	5.01E+08	9.12E+03	5.01E+08	2.41E+06	5.01E+02	3.99E+04	8.68E+08
RBSL(C_{TPH}) (mg/kg)		200000	10000	5E+11	>Csat	9000	>Csat	2000000	500	40000	900000000

#Significant Figures 1
Use Raoult's Law (Yes/No' no

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

Table A-19 (cont'd): Composition Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000835

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.03	0.015	2.76E-03	3.54E-05	6.29E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.35	0.175	3.22E-02	1.41E-04	2.51E-02
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.35	0.175	3.22E-02	1.28E-04	2.27E-02
218-01-9	Chrysene	2.28E+02	<	0.35	0.175	3.22E-02	1.41E-04	2.51E-02
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.35	0.175	3.22E-02	1.16E-04	2.06E-02
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.35	0.175	3.22E-02	1.17E-04	2.07E-02
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	1.93E-02	2.38E-04	4.24E-02
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	1.93E-02	1.93E-04	3.44E-02
	C>8-C10 aliphatics	1.30E+02		13.7	13.7	2.52E+00	1.94E-02	3.45E+00
	C>10-C12 aliphatics	1.60E+02		188.6	188.6	3.47E+01	2.17E-01	3.86E+01
	C>12-C16 aliphatics	2.00E+02		245	245	4.51E+01	2.25E-01	4.01E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.93E+00	7.15E-03	1.27E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	4.60E-04	5.89E-06	1.05E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	4.60E-04	4.99E-06	8.88E-04
	C >8 - C10 aromatics	1.20E+02	<	4.2	2.1	3.86E-01	3.22E-03	5.73E-01
	C>10-C12 aromatics	1.30E+02		11.6	11.6	2.13E+00	1.64E-02	2.92E+00
	C>12-C16 aromatics	1.50E+02		35	35	6.44E+00	4.29E-02	7.63E+00
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.93E+00	1.02E-02	1.81E+00
	C>21-C35 aromatics	2.40E+02	<	53	26.5	4.87E+00	2.03E-02	3.61E+00

Total TPH fractions		*Sum of weight %*	5.62E-01
aliphatics	458.01	100	
aromatics	85.705		
Total	543.715		

(LOCATION): GS000836

Table A-20: TPH Fraction Risk-Based Screening Levels (RBSLs)
Commercial Receptor

	C_{list} TPH fractions (i) (mg/kg)	Surface Soil Ingestion (mg/kg)	Surface Soil Dermal (mg/kg)	Fugitive Dust Inhalation (mg/kg)	Surface soil Outdoor vapor Inhalation (mg/kg)	Surface soil Soil, Dust, Vapor Combined (mg/kg)	Surface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Outdoor vapor Inhalation (mg/kg)	Subsurface soil Indoor vapor Inhalation (mg/kg)	Subsurface soil Leaching to gw Ingestion (mg/kg)	Groundwater Outdoor vapor Inhalation (mg/L)
>5-6 Aliphatics	4.7E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	4.1E+03	6.1E+01	8.1E+04	1.0E+04
>6-8 Aliphatics	2.6E+02	1.0E+07	6.5E+05	1.2E+13	4.5E+06	5.4E+05	4.5E+06	9.8E+03	1.5E+02	2.9E+05	6.8E+03
>8-10 Aliphatics	1.4E+02	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	2.3E+03	3.4E+01	4.1E+04	2.3E+02
>10-12 Aliphatics	8.6E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	1.2E+04	1.8E+02	3.1E+05	1.5E+02
>12-16 Aliphatics	3.8E+01	2.0E+05	1.3E+04	6.3E+11	2.4E+05	1.2E+04	2.4E+05	5.4E+04	8.1E+02	6.2E+06	3.6E+01
>16-21 Aliphatics	1.6E+01	4.1E+06	2.6E+05	No RfC	No RfC	2.4E+05	No RfC	No RfC	No RfC	1.6E+10	No RfC
>5-7 Aromatics	1.6E+03	2.0E+03	1.3E+02	5.7E+09	2.2E+03	1.2E+02	2.2E+03	2.3E+01	3.5E-01	1.1E+00	5.2E+02
>7-8 Aromatics	1.3E+03	4.1E+05	2.6E+04	2.5E+11	9.7E+04	1.9E+04	9.7E+04	2.3E+03	3.4E+01	6.1E+02	2.1E+04
>8-10 Aromatics	1.0E+03	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	3.7E+03	5.6E+01	7.9E+02	6.1E+03
>10-12 Aromatics	6.3E+02	8.2E+04	5.2E+03	1.3E+11	4.9E+04	4.4E+03	4.9E+04	2.0E+04	3.0E+02	1.2E+03	1.4E+04
>12-16 Aromatics	2.9E+02	8.2E+04	5.2E+03	1.3E+11	6.4E+04	4.5E+03	6.4E+04	1.1E+05	1.6E+03	2.5E+03	2.3E+04
>16-21 Aromatics	1.0E+02	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	5.9E+03	No RfC
>21-35 Aromatics	8.3E+00	6.1E+04	3.9E+03	No RfC	No RfC	3.7E+03	No RfC	No RfC	No RfC	4.7E+04	No RfC
	Weight Fraction (f_i) (mg/kg/mg/kg)	**Hazard Quotients (HQ_i) for fractions that are calculated iteratively to obtain TPH RBSLs (unitless)**									
>5-6 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	1.0E-04	1.3E-05	1.0E-04	1.1E-01	7.8E-03	1.4E-04	3.5E-03
>6-8 Aliphatics	1.3E-03	1.1E-05	1.1E-05	5.6E-05	5.7E-05	1.3E-05	5.7E-05	2.6E-02	3.2E-03	3.8E-05	7.9E-04
>8-10 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	5.8E-04	2.3E-02	5.8E-04	6.1E-02	5.5E-01	3.5E-03	1.9E-03
>10-12 Aliphatics	5.0E-02	2.3E-02	2.3E-02	4.0E-02	3.5E-04	2.3E-02	3.5E-04	7.3E-03	1.1E-01	2.7E-04	2.2E-04
>12-16 Aliphatics	1.3E-01	5.7E-02	5.7E-02	1.0E-01	1.6E-04	5.9E-02	1.6E-04	7.0E-04	4.7E-02	6.1E-06	2.1E-05
>16-21 Aliphatics	1.3E-01	2.9E-03	2.9E-03	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.0E-09	0.0E+00
>5-7 Aromatics	3.0E-05	1.4E-03	1.4E-03	2.7E-03	7.4E-01	1.4E-03	7.4E-01	4.7E-01	3.2E-02	2.3E-01	3.4E+00
>7-8 Aromatics	3.0E-05	6.8E-06	6.8E-06	6.1E-05	1.3E-02	8.3E-06	1.3E-02	4.8E-03	3.3E-04	4.4E-04	2.4E-02
>8-10 Aromatics	2.5E-02	2.8E-02	2.8E-02	1.0E-01	2.1E-02	3.0E-02	2.1E-02	2.8E-01	1.7E-01	2.7E-01	1.1E-02
>10-12 Aromatics	5.0E-02	5.7E-02	5.7E-02	2.0E-01	1.3E-02	6.1E-02	1.3E-02	3.1E-02	6.2E-02	3.5E-01	1.8E-03
>12-16 Aromatics	1.3E-01	1.4E-01	1.4E-01	5.1E-01	4.6E-03	1.5E-01	4.6E-03	2.7E-03	3.0E-02	1.2E-01	2.5E-04
>16-21 Aromatics	1.3E-01	1.9E-01	1.9E-01	0.0E+00	0.0E+00	1.9E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-02	0.0E+00
>21-35 Aromatics	3.1E-01	4.7E-01	4.7E-01	0.0E+00	0.0E+00	4.6E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00
Total	1.0E+00										
Hazard Index (HI) (ΣHQ_i)		1.0E+00	1.0E+00	1.0E+00	8.0E-01	1.0E+00	8.0E-01	1.0E+00	1.0E+00	1.0E+00	3.5E+00
		TPH Risk Based Screening Levels									
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)
Total TPH (mg/kg)		9.24E+04	5.85E+03	5.12E+11	5.01E+08	5.37E+03	5.01E+08	3.67E+05	3.74E+02	8.77E+03	8.68E+08
RBSL(C_{TPH}) (mg/kg)		90000	6000	5E+11	>Csat	5000	>Csat	400000	400	9000	900000000
#Significant Figures	1										
Use Raoult's Law (Yes/No	no										

Pathways:

surface soil ingestion = incidental ingestion of surficial soil
surface soil dermal = dermal contact with surficial soil
fugitive dust inhalation = inhalation of dust from surface soil
surface soil outdoor vapor inhalation = outdoor inhalation of vapors from surficial soil
surface soil indoor vapor inhalation = indoor inhalation of vapors from surficial soil
surface soil ingest, dermal, inhal = combined incidential ingestion, inhalation of dust, and outdoor inhalation of vapors from surficial soil
subsurface soil outdoor vapor inhalation =outdoor inhalation of vapors from subsurface soil
subsurface indoor vapor inhalation =indoor inhalation of vapors from subsurface soil
gw outdoor vapor inhalation = outdoor inhalation of vapors from groundwater
gw indoor vapor inhalation =indoor inhalation of vapors from groundwater
gw ingestion = ingestion of groundwater
subsurface soil leaching to gw ingestion = ingestion of groundwater that contains contaminants leaching from subsurface soil

Sample Identification Data

(MM/D/YR): 09/19/00
(TYPE): Soil
(SITE NAME): ST702/8
(LOCATION): GS000836

Table A-20 (cont'd): Composition Data

CAS #	COMPOUND	Molecular Weight (g/mol)	Soil Data (mg/kg)		Calculation (.5* det. Lim.)	Weight percent	(mol/g)	Mole Percent
	Volatile Organic Compounds							
71-43-2	Benzene	7.80E+01	<	0.005	0.0025	3.02E-03	3.87E-05	7.38E-03
	Carcinogenic PAHs							
56-55-3	Benz(a)anthracene	2.28E+02	<	0.34	0.17	2.06E-01	9.01E-04	1.72E-01
50-32-8	Benzo(a)pyrene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
205-99-2	Benzo(b)fluoranthene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
207-08-9	Benzo(k)fluoranthene	2.52E+02	<	0.34	0.17	2.06E-01	8.16E-04	1.55E-01
218-01-9	Chrysene	2.28E+02	<	0.34	0.17	2.06E-01	9.01E-04	1.72E-01
53-70-3	Dibenz(ah)anthracene	2.78E+02	<	0.34	0.17	2.06E-01	7.39E-04	1.41E-01
193-39-5	Indeno(123-cd)pyrene	2.76E+02	<	0.34	0.17	2.06E-01	7.45E-04	1.42E-01
	TPH fractions							
	C>5-C6 aliphatics	8.10E+01	<	0.21	0.105	1.27E-01	1.57E-03	2.99E-01
	C>6-C8 aliphatics	1.00E+02	<	0.21	0.105	1.27E-01	1.27E-03	2.42E-01
	C>8-C10 aliphatics	1.30E+02	<	8.3	4.15	5.02E+00	3.86E-02	7.35E+00
	C>10-C12 aliphatics	1.60E+02	<	8.3	4.15	5.02E+00	3.14E-02	5.97E+00
	C>12-C16 aliphatics	2.00E+02	<	21	10.5	1.27E+01	6.35E-02	1.21E+01
	C >16-C21aliphatics	2.70E+02	<	21	10.5	1.27E+01	4.70E-02	8.96E+00
	C>5-C7 aromatics	7.80E+01	<	0.005	0.0025	3.02E-03	3.87E-05	7.38E-03
	C>7-C8 aromatics	9.21E+01	<	0.005	0.0025	3.02E-03	3.28E-05	6.25E-03
	C >8 - C10 aromatics	1.20E+02	<	4.1	2.05	2.48E+00	2.07E-02	3.93E+00
	C>10-C12 aromatics	1.30E+02	<	8.3	4.15	5.02E+00	3.86E-02	7.35E+00
	C>12-C16 aromatics	1.50E+02	<	21	10.5	1.27E+01	8.46E-02	1.61E+01
	C>16-C21 aromatics	1.90E+02	<	21	10.5	1.27E+01	6.68E-02	1.27E+01
	C>21-C35 aromatics	2.40E+02	<	52	26	3.14E+01	1.31E-01	2.49E+01

Total TPH fractions		*Sum of weight %*	5.25E-01
aliphatics	29.51	100	
aromatics	53.205		
Total	82.715		

APPENDIX B

RBSL CALCULATIONS

TPHCWG Demonstration
MAC Chalet, Site ST702/8
Elmendorf AFB, Alaska

The procedure for calculating a TPH RBSL for cross-media pathways based upon summing the risk from each fraction is complex. Please note that the following procedure is only appropriate for calculation of RBSLs for cross-media pathways since it sets as an upper limit for the RBSL the degree of saturation, which does not limit exposure for direct routes such as soil ingestion, dermal exposure, and inhalation of particulates. An additional procedure used to calculate exposure for direct pathways is provided later.

Cross-media Pathways

Partitioning qualities govern how a chemical interacts with its environment. Specific physical properties responsible include solubility, vapor pressure, sorption coefficient, and Henry's Law Constant. A brief discussion of the role these parameters play in basic partitioning in the environment is provided in the following paragraphs. The fraction-specific values for each of the described fate and transport parameters are provided in Table 3-1. The equations used to develop these fate and transport properties are available in the TPH Criteria Working Group "Volume III. Selection of Representative TPH Fractions Based on Fate and Transport Considerations" (1998).

The solubility of aromatic hydrocarbons, for any EC number, is generally greater than that of aliphatic hydrocarbons, especially at high EC values. The variability in solubility around any given EC value is about an order of magnitude. The higher solubility of the aromatics means that aromatic hydrocarbons are more likely to be present as dissolved constituents in groundwater than are the corresponding aliphatic hydrocarbons.

The soil-water sorption coefficient (k_s) expresses the tendency of a chemical to be adsorbed onto a soil particle. The magnitude of the sorption coefficient for most soil/water systems is a function of the hydrophobicity of the chemical (as indicated by its solubility) and the organic carbon content of the soil. For non-ionic, hydrophobic chemicals such as petroleum hydrocarbons, the primary property found to control sorption is the organic carbon content (f_{oc}) of the soil.

In general, aliphatic fractions are more likely to remain bound to a soil particle than the aromatic fraction of an equivalent EC. This tendency was previously indicated by the low solubility observed for aliphatic fractions. The majority of log k_{oc} (carbon-water sorption coefficient) values presented in Table 3-1 were derived from the octanol-water partitioning coefficient.

There is very little difference in vapor pressure between aliphatic and aromatic constituents of an equivalent EC. In effect, the EC and vapor pressure are closely related. This relationship is expected because both EC and vapor pressure are largely functions of a compound's boiling point.

The Henry's law constant (H_c) is definable as an air-water partitioning coefficient and may be measured as the ratio of a compound's concentration in air to its concentration in water at equilibrium. Aliphatics and aromatics behave differently based on Henry's law constant. For aromatic fractions, the Henry's law constant decreases with increasing EC; for aliphatic fractions,

the Henry's law constant is virtually unaffected by EC. In general, aliphatic hydrocarbons are less soluble and more volatile than aromatic hydrocarbons. It is important to note, however, that benzene, an aromatic compound, is very volatile and more toxic than the corresponding aliphatic fractions. Therefore, when present, benzene is likely to drive risk calculations for pathways involving volatilization from soil or groundwater.

The parameters described above are combined into simple fate and transport models to evaluate the partitioning and migration of chemicals for the different applicable pathways. For leaching and volatilization pathways where transport and therefore exposure are maximized at the saturation concentration for specific fractions, the following equation is solved:

$$HI = \sum_{i=1}^{i=n} HQ_i = Min\left(\sum_{i=1}^{i=n} \frac{fiC_{TPH}}{RBSL_i}, \sum_{i=1}^{i=n} \frac{C_{isat}}{RBSL_i}\right) \leq 1 \quad \text{given that,}$$

$$\sum_{i=1}^{i=13} f_i = \sum_{i=1}^{i=n} \frac{C_i}{C_{TPH}} = 1$$

where,

HI	=	Hazard Index (typically ≤ 1) [unitless]
n	=	number of fractions (13 total) [unitless]
HQ	=	Hazard Quotient for each specific fraction [unitless]
f	=	Percent Weight of each TPH fraction in total TPH mixture [unitless]
$C_{i\,sat}$	=	Saturation concentration for i^{th} TPH fraction (mg/kg)
$RBSL_i$	=	Tier 1 risk-based screening level for i^{th} TPH fraction(mg/kg)
C_{TPH}	=	Concentration of TPH mixture

The saturation concentration is defined by the following equation:

$$C_{sat}\left[{}^{mg}/_{kg}\right] = \frac{S}{\rho_s} * [H_c\theta_{as} + \theta_{ws} + k_s\rho_s]$$

where:

S	=	Fraction effective solubility [mg/L]
ρ_s	=	Soil Bulk Density [g/cm^3]
H_c	=	Henry's Constant [atm-m^3/mol]
θ_{as}	=	Volumetric air content of the soil [cm^3/cm^3]
θ_{ws}	=	Volumetric water content of the soil [cm^3/cm^3]
k_s	=	Soil sorption coefficient (k_{oc}*f_{oc}) [cm^3/g]

Note: The effective solubility of a hydrocarbon fraction is equal to the fraction's solubility limit multiplied by the mole fraction of the hydrocarbon fraction in the mixture (i.e., TPH).

The value obtained for C_{sat} will vary considerably if the effective C_{sat} of each fraction present in the sample is considered through the use of Raoult's law. The two equations above are iteratively solved for each TPH fraction, which is the additive mixture RBSL for the soil sample. Residual saturation is the point at which any increase in chemical concentration will not change the risk, up until the point at which free product migration becomes an issue. For purposes of comparing RBSLs obtained using different analytical fractionation methods, such as the MADEP TPH Method, Raoult's law was not used to calculate the RBSLs presented in the following sections.

Soil Leaching to Groundwater Pathway

Leaching of contaminants from impacted soil into groundwater through infiltrating water is one exposure pathway evaluated in the RBCA analysis. Soil RBSLs are calculated to be protective of groundwater quality. This involves: 1) calculating a groundwater RBSL ($RBSL_{gw}$) to determine an acceptable water concentration, 2) calculating a leachate concentration protective of groundwater (based on the groundwater RBSL), and 3) calculating a soil concentration which would result in this leachate concentration. The following equation calculates the $RBSL_{gw}$ for ingestion.

$$RBSL_{gw}\left[\frac{mg}{L\text{-}water}\right] = \frac{THQ \times RfD_o \times BW \times AT_n \times 365^{days/yr}}{IR_{water} \times EF \times ED}$$

where:

THQ	=	Target hazard quotient [unitless]
RfD_o	=	Oral chronic reference dose [mg/kg-day]
BW	=	Body weight [kg]
AT_n	=	Averaging time for noncarcinogens [yrs]
IR_{water}	=	Daily ingestion rate [L/day]
EF	=	Exposure frequency [days/yr]
ED	=	Exposure Duration [yrs]

The $RBSL_{gw}$ is based on a target hazard quotient of 1.0. Exposure parameters are provided in Table B-1. RfDs for the fractions are listed in Table 3-2.

TABLE B-1: TIER 1 DEFAULT EXPOSURE FACTORS

Name	Parameter	Units	Construction Scenario	Commercial Scenario
Averaging Time: carcinogens	At_c	y	70	70
Averaging Time: non-carcinogens	At_n	y	0.083	25
Body Weight	BW	kg	70	70
Exposure Duration	ED	y	0.083[a]	25
Exposure Frequency	EF	days/y	250	250
Ingestion rate: soil	IR_{soil}	mg/day	100	50
Inhalation Rate: air-indoor	$IR_{air\text{-}in}$	m^3/day	NA	20
Inhalation Rate: air-outdoor	$IR_{air\text{-}out}$	m^3/day	20	20
Ingestion rate: water	IR_w	L/day	1	1
Soil Adherence Factor	M	mg/cm^2	0.5	0.5
Dermal Absorption Factor	RAF_d	-	c.s.	c.s.
Oral Absorption Factor	RAF_o	-	1	1
Skin surface area	SA	cm^2/day	3160	3160
Target Hazard Quotient for Individual Constituents.	THQ	-	1	1
Target Excess Ind. Lifetime Cancer Risk	TR	-	1E-06	1E-06

The analytical model used to estimate soil leaching to groundwater determines the partitioning of a constituent into water, vapor, and sorbed phases based on the physical and chemical properties of the constituent. In this model, infiltrating water migrates through contaminated soils in the vadose zone. At this point, some of the contaminant partitions from the soil or vapor phase into the water phase. This leachate is then assumed to migrate completely and instantaneously into groundwater. Some dilution of the leachate is included using an attenuation factor based on infiltration rate, groundwater velocity, source width, and height of the mixing zone in the water column. The equation describing this attenuation factor (AF) is as follows:

$$AF = \left[1 + \frac{U_{GW}\delta_{GW}}{IW}\right]$$

where:

U_{GW} = Groundwater velocity [ft/day]
δ_{GW} = Height of groundwater mixing zone [ft]
I = Precipitation infiltration rate [ft/day]
W = Width of the source area parallel to the mixing zone [ft]

Partitioning into the three phases, soil, water, and air, is governed by the partitioning factor. As Henry's law constant is applicable only to dilute solutions, the use of this model is not appropriate when free phase liquid is present. The partitioning factor (PF) is shown below:

$$PF = \frac{[\theta_{ws} + k_s\rho_s + H_c\theta_{as}]}{\rho_s}$$

where,

θ_{ws}	=	Soil volumetric water content [cm^3/cm^3]
k_s	=	Soil sorption coefficient ($k_{oc}*f_{oc}$) [cm^3/g]
ρ_s	=	Soil density [g/cm^3]
H_c	=	Henry's Constant [atm-m^3/mol]
θ_{as}	=	Soil volumetric air content [cm^3/cm^3]

The PF multiplied by AF, which accounts for dilution of leached water into underlying groundwater, is termed the leaching factor (LF). The ultra-conservative leaching model assumes that no attenuation of leachate occurs from the vadose to the saturated zone. In fact, biological degradation of the constituent or repartitioning onto soil or into the vapor phase are all likely to occur as the leachate migrates to groundwater. Other assumptions of the model include: 1) a constant chemical concentration in the subsurface soils, 2) linear equilibrium partitioning within the soil matrix between sorbed, dissolved, and vapor phases, 3) steady-state leaching from the vadose zone to groundwater, and 4) steady state, well-mixed dispersion of the leachate within the groundwater mixing zone. Therefore the LF, which governs the movement of contaminants from soil to infiltrating water, incorporates both the PF and the AF, in the following equation:

$$LF = \frac{\rho_s}{[\theta_{ws} + k_s + H\theta_{as}]\left(1 + \frac{U_{gw}\delta_{gw}}{IW}\right)}$$

where:

LF	=	leaching factor [mg/L-H_2O / mg/kg-soil]
U_{gw}	=	groundwater Darcy velocity [cm/yr]
δ_{gw}	=	groundwater mixing zone thickness [cm]
I	=	infiltration rate of water through soil [cm/yr]
W	=	width of source area parallel to groundwater flow direction [cm]

Parameters for the leaching pathway are provided in Table B-2. Once the LF has been established, fraction-specific soil RBSLs may be calculated as follows:

$$RBSL_s\left[\frac{mg}{kg-soil}\right] = \frac{RBSL_w\left[\frac{mg}{L-air}\right]}{LF_{sw}}$$

The fraction-specific RBSLs are then used to calculate "whole TPH" RBSLs.

Volatilization to Indoor Air Pathway

The mathematical model used to estimate volatilization from soil to indoor air is based upon the partitioning of a constituent into water, vapor, and sorbed phases as determined by the physical properties of the chemical. The model accounts for the contaminant partitioning into soil pore gas and migrating through the vadose zone to the base of a building foundation. From there the gas diffuses through cracks in the foundation and into the building air space, where exposure through inhalation may occur.

The first step in calculating a soil RBSL for the indoor air pathway requires the calculation of an air concentration or RBSL, which is protective of indoor air quality (based on a target HQ of 1.0). Indoor air RBSLs are calculated for each TPH fraction and then a whole TPH RBSL is calculated based on the percent composition of each fraction. The following equation is used to calculate the air RBSLs:

$$RBSL_{air}\left[\frac{\mu g}{m^3 air}\right] = \frac{THQ \times RfD_i \times BW \times AT_n \times 365\,{}^{days}/_{yr} \times 10^3\,{}^{\mu g}/_{mg}}{IF_{air-in} \times EF \times ED}$$

where:

THQ	=	Target hazard quotient [unitless]
RfD_i	=	Inhalation chronic reference dose [mg/kg-day]
BW	=	Body weight [kg]
AT_n	=	Averaging time for noncarcinogens [yrs]
IF_{air-in}	=	Daily inhalation rate [m^3/day]
EF	=	Exposure frequency [days/yr]
ED	=	Exposure Duration [years]

The second step in calculating a soil concentration ($RBSL_{soil}$) which will result in an acceptable indoor air concentration ($RBSL_{air}$) is to model the transport of contaminants from the vadose soil to indoor air. This model is extremely conservative, assuming: 1) a constant chemical concentration in subsurface soils; 2) linear equilibrium partitioning in the soil between sorbed, dissolved, and vapor phases; and 3) steady-state vapor- and liquid-phase diffusion through the vadose zone and foundation cracks. In addition, the model assumes that vapors migrate completely and instantaneously into the building, i.e., no attentuation occurs. It does not account for any biodegradation and soil sorption which could occur as the vapor migrates through the vadose zone.

TABLE B-2: PARAMETERS FOR CROSS-MEDIA RBSL CALCULATIONS

Description	Parameter	Units	Teir 1 Default Values	Modified Teir 1a Values
Ambient air mixing zone height	δ_{air}	cm	c.s. & m.s.	
Areal fraction of cracks in foundations/walls	η	cm^2/cm^2	100	
Averaging time for vapor flux	τ	s	c.s.	
Carbon-water sorption coefficient	k_{oc}	cm^3/g	c.s.	
Depth to groundwater (hcap+hv)	L_{GW}	cm	0.00023	
Depth to subsurface soil sources	L_S	cm	0.01	
Diffusion coefficient in air	D^{air}	cm^2/s	c.s.	
Diffusion coefficient in water	D^{wat}	cm^2/s	5	
Enclosed space air exchange rate	ER	1/s	295	
Enclosed space foundation or wall thickness	L_{crack}	cm	30	7[a]
Enclosed space volume/infiltration area ratio	L_B	cm	c.s.	
Fraction organic carbon in soil	f_{oc}	g/g	foc*koc	
Groundwater Darcy velocity	μ_{gw}	cm/yr	300 - commercial	
Groundwater mixing zone thickness	δ_{gw}	cm	15	
Henry's Law Constant	H	(cm^3/cm^3)	300	143.3[a]
Infiltration rate of water through soil	I	cm/yr	100	61[a]
Lower depth of surficial soil zone	d	cm	2.2E-10	
Particulate emission rate	PE	g/cm^2-s	c.s.	
Particulate Emission Rate	VF_p	(mg/m^3)/ (mg/kg)	225	
Pure component solubility in water	S	mg/L	2500	354[a]
Soil bulk density	ρ	g/cm^3	1500	
Soil-water sorption coefficient	k_s	cm^3/g	200	
Thickness of capillary fringe	h_{cap}	cm	200	
Thickness of vadose zone	h_v	cm	0.01	
Total soil porosity	θ_T	cm^3/cm^3	0.038	
Volatilization Factor	VF_i	$\frac{(mg/m^3)}{(mg/m^3)}$	0.26	
Volumetic air content in vadose zone soils	θ_{as}	cm^3/cm^3	0.26	0.03[a]
Volumetric air content in capillary fringe soils	θ_{acap}	cm^3/cm^3	0.38	0.232[a]
Volumetric air content in foundation cracks	θ_{acrack}	cm^3/cm^3	0.342	
Volumetric water content vadose zone soils	θ_{ws}	cm^3/cm^3	0.12	
Volumetric water content: capillary fringe	θ_{wcap}	cm^3/cm^3	0.12	
Volumetric water content: foundation cracks	θ_{wcrack}	cm^3/cm^3	1.7	1.88[a]
Width of source area parallel to flow direction	W	cm	7.88E+08	
Wind speed above ground surface	U_{air}	cm/s	6.90E-14	

c.s. = chemical specific

m.s. = media specific

Dilution of vapor is expected to occur between the source and the building. Therefore the following diffusion factor is used:

$$D_s^{eff}\left[\frac{cm^2}{s}\right] = D^{air}\frac{\theta_{as}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H_c}\times\frac{\theta_{ws}^{3.33}}{\theta_T^2}$$

where:

D^{air}	=	Diffusion coefficient in air [cm^2/sec]
θ_{as}	=	Soil volumetric air content [cm^3-air/cm^3-soil]
θ_T	=	Total soil porosity [cm^3/cm^3]
D^{wat}	=	Diffusion coefficient in water [cm^2/sec]
H_c	=	Henry's constant [cm^3-air/cm^3-soil]
θ_{ws}	=	Soil volumetric water content [cm^3-water/cm^3-soil]

The diffusion of the pore gas through cracks in the foundation is governed by the following equation:

$$D_{crack}^{eff}\left[\frac{cm^2}{s}\right] = D^{air}\frac{\theta_{acrack}^{3.33}}{\theta_T^2} + D^{wat}\frac{1}{H_c}\times\frac{\theta_{wcrack}^{3.33}}{\theta_T^2}$$

where:

D^{air}	=	Diffusion coefficient in air [cm^2/sec]
θ_{acrack}	=	Volumetric air content in foundation [cm^3-air/cm^3]
θ_T	=	Total soil porosity [cm^3/cm^3]
D^{wat}	=	Diffusion coefficient in water [cm^2/sec]
H_c	=	Henry's constant [cm^3-air/cm^3-soil]
θ_{wcrack}	=	Volumetric water content in foundation [cm^3-water/cm^3]

The default parameters used in these equations are provided in Table B-2.

Chemical Partitioning

The partitioning equation which accounts for the movement of chemicals from the soil into the vapor phase in the soil pore space is defined as the partitioning factor (soil/vapor phase) as follows:

$$PF_{S-V} = \frac{H_c\rho_s}{\theta_{ws} + k_s\rho_s + H_c\theta_{as}}$$

where:

PF_{S-V}	=	Soil/Vapor phase partitioning factor (unitless)
H_c	=	Henry's Constant [cm^3-water/cm^3-air]

ρ_s	=	Soil bulk density [g/cm^3]
θ_{ws}	=	Soil volumetric water content [cm^3/cm^3]
k_s	=	Soil sorption coefficient (k_{oc}*f_{oc}) [cm^3/g]
θ_{as}	=	Soil volumetric air content [cm^3/cm^3]

The diffusion coefficients and partitioning factor are combined to yield a subsurface soil to enclosed space volatilization factor (VF_{sesp}), which takes into account partitioning, diffusion in the vadose zone, effective diffusion into an enclosed space, and adds terms for accumulation of vapors in the enclosed space. The VF is calculated as follows:

$$VF_{sesp} = \frac{\dfrac{(PF_{S-V})D_s^{eff}}{L_s(ER)L_B}}{1+\dfrac{D_s^{eff}}{ERL_s}+\dfrac{D_s^{eff}+L_{crack}}{(L_sD_{crack}^{eff})\times\eta}} \times 10^3\left[\frac{cm^3-kg}{m^3-g}\right]$$

where:

PF_{s-v}	=	Soil/Vapor phase partitioning factor (unitless - see equation above)
D_s^{eff}	=	Effective diffusion coefficient in soil [cm^2/s]
L_s	=	Depth to subsurface soil sources [cm]
ER	=	Enclosed-space air exchange rate [s^{-1}]
L_B	=	Enclosed-space volume/infiltration area ratio [cm]
D_{crack}^{eff}	=	Effective diffusion coefficient through foundation cracks [cm^2/s]
L_{crack}	=	Enclosed-space foundation or wall thickness [cm]
η	=	Areal fraction of cracks in foundation/walls [cm^2/cm^2]

Values in these calculations are provided in Table B-2. The term VF_{sesp}, when combined with the allowable concentration of contaminant in the air space ($RBSL_{air}$), determines the maximum allowable concentration in the subsurface soil source area as shown in the following equation:

$$RBSL_{svin}\left[\frac{mg}{kg-soil}\right] = \frac{RBSL_{air}\left[\frac{mg}{m^e-air}\right]}{VF_{sesp}}$$

where:

$RBSL_{svin}$	=	Risk based screening level (volatilization to indoor air pathway)

Fraction-specific RBSLs are then used to calculate the "whole TPH" RBSLs.

Volatilization to Outdoor Air Pathway

The volatilization to outdoor air model is similar to the indoor air model. It assumes contaminants partition into soil pore gas which migrates through the vadose zone to the surface

and mixes with the ambient air. Dispersion into ambient air is modeled using a "box model", which is typically valid for source widths of less than 100 feet parallel to wind direction. Steady-state well-mixed atmospheric dispersion of the vapors within the breathing zone is assumed. Other assumptions listed for the indoor air model include linear equilibrium partitioning, steady-state vapor diffusion through the vadose zone and no attenuation of the chemical as it migrates through the vadose zone.

The calculation of a soil RBSL protective of outdoor air quality is similar to that used for the indoor air pathway. A volatilization factor for ambient air (VF_{samb}) is derived, using the same effective diffusion coefficient in vadose soils and partitioning factor. Default values are provided in Table B-2.

$$VF_{samb}\left[\frac{mg/m^3-air}{mg/kg-soil}\right] = \frac{PF_{S-V}}{1+\frac{U_{air}\delta_{air}Ls}{D_S^{eff}w}} \times 10^3\left[\frac{cm^3-kg}{m^3-g}\right]$$

where:

PF_{s-v}	=	Soil/Vapor phase partitioning factor [unitless]
D_s^{eff}	=	Effective diffusion coefficient in soil [cm^2/s]
U_{air}	=	Wind speed above ground surface in ambient mixing zone [cm/s]
δ_{air}	=	Ambient air mixing zone height [cm]
w	=	Width of source area parallel to wind direction [cm]

VF_{samb} is then combined with the allowable concentration of contaminant in the air space ($RBSL_{air}$) to determine the maximum allowable concentration of contaminant in the subsurface soil ($RBSL_{svout}$), as shown below:

$$RBSL_{svout} = \frac{RBSL_{air}\left[\frac{mg}{m^e-air}\right]}{VF_{samb}}$$

Fraction-specific RBSLs are then used to calculate "whole TPH" RBSLs. Parameter values are presented in Table B-2.

Direct Contact Pathway

For direct exposure routes such as soil ingestion, dermal absorption, and inhalation of particulates, exposure is not limited by C_{sat}. The assumption is made that intake will continue to increase linearly with soil loading beyond C_{sat} for ingestion, dermal, and particulate inhalation pathways. For the direct contact pathways, the following equations are solved:

$$HI = \sum_{i=1}^{i=n} HQ_i = \sum_{i=1}^{i=n} \frac{f_i C_{TPH}}{RBSL_i} \leq 1$$

$$RBSL_{ss}\left[\frac{ug}{kg-soil}\right]=\frac{THQ\times BW\times AT_n\times 365\ ^{days}/_{yr}}{EF\times ED\times\left[\frac{10^{-6}\ ^{kg}/_{mg}\times(IR_{soil}\times RAF_o\times SA\times M\times RAF_d)}{RfD_o}\right]+\left[\frac{IR_{air}\times(VF_{ss}+VF_p)}{RfD_i}\right]}$$

where:

THQ	=	Target hazard quotient for constituent [unitless]
BW	=	Body weight [kg]
AT_n	=	Averaging time for noncarcinogens [years]
EF	=	Exposure frequency (days/year]
ED	=	Exposure duration [years]
IR_{soil}	=	Soil ingestion rate [mg/day]
RAF_o	=	Relative oral absorption factor [unitless]
SA	=	Skin surface area [cm^2/day]
M	=	Soil to skin adherence factor [mg/cm^2]
RAF_d	=	Relative dermal absorption factor [unitless]
RfD_o	=	Oral chronic reference dose [mg/kg-day]
IR_{air}	=	Inhalation rate [m^3/day]
VF_{ss}	=	Surficial soils to ambient air partition factor (vapor) [unitless]
VF_p	=	Surficial soils to ambient air partition factor [unitless]
RfD_i	=	Inhalation chronic reference dose [mg/kg-day]

Similar to the HI calculation, the RBSL equation is solved iteratively to find C_{TPH} such that HI=1 under the constraint of a target hazard index of 1.0. Default exposure parameters are provided in Table B-1. The fraction specific RfDs are provided in Table 3-2.

APPENDIX C

FIELD DEMONSTRATION PHOTOGRAPHS: SAMPLING SITES AND SITE SAMPLING ACTIVITIES

TPHCWG Demonstration
MAC Chalet, Site ST702/8
Elmendorf AFB, Alaska

Figure C-1: Back of MAC Chalet. Photograph taken while standing on 702WL04.

Figure C-2: Six Mile Lake. Photograph taken while standing on 702WL04. GS000831 located opposite horseshoe pit (to the right, out of the picture).

Figure C-3: Pat Kelly (Hughes Drilling) opens split spoon held by Major Wade Weisman (3AMDS) while Teri Sterner (OpTech) catches sample.