Note to anyone reviewing this Administrative Record:

This Sampling and Analysis Work Plan was prepared primarily for the purposes of LDEQ's Risk Based Corrective Action Plan (RBCA). When the NRDA sampling protocol was drawn up, LOSCO, the State Natural Resource Trustees, and Marathon, agreed that enough overlap existed between the two sampling protocols that the NRDA protocol should be appended to the RBCA protocol to avoid unnecessary redundancy.

The resulting appendix follows this report in the Administrative record.

Marion E Boulden 10-14-96
Marion Boulden
Natural Resource Specialist
Louisiana Oil Spill Coordinator's Office

FINAL REPORT

#E1

SAMPLING AND ANALYSIS WORK PLAN

MARATHON PIPELINE RELEASE
AIRLINE HIGHWAY
ST. JAMES PARISH, LOUISIANA

Prepared for:
Marathon Refinery
Garyville, Louisiana

August 1996

WCC File 96B195-3

Woodward-Clyde

Woodward-Clyde Consultants
2822 O'Neal Lane
Baton Rouge, Louisiana 70816

Woodward-Clyde
Engineering & science applied to the earth & its environment

August 2, 1996

Ms. Jennifer Bracey
Environmental Engineer
Marathon Oil Company
P. O. Box AC
Garyville, Louisiana 70051

Re: Sampling and Analysis Workplan
Initial Assessment for Airline Highway Pipeline Release
WCC File 96B195-3

Dear Ms. Bracey:

Woodward-Clyde Consultants (WCC) is pleased to submit nine (9) copies of the Sampling and Analysis Workplan to conduct an assessment at the Marathon pipeline release site in Garyville, Louisiana. Five (5) copies of the Workplan are to be delivered to LDEQ for their review.

WCC appreciates the opportunity to assist Marathon on this important project.

Very truly yours,

Charles B. Dartez, C.H.M.M.

Johnny L. Hebert, CPG, C.H.M.M.

JLH:tlc

Enclosures

96B195\PWPO-2.CVL MARATHON

Woodward-Clyde Consultants — A Subsidiary of Woodward-Clyde Group, Inc.
2822 O'Neal Lane • Baton Rouge, Louisiana 70816
(504) 751-1873 • Fax (504) 753-3616

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EXECUTIVE SUMMARY

This workplan has been developed for the purposes of assessing the long-term impacts of a recent gasoline release from Marathon Pipeline Company's pipeline along Airline Highway near Gramercy, Louisiana. The release occurred on May 24, 1996 in an uninhabited privately owned swampy area along a right-of-way that includes a total of eight pipelines owned by various parties. The release was limited to the right-of-way and drainages to nearby Blind River. Of the 11,308 barrels of gasoline released, a total of 780 barrels was recovered via the emergency response activities.

The workplan presented herein is based on specific project objectives, essentially to evaluate whether site conditions pose an unacceptable risk to human health and the environment. The objectives, approach and resulting sampling strategy were developed using U.S. Environmental Protection Agency's (EPA) Guidance Documents on Data Quality Objectives (EPA, 1987) and Louisiana Department of Environmental Quality's (LDEQ) Draft RBCA Guidance (August, 1995). This approach includes a completed preliminary exposure assessment to identify potential human and ecological receptors, proposed sampling locations for potentially affected media in the most impacted areas of the spill at the exposure points, establishment of exposure point concentrations, comparison of data to human health risk-based screening levels, a qualitative assessment of ecological impacts and collection of data to evaluate natural attenuation potential.

Although the identified potential receptors and their exposure pathways are considered complete with respect to the site, any additional receptors that may be identified can be screened using the process described herein and the data collected from this workplan (or additional data if needed) to evaluate potential risks for additional receptor(s). Following completion of this initial phase of work, and depending on the above findings, additional characterization activities may be required prior to evaluating the feasibility of remedial alternatives. This could include a site-specific baseline risk assessment and additional sampling to evaluate potential risks. The information to be collected during this assessment may also be referenced for purposes of evaluating chronic effects under Natural Resource Damage Assessment activities.

1.0 INTRODUCTION

This proposed workplan has been prepared for the Garyville, Louisiana Marathon Refinery for the assessment of a recent gasoline release from a buried pipeline. The release site is located along US Highway 61 (Airline Highway) in St. James Parish near Gramercy, Louisiana. The spill location is shown on Figure 1.

The purpose of this document is to provide an assessment strategy and field and laboratory methods for collection of data to meet specific data quality objectives. The workplan establishes project data quality objectives in conformance to U.S. EPA Guidance Documents (Data Quality Objectives for Remedial Response Activities, U.S. EPA, March 1987) and the draft version of the Louisiana Department of Environmental Quality's "Proposed Approach for Implementing a LDEQ Risk Based Corrective Action Program" (August, 1995). These documents form the basis for the sampling and analysis program and future decision making regarding the site.

The workplan is organized as follows:

- Section 2 provides background information on the spill history, environmental setting and potential chemicals of concern;
- Section 3 outlines the project purpose, technical approach and data needs;
- Section 4 is an exposure assessment which identifies the potential receptors and establishes the basis for the sampling strategy;
- Section 5 describes the sampling strategy, including the types and numbers of samples for each potential receptor;
- Section 6 provides procedures for field sample collection;
- Section 7 includes the laboratory analytical program;
- Section 8 establishes the quality assurance and quality control program for the field and lab; and
- Sections 9 and 10 include reporting and possible future work phases.

2.0 PROJECT BACKGROUND

2.1 Spill History

Approximately 11,308 barrels of unleaded gasoline were released from the Garyville-to-Zachary 20-inch pipeline on May 24, 1996 in an uninhabited swampy area along Airline Highway. Initial observations of the pipeline indicate a hole in the line approximately 51 inches long by 6 inches wide, possibly caused by an outside source.

2.1.1 Abatement Actions

Various emergency response activities were conducted following the release. Within one hour of detecting the release, Marathon's emergency spill response team was at the affected area, initiating assessment and recovery activities. Initially, 160 Marathon employees and contractor personnel were onsite. Approximately 3,600 feet of containment and absorbent booms were deployed to contain the release. Absorbent booms currently remain in place in specific drainages (1, 3, 5 and 6) at their discharge points into Blind River.

Berms and water filled structures were constructed on the northeast and southwest ends of the right-of-way perpendicular to Airline Highway to contain the product. The berms are constructed of river sands, capped with spill way dirt, and topped with a matting to promote vegetation.

The point of release was isolated by closing valves and displacing the product with water. Repairs have been completed and the pipeline was placed back in service on June 5, 1996.

It is estimated by Marathon that 780 barrels have been recovered by mechanical means. No human injuries resulted from the incident, and applicable OSHA regulations have been followed during the spill response and subsequent assessment activities.

2.1.2 Impacted Area (Site Definition)

The known impacted area is defined by Airline Highway to the northwest, the railroad to the southeast, the containment berm on the west end and the river on the east. The dimensions are roughly 5,300 feet long by 700 feet wide. Tributaries or drainages designated as 1, 3, 5 and 6 southeast of the site that drain from the pipeline right-of-way to Blind River were identified as being most affected.

2.1.3 Sampling Results

Sampling efforts to date have focused on sediments and surface waters of Blind River and tributaries between the release site and Blind River. Except for data on the tributaries to Blind River, information on surface soils, sediments, surface waters or groundwater within the impacted area has not been collected to date. Data collected during the spill response and surface water, sediment data from the tributaries is still being evaluated as of this data. Ambient air sampling within the impacted area was conducted during the emergency response actions.

2.1.4 Agency Requirements

There are no pending orders or directives from agencies at the present time other than agreements made in previous meetings to submit a workplan for the assessment of impacts. As a preventative measure, Marathon has applied for a temporary stormwater consent order if surface water discharges are needed to maintain adequate freeboard at the berms. It is anticipated that this workplan provides for an assessment of the release and a means for evaluating of the need for long term corrective action. Based on preliminary discussions, the application of LDEQ's Risk Based Corrective Action Program (RBCA) will be implemented for this assessment. An overview of the approach presented herein was discussed with LDEQ's RBCA group on July 3, 1996. Preliminary comments to the approach were provided to Marathon by LDEQ during that meeting. LDEQ visited the site on July 16, 1996 to physically review the site setting and the sampling strategy.

2.2 Environmental Setting

Information on the environmental setting is available for the subject site and has been reviewed as part of this workplan for inclusion into the assessment report. This information includes the following:

- Land use
- Topography
- Surface water flow direction
- Soils
- Regional geology
- Regional groundwater aquifers
- Aquifer recharge potential

The environmental setting review has been incorporated into the technical approach and sampling strategy presented herein.

Land Use

As discussed previously, current land use is undeveloped privately owned swamp and lowlands which have been cleared of trees along the right-of-way that comprises most of the release area. A total of eight pipelines currently exist along the right-of-way, owned by various parties. In addition to the pipeline right-of-way, a railroad right-of-way occurs along the southwestern margin. Along with the swampy conditions, these right-of-ways will preclude further development in the foreseeable future. Trespassers (primarily hunters) could enter the area from Airline Highway and Blind River.

Topography and Surface Water Flow

According to U.S. Geological Survey topographic maps (see Figure 1), the area is characterized as a lowland swamp that was cleared of trees for the pipeline right-of-way. Surface water flow is to the southeast along drainages toward Blind River and thence to Lake Maurepas. The sampling plan incorporates sediments and surface waters in the most impacted areas.

Soils

According to Soil Survey of St. James and St. John The Baptist Parishes, Louisiana (United States Department of Agriculture, August 1973) Soil Conservation Service, the release area is located within the frequently flooded, clayey soils of the Barbary-Sharkey Association. These soils are of high organic content and the water table is within a few feet of the surface. It is not known whether additional shallow groundwater zones are present between the water table and regional aquifers in the area.

Regional Geology

According to the "Geological Map of Louisiana" (Louisiana Geological Survey, 1984) the site is underlain by the Quartenary alluvium, described as gray to brownish gray silty clay with some local sand and gravel.

Regional Groundwater Aquifers

Based on current site knowledge (USGS Water Resources Technical Report No., 24, "Ground Water Resources of the Gramercy Area, Louisiana, by Dial and Kilburn, 1980) the shallowest regional aquifer is the Gramercy Aquifer, mapped to be thin to absent in the spill site area at approximately -175 feet msl. One water well is known to exist in the immediate area (2 mile radius), which is located at the St. James Boat Club approximately one-half mile to the southeast of the site downstream along Blind River. This well is screened at a depth of 190 feet, in the Gramercy Aquifer, according to a recent Louisiana Department of Transportation and Development (LDOTD) water well survey. The well is believed to be used for domestic purposes. The Norco Aquifer, expected to occur at -300 feet mean sea level (msl), occurs below the Gramercy Aquifer. The Norco Aquifer is mapped in USGS reports to be salty in this area and is therefore not potable.

Aquifer Recharge Potential

According to the "Recharge Potential of Louisiana Aquifers" Map (Louisiana Geological Survey and LDEQ, 1988) the release area is described as being in the recharge area for the Alluvial Aquifer System. The recharge potential is not further specified, but is believed to be low due to the soil conditions and proximity to the boundary where there is no recharge to major aquifers.

2.3 Identification of Chemicals of Potential Concern

The identification of the chemicals of potential concern (COCs) is based on Marathon's product composition report dated June 13, 1996 in which a product sample was analyzed for chemical composition (see Appendix A). The COCs are also based on informal discussions with LDEQ during a meeting on June 6, 1996.

The released product was Garyville Regular Unleaded Gasoline. The COCs for characterization and assessment purposes are as follows:

- Benzene
- Toluene
- Ethylbenzene
- Xylenes
- Total Petroleum Hydrocarbons - Gasoline Range Organics (TPH-GRO)

Screening level calculations for TPH-GRO will be based on the following TPH-GRO carbon ranges and their respective surrogates, to be provided by the laboratory:

- Alkanes/cycloalkanes ($<C_8$): n-hexane
- Alkenes/aromatics ($>C_8$): naphthalene

3.0 PROJECT OBJECTIVES

The initial sampling and analysis strategy and future phases of work are tied directly to the project objectives described below.

3.1 Project Purpose

The primary purpose for this project will be to evaluate whether existing conditions pose unacceptable risks to human health and the environment and, if so, to develop a long term remedy to mitigate such risks. The specific project objectives will therefore consist of the following:

a) Establishment of risk based screening levels (RBSLs) for media of concern
b) Collection of data at the exposure points for media of concern
c) Comparison of site levels to risk based screening levels
d) Preliminary data collection for evaluation of natural attenuation

The strategy and approach to meet these objective are discussed below.

3.2 Technical Approach

The approach for this assessment is based on the above objectives and includes the following six steps:

Step 1: Identification of potential receptors
Step 2: Identification of potential exposure points and pathways
Step 3: Determination of COCs
Step 4: Calculation of risk-based screening levels for each media/receptor
Step 5: Determination of COC exposure point concentrations (current and model for future)
Step 6: "Baseline" risk assessment (for media with COCs above screening levels)
Step 7: Additional characterization of COCs for media and areas exceeding risk based screening levels
Step 8: Evaluation of various remedial options, (including review of natural attenuation potential versus cost/benefit of intrusive activities on the ecosystem)

Steps 1, 2 and 3 have been evaluated and are discussed in this workplan as a mechanism to identify initial sampling points. Steps 4 and 5 will be completed as part of this initial phase of work in order to evaluate whether additional characterization is warranted. Depending on the results from this sampling and analysis program, Steps 6 and 7 may be necessary to further evaluate exposure assumptions and to calculate site-specific risks. Step 8 constitutes a feasibility study for addressing areas and media that pose an unacceptable risk to human health or the environment. The data needs are summarized below.

3.3 Data Needs

Using the DQO process, data will be collected for this initial Phase of the project in order to obtain/develop the following:

- Site specific Risk Based Screening Levels (RBSLs) for media of concern
- COC exposure point concentrations
- Determination of completeness of pathways for potential receptors
- Intrinsic groundwater natural attenuation conditions

3.3.1 Site Specific RBSL Development

In order to evaluate the significance of sample results and to make field decisions regarding the necessity for additional assessment, RBSLs will be calculated for the site during this phase. These levels are intended to be used as an internal means of screening areas or media in the field that may warrant further review. The process for RBSL development will be conducted separately via discussions with LDEQ. It is proposed that the RBSLs be developed in sufficient time (prior to completion of these sampling activities) for a comparison to site sampling data as a means of determining whether additional assessment is necessary. In the event various areas or media exceed RBSLs, further characterization is anticipated which will include additional sampling and a site-specific baseline risk assessment.

3.3.2 COC Concentrations at the Exposure Points and Determination/ Quantification of Pathway Completeness

In order to determine COC concentrations at the exposure points and to determine the relative completeness of (or quantitation of) potentially complete pathways, sampling and analysis will be conducted in the media of interest. The sampling and analysis program is presented in Section 5.0. As described in Sections 4.0 and 5.0, the sampling locations are in areas of known impact as a conservative means of establishing COC concentrations for each potential receptor at the exposure points.

3.3.3 Intrinsic Soil and Groundwater Natural Attenuation Conditions

As a preliminary step in evaluating the environmental setting and potential remedial options, information will be collected to establish the potential for natural attenuation of impacted media. Such information will include parameters outlined in the draft of the proposed "Guide for Remediation by Natural Attenuation at Petroleum Release Sites" (ASTM, March 1996).

4.0 IDENTIFICATION OF POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

An exposure pathway consists of four necessary elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium for the released chemical
- A point of potential receptor contact with the medium and the receptors located at the point of contact
- An uptake route (intake of media containing site-related chemicals) at the point of exposure

All four elements must be present for an exposure pathway to be complete and for exposure to occur. Figure 2 is a preliminary site conceptual human health exposure model that has been developed for the site. It identifies pathways that are considered complete, with a solid circle and pathways that are potentially complete, with open circles. Pathways that are not applicable to a situation are marked "NA".

The use of the exposure model is again for the purposes of selecting sampling locations as part of this initial assessment. In assessing contaminant pathways and potential receptors, it is believed that the exposure discussion provided herein is complete and representative of actual site conditions. In the event future receptors are identified, these additional receptors can be screened using a process similar to that conducted herein, and the data collected for this assessment (or additional data. if necessary) could be used in evaluating the potential risks to the additional receptor(s).

4.1 Potential Receptors - Human Health

The potential receptors and respective human health exposure pathways are as follows:

Onsite Trespasser

The trespasser receptor population represents hunters and those individuals who potentially could wander into the pipeline right-of-way or the area between the release site and the Blind River.

Figure 2 shows the following complete exposure pathways for the trespasser:

- Inhalation of COCs in vapor and particulates from the surface soils
- Direct contact (dermal and ingestion) with COCs in surface soils

Additional exposure pathways for the trespasser receptor that are identified in Figure 2 as potentially complete include:

- Inhalation of volatiles that have moved from the surface of the groundwater through the unsaturated zone to the air where exposures could occur. Additional data are required to determine whether this pathway is complete. (It would only be complete if free product occurs on the groundwater and provides a source significant enough for volatilization and migration to the surface to occur.)

- Direct contact with dermal and ingestion surface water and sediments that have been contaminated via overflow and runoff. Additional data are required to determine whether the surface water/sediment areas have been contaminated to the extent that they provide a source for this pathway.

- Inhalation of volatiles from surface water and sediments. Additional data are required to determine whether the surface water/sediment areas have been contaminated to the extent that they provide source for this pathway.

- Ingestion of fish/crustaceans (e.g., crawfish) that have assimilated COCs from surface water and sediments. The primary COCs identified for this study typically do not biomagnify, so this is not considered a significant pathway although it is listed as potentially complete until additional surface water and sediment data are obtained.

- Ingestion of game (e.g., deer, rabbit, squirrel) that have assimilated COCs from surface soils. The primary COCs identified for this study typically do not biomagnify, so this is not considered a significant pathway although it is listed as potentially complete until additional surface water and sediment data are obtained.

Future Pipeline Construction Worker

The future pipeline construction worker could potentially be exposed to impacted areas in the pipeline right-of-way during maintenance and repair activities. This may include workers of Marathon or of other pipelines in the right-of-way.

Figure 2 shows the following complete exposure pathways for the pipeline construction worker:

- Inhalation of COCs that volatilize from groundwater in an excavation scenario.

- Direct contact (dermal and ingestion) with COCs in surface and subsurface soils.

- Inhalation of COCs in vapor and particulates from the surface and subsurface soils.

- Direct contact (dermal and ingestion) with COCs in surface water and sediments via overflow and/or runoff.

Future Offsite Recreational Camper

The future offsite recreational camper will infrequently inhabit offsite swamp and ground along the river with the potential for some trespassing into the pipeline right-of-way.

The following complete exposure pathways are shown in Figure 2 for the recreational camper:

- Inhalation of COCs in vapor and particulates from the surface soils during the periods when the recreational camper wanders to the contaminated soil areas.

- Direct contact (dermal and ingestion) with COCs in surface soils during the periods when the recreational camper wanders to the contaminated soil areas.

Additional exposure pathways for the recreational camper that are identified in Figure 2 as potentially complete include:

- Inhalation of volatiles that have moved from the surface of the groundwater through the unsaturated zone to the air where exposures could occur. (See discussion for trespasser.)

- Direct contact with dermal and ingestion to surface water and sediments that have been contaminated via overflow and runoff. (See discussion for trespasser.)

- Inhalation of volatiles from surface water and sediments. (See discussion for trespasser.)

- Ingestion of fish/crustaceans (e.g., crawfish) that have assimilated COCs from surface water and sediments. (See discussion for trespasser.)

- Ingestion of game (e.g., deer, rabbit, squirrel) that have assimilated COCs from surface soils. (See discussion for trespasser.)

4.2 Potential Receptors - Ecological

Figure 3 identifies exposure pathways for ecological receptors. The potential receptor/pathway combinations are summarized below.

Aquatic Plants

Aquatic plants are those that are either partially or wholly submerged in surface water. These would be the plants that are growing in the surface water drainages, Blind River, and the flooded swamp area. The following pathways were identified for the aquatic plants:

- Direct contact to COCs in sediments.

- Direct contact to COCs in surface water.

- Volatilization of COCs from surface water.

Terrestrial Plants

Terrestrial plants are plants that are typically rooted in soil and not submerged in surface water . These would include all of the plants in the area that are not characterized as aquatic The following pathways were identified for the terrestrial plants:

- Volatilization of COCs from the groundwater into the unsaturated zone where uptake could occur through the plant roots.

- Uptake of COCs directly from the groundwater for plants that have roots that extend to the water table.

- Contact of the plant leaves to COCs from volatilization/particulates from the surface soil.
- Direct contact to contaminated surface and subsurface soils.

Aquatic Animals

Aquatic animals include fish and other animals that live in the surface water drainages, Blind River and the flooded swamps area. The following pathways were identified for the aquatic animals:

- Direct contact (dermal and ingestion) to COCs in sediments.

- Ingestion of forage items that have accumulated COCs from exposures to sediments.

- Direct contact (dermal and ingestion) to COCs in surface water.

- Ingestion of forage items that have accumulated COCs from exposures to surface water.

- Ingestion of forage items that have accumulated COCs from exposures to surface soils.

Terrestrial Animals

These include the nonaquatic and semiaquatic animals that live within the area or migrate through the area. The following pathways were identified for the terrestrial animals:

- Direct contact (dermal and ingestion) to COCs in sediments.

- Ingestion of forage items that have accumulated COCs from exposures to sediments.

- Direct contact (dermal and ingestion) to COCs in surface water

- Ingestion of forage items that have accumulated COCs from exposures to surface water.
- Volatilization of COCs from surface water.

- Direct contact (dermal and ingestion) to COCs in surface soils.

- Ingestion of forage items that have accumulated COCs from exposures to surface media.

A site reconnaissance to identify the specific types of plants and animals in the impacted area will be conducted as part of the site investigation activities. Based on this survey and knowledge regarding the toxicological and chemical properties of the COCs, a qualitative assessment of the ecological impacts will be completed.

5.0 SAMPLING STRATEGY

The sampling strategy is designed to satisfy the data needs discussed in Section 3.0. Specifically the sampling and analysis program will provide information on the completeness of relevant pathways (now deemed potentially complete) and COC concentrations at the exposure points for pathways deemed complete.

5.1 Data Users, Data Types and Data Quantity

Data Users

The sample data will be used by risk assessment and environmental scientists to determine whether the conditions pose an unacceptable risk to human health or the environment.

Data Types

The types of data required have been discussed and include surface soil, surface water, sediment, subsurface soil and groundwater data in the impacted area, as well as sediment and surface water data within the drainages between the right-of-way (ROW) and Blind River. Specifically, the following data is needed for each potential receptor:

Pipeline Worker:

- Surface soils along pipeline
- Subsurface soils along pipeline
- Groundwater along pipeline
- Sediments along ROW
- Surface soils along ROW
- Air/particulates along ROW[1]

Trespasser and Recreational Camper:

- Surface soils along ROW
- Surface waters along ROW
- Sediments along ROW
- Groundwater along ROW (vapors)[1]
- Air/particulates along ROW[1]

Aquatic Plants:

- Sediments along ROW and swamp between ROW and Blind River
- Surface water along ROW and swamp between ROW and Blind River
- Air adjacent to surface water/sediment areas along ROW and swamp between ROW and Blind River[1]

Terrestrial Plants:

- Surface soils along ROW and swamp between ROW and Blind River
- Subsurface soils along ROW and swamp between ROW and Blind River
- Air/particulates along ROW and swamp between ROW and Blind River[1]
- Groundwater along ROW and swamp between ROW and Blind River

[1] To be determined through empirical relationships or modeling rather than direct sampling.

Aquatic Animals:

- Sediments along ROW and swamp between ROW and Blind River
- Surface water along ROW and swamp between ROW and Blind River
- Forage organisms along ROW and swamp between ROW and Blind River[1]

Terrestrial Animals:

- Sediments along ROW and swamp between ROW and Blind River
- Surface water along ROW and swamp between ROW and Blind River
- Surface soils along ROW and swamp between ROW and Blind River
- Air/particulates along ROW and swamp between ROW and Blind River[1]
- Forage organisms along ROW and swamp between ROW and Blind River[1]

Data Quantity

A sufficient number of samples will be required to establish representative site concentrations and to allow for valid comparisons and decisions regarding the need for future work. A preliminary review of statistical approaches indicates that statistical establishment of sample quantities at the present time (prior to sampling) is not possible due to uncertainty of sample variance. The approach will therefore consist of the collection of data as detailed herein in areas of greatest concern of and then statistically evaluating the data to determine the distribution and relative representativeness for the purpose of estimating exposure point concentrations. The distribution of samples will be characterized as normal, log-normal, or non-normal[2]. Several statistical test procedures are available for evaluating the distribution

[1] To be determined through empirical relationships or modeling rather than direct sampling.

[2] A non-normal distribution pattern may be addressed through use of alternate data transformations, e.g., square root, inverse etc., a nonparametric statistical approach, or necessitate additional sampling.

of environmental measurement data (Gilbert 1987[3], Sokal and Rolhf 1981[4]). The most commonly used and recommended for datasets with less than 50 points is the Shapiro Wilk W Test (Gilbert 1987). Other tests are available as well, Filben's Statistic, the Kromogorov-Smirnoff Test, coefficients of skewness and kurtosis tests and the Chi-Square Test are examples (USEPA 1995[5]). As shown in Figure 4 and Section 5.2, the location of the samples is such that the samples are conservatively being collected in areas of the spill and is not skewed toward areas of likely non-detects.

An effective tool for evaluating the magnitude and/or significance of this spread is the *Coefficient of Variation* (CV, USEPA 1995, Sokal and Rolhf 1981) which is the ratio between the SD and the mean, expressed as a percentage. If the CV is high, e.g., greater than 75 or 100%, review of the data is warranted for assessment of possible outlier values (USEPA 1995, Gilbert 1987). Outliers can distort the distribution of the dataset and produce unwarranted overestimation of the population variance.

Given the distribution pattern has been established and that the data have been found to be sufficiently representative (i.e., not highly variable), exposure point concentrations will be estimated. Both mean values and the upper 95% confidence limit of the mean can be used to represent exposure point concentrations for the receptors. The upper 95% confidence limit (95% UCL) is that concentration, based on the probability density function established for data, for which there is a 95% probability that any given random measurement will not exceed.

The sampling plan is summarized below by potential receptors.

---

[3] Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold, New York, N.Y.

[4] Sokal, R.R. and F.J. Rolhf. 1981. Biometry: The Principles and Practice of Statistics in Biological Research. Second Edition. W.H. Freeman & Co., San Francisco, CA.

[5] U.S. Environmental Protection Agency. 1995. Guidance for Data Quality Assessment, External Working Draft. USEPA Quality Assurance Management Staff, Washington, D.C., March 17, 1995.

5.2 Sampling Plan

The sampling strategy will be implemented by collecting samples at the locations described below. The sampling locations are based on collecting data at the potential exposure points described above. Figure 4 depicts the proposed sampling locations which are intended to provide data to meet the project objectives. The sampling plan is discussed below by potential receptor (see Figures 2 and 3). It is important to note that the sampling locations are conservatively located in areas of greatest impacts to the potential receptors. Again, the purpose of the sampling is to establish the COC concentrations at the exposure points for evaluation of potential risks, rather than delineation with no specific objective or reference values.

5.2.1 Future Pipeline Workers

As discussed previously, the future pipeline construction worker may be exposed via the following media; surface soils, subsurface soils, surface water, sediments, and groundwater, including inhalation of volatiles from these sources.

Based on the spill source as an underground point below or within the water table, the maximum concentrations are expected to be in subsurface soils and groundwater within the immediate area of the pipeline release. Residual concentrations in surface soils, sediments or surface waters may be present as a result of leaching from overland flow and settlement of nonvolatilized product.

As shown on Figure 4, a transect along the pipeline corridor where the individual could be working is proposed with a total of eight (8) boring locations. At each location, a surface soil, a subsurface soil (highest OVA) and a groundwater sample from the water table will be collected. The groundwater sample will be collected via a temporary well point placed into the boring with the well point placed such that the screen intercepts the water table surface.

To evaluate sediment and surface water exposure potential, the sample results for the trespasser, discussed below, will be used.

5.2.2 Trespasser

The trespasser may be exposed to surface waters, surface soils, sediments, volatiles from groundwater plumes or particulates. The trespasser is not expected to focus his/her presence in a single location, but will be potentially crossing the right of way at various accessible locations.

As shown on Figure 4, the sampling strategy includes a series of transects perpendicular to the ROW in the area of impact. Currently, a total of thirteen (13) transects are proposed. Along each transect, three (3) surface soils or sediments, and three (3) surface water samples will be collected. In addition, a transect along the southeastern side of the railroad tracks will be completed with a proposed total of seven (7) sample locations. At each of these locations along the railroad, a surface soil/sediment and a surface water sample will be collected.

To measure the potential for groundwater inhalation, the data from the temporary well points along the pipeline corridor will be used. In addition, well point will be installed at every other location along the railroad track transect for collection of a groundwater sample.

5.2.3 Recreational Camper

The recreational camper is expected to be primarily located along the accessible banks of Blind River with the potential for trespassing the right-of-way. The exposure potential will therefore be evaluated by sampling surface media and groundwater along areas where the drainages from the spill site enter Blind River. The right-of-way trespasser pathways will be evaluated from the data described above for the Trespasser.

As shown on Figure 4, the sampling strategy includes transects along the drainages where they enter Blind River (where the camper is most likely to be). Along each transect, surface soil/sediment, surface water and groundwater samples will be collected. For groundwater samples, a temporary well point, similar to that described for the pipeline corridor, will be installed. Sampling sediments or surface waters of the Blind River itself is not considered as direct or relevant in terms of the project objectives. Sampling in the river is also subject to expected interferences of residual level of similar COCs along the river by historical recreational uses unrelated to the Marathon spill. The river sediments and surface waters are expected to be significantly lower than the proposed locations in terms of concentrations due to dilution and mixing, making such data irrelevant for purposes of this workplan.

5.2.4 Background Conditions

The proposed workplan includes an evaluation of the uppermost groundwater zone. As discussed previously, information on shallow stratigraphy, groundwater zones, depths, and relationship to the water table is needed for planning the temporary well point placement.

As part of the initial assessment, exploratory borings are proposed along the upgradient side of the area. As shown on Figure 4, three borings along Airline Highway will be drilled and continuously sampled to a maximum depth of 30 feet bgs. A temporary casing will be set for collection of a shallow groundwater sample and analyzed for the COCs to evaluate conditions along this area. The casings will be left in place for a sufficient period to determine groundwater flow direction, in conjunction with other temporary well points along the transects described above.

5.2.5 Aquatic Plants

The potential exposures to aquatic plants would occur primarily in the drainages between the pipeline right-of-way and Blind River. As shown on Figure 2, these plants could be exposed by direct contact or uptake from the sediments and surface water, and volatilization from the surface water. The sediment/surface water data collected from the drainages, as shown on Figure 4, will be used to evaluate exposures to these media.

5.2.6 Terrestrial Plants

The maximum potential for COC exposure for the terrestrial plants is on the pipeline ROW. Therefore, exposures to surface soils and air exposures resulting from the soils will be evaluated using data from the surface soil transects shown in Figure 4. Groundwater exposures and volatiles from groundwater will be evaluated with the data from the pipeline temporary well points.

5.2.7 Aquatic Animals

Exposures to aquatic animals could occur through direct contact to sediments and surface water, and ingestion of forage organisms that have accumulated COCs. The sediment/surface water data from the drainage between the pipeline ROW and the Blind River will be used to evaluate these pathways. After collecting the data in the abiotic media, an evaluation will be made regarding whether there is a potential for significant concentrations of COCs in forage organisms. Because the COCs typically do not accumulate in biological tissue, it is anticipated that the abiotic data will be sufficient, and biological sampling will not be required.

5.2.8 Terrestrial Animals

Exposures to terrestrial animals could occur through direct contact to surface soils, sediments, surface water, and ingestion of forage organisms that have accumulated COCs. Exposures could also occur through volatile/particulate emissions from surface soils/surface water and volatiles from the groundwater. The sediment/surface water data from the drainages between the pipeline ROW and the Blind River will be used to evaluate direct exposure to these media, and also exposure through volatilization from surface water. The surface soil data from the transects will be used to evaluate direct exposures to the soils and exposures from soil volatile/particulate emissions. Volatilization from the groundwater will be evaluated with the data from the temporary well points along the pipeline. Similar to the approach for the aquatic plants, it is anticipated that the abiotic media can be used to demonstrate that ingestion of forage organisms is not a significant pathway and biological sampling will not be required.

6.0 FIELD METHODOLOGIES

The field methodologies and procedures for sample collection are described below. The field procedures can be divided into the following elements.

- Site Clearance (locate pipelines, permission)
- Health and Safety
- Sample Surveying

- Sample Collection
- Grouting
- Documentation
- Decontamination
- Sample Custody
- Sample Containers, Preservatives and Holding Times
- Sample Identification and Labeling
- Sample Packaging and Shipping

6.1 Site Clearance

Prior to initiating subsurface field work, Woodward-Clyde will subcontract the services of a site utility clearance specialist and coordinate with Marathon on the locations and depths of all pipelines in the area. Specifically, the Marathon Pipeline and the other pipelines will be marked for location of subsurface borings and temporary well points.

6.2 Health and Safety

Prior to initiating work, a health and safety plan will be developed and all site personnel will be required to read the plan and signify compliance and understanding of the plan in writing. The health and safety plan will designate a site safety officer and action levels for upgrading to higher safety precautions. The purpose of this plan is to provide guidance procedures to ensure the personal safety and protection of the field personnel performing the assessment.

In accordance with the health and safety requirements found under OSHA 29 CFR Part 1910.120, the Health and Safety Plan will address the following requirements which include:

Training:	40-Hour Initial/8-Hour Initial Supervisors/8-Hour Annual Refresher/Certification Thereof;
Medical Surveillance:	Baseline and Periodic Personnel Health Monitoring;
Information Programs:	Site Health and Safety Plan/Hazard Communication/Pre-Entry Briefings;

Emergency Response: Pre-Planning/Training/Response Personnel; and

Site Control: Work Zones/Site Security/Decontamination/Air Monitoring (if required).

In addition to OSHA 29 CFR Part 1910.120, the Health and Safety Plan will address the following regulations:

- Subpart I - 1910.132 - Personal Protective Equipment;
- 1910.134 - Respiratory Protection;
- 1910.15 - Medical Services and First Aid; and
- 1904 - Recordkeeping and Reporting.

6.3 Sample Surveying

Sample locations will be surveyed by a State of Louisiana Licensed Surveyor or by global positioning system (GPS) recordings of latitude and longitude. GPS is a satellite based system which consists of a base station located on a referenced benchmark and a rover unit which will be taken to each sample location.

Water level elevations from temporary well points or temporary cased borings will be measured from the top of risers or casings. The water levels will be converted to elevations above mean sea level and utilized to produce a groundwater potentiometric surface map. The elevations (mean sea level datum) of the tops of risers or casings will be surveyed from benchmarks in the area or from a relative fixed or permanent structure.

6.4 Sample Collection Procedures

The sampling activities described in this workplan will include surface soil (discrete samples collected from within the upper 6 inches), subsurface borings (discrete samples collected from borings less than 30 feet deep), discrete surficial sediments where soils are not present, surface waters, and groundwater.

6.4.1 Sample Locations

Figure 4 shows the proposed sample locations. Each sample point will be located in the field as accurately as possible by measuring the precise distance and direction from an established reference point or by surveying. Once the sampling point is established, additional sample points can be located relative to it. Distance measurements can be made with a tape, and a compass can be used to obtain directional information. These data will be entered in the field notebook or recorded on a site location map of the subject area. If a sample can not be collected at the designated location, an adjacent location will be selected and the new location and reason for changing will be documented in the field log book. After completion of the field work, sample locations will be surveyed as described in Section 6.3.

6.4.2 Soil Sampling

The methods and equipment used for soil sampling will depend on the sample depth, type of sample, and type of soil. The sampling equipment must be constructed of material that is compatible with the sample media and the analytes of interest. Typically, the material will be steel or stainless steel. The following is a list of the planned sampling equipment:

- Stainless-steel and steel hand augers
- Stainless-steel and steel trowels
- Stainless-steel and steel spoons
- Large stainless-steel mixing bowls
- Disposable plastic spoons
- Disposable large plastic mixing bowls
- Steel and stainless-steel knives
- Measuring tapes
- Steel shovels
- Disposable plastic push-tubes
- Post-hole diggers
- Pyrex glass mixing bowls

6.4.2.1 **Sediment/Surface Soils**. Sediment/surface soil samples will be collected using hand equipment such as spoons, shovels, trowels, post-hole diggers, and/or push-tubes constructed of steel, stainless steel, or disposable plastic. The non-disposable sampling equipment will be decontaminated using the decontamination procedure described in Section 6.6 prior to sample collection and between sample intervals. If a thick, matted root zone is encountered at the surface, it will be removed prior to sampling. Other foreign objects will be removed prior to sampling.

Samples will be described by a qualified professional and classified in general accordance with the Unified Soil Classification System (equivalent to ASTM D 2487 and 2488). Sample descriptions and classifications will be recorded in the field log book. The soil sample will be placed in a mixing bowl or pan and thoroughly mixed prior to placing in the sample container as described in Section 6.4.2.4. Samples collected for BTEX analysis will be collected with minimal disturbance and placed in containers such that headspace is minimized. The BTEX samples will not be mixed prior to placing in the sample container.

After sampling is complete, the sample hole will be filled with the native material and, to the extent feasible, the area will be restored to its previous condition.

6.4.2.2 **Subsurface Soils**. Subsurface soil borings at all locations except the exploratory boring/temporary piezometer locations will generally be completed using hand augering equipment. For a hand-augered borings, the auger hole will be advanced at 1-foot intervals until the top of the uppermost groundwater zone, or 10 feet in depth is encountered, whichever is less. For discrete grab samples, the auger-bucket will be decontaminated between samples using the decontamination procedure described in Section 6.6. The top few inches of the soil will be removed from the bucket to minimize cross contamination due to "fall-in" of material from the upper portions of the hole. As discussed in Section 6.4.2.5, sample intervals will be screened using an OVA (or similar FID device). Sample selection will be conducted per Section 6.4.2.5.

6.4.2.3 **Exploratory Borings**. Exploratory soil samples will be collected continuously by soil probe sampling with a Geoprobe™ sampler. The sample tools are stainless steel thin wall sample tubes or split spoon samplers. The sampling tools are typically 1- to 2-foot in length and 1½- to 2-inches in diameter. Continuous soil sampling will be conducted on 2-foot intervals until the top of the uppermost groundwater zone, or 30 feet in depth is encountered, whichever is less. Section 6.4.2.5 describes the sample selection criteria.

Geoprobe™ soil boring equipment is typically mounted on the rear of a pickup truck or on the rear of an all terrain vehicle. The geoprobe system uses a direct-push method that consists of a small diameter hollow steel rod with a stainless steel sampling tool fitted to the base of the rod. Soil samples are collected by pushing or driving the sampler to the desired sampling depth. The soil sampling tool remains completely sealed while being advanced to the desired sampling depth. The drive tip is then mechanically released and the thin wall sample tube sampler is pushed into the soil at the base of the borehole. The sampler uses a plastic polybutyrate liner which is extruded upon retrieval of the sampler from the borehole.

6.4.2.4 **Soil Sample Mixing.** Soil samples will be mixed as thoroughly as possible to ensure that the sample is representative of the sample interval. The mixing pan or bowl will be constructed of material that is compatible with the sample media and analytes of interest. A common method of mixing is "quartering". The sample is placed in the sample mixing pan and divided into quarters. Each quarter is thoroughly mixed and all quarters are mixed together. This procedure is repeated several times until the sample is thoroughly mixed. If a round bowl is used, the sample can be mixed by stirring in a circular manner and occasionally turning the material over. After mixing the samples will be placed in laboratory supplied precleaned sample containers, labeled, and stored on ice at approximately 4°C. The soil samples for BTEX will be placed directly into the sample containers without mixing. Table 1 summarizes the sample container, volume, preservatives and holding time requirements for this project.

6.4.2.5 **Soil Sampling Screening Procedures.** Headspace screening with a OVA will be conducted on all soil samples. While all surficial soil samples will be submitted for TPH and BTEX analysis, only select subsurface soil samples will be collected for analysis. The sample interval selected for TPH and BTEX analysis will be determined based on headspace screening. The sample interval exhibiting the highest OVA reading will be selected and submitted to the laboratory for analysis. After collection of the soil sample, the sample will be split into two subsamples. One subsample will be placed in the appropriate container, labeled, and placed on ice. The other subsample is for the headspace analyses, and will be placed in a Ziploc® bag or a tightly capped glass jar, labeled, and allowed to stand at ambient temperature for at least 30 minutes to allow volatile organic constituents, if any, to accumulate in the headspace. The headspace will then be measured with an OVA and recorded in the field log book. Samples sent for analysis based on these headspace readings will be the subsample from the corresponding interval that is stored on ice. The OVA will be calibrated in conformance with the manufacturer's instructions. OVA calibration will be documented on the Equipment Calibration Log.

In the event all sample intervals exhibit background readings, the surface soil sample interval (0- to 2-foot) and the interval at the soil/groundwater interface will be selected for analysis. If groundwater is not encountered, the soil sample interval at the base of the boring will be collected for analysis along with the surface soil sample.

6.4.3 Groundwater Elevations and Sampling

Groundwater samples and groundwater elevations will be collected from each exploratory boring/temporary piezometer, pipeline worker transect sample location and temporary well point location.

6.4.3.1 **Exploratory Borings/Temporary Piezometers.** Each exploratory borehole will be completed with a temporary piezometer. Each temporary piezometer will be constructed of 1-inch diameter, flush threaded, Schedule 40 PVC well casing and screen. The well screen will consist of 5 feet of 1-inch diameter Schedule 40 PVC pipe with 0.010-inch slots. The blank/riser pipe will consist of 1-inch Schedule 40 blank PVC pipe. Upon completion of the installation of the well construction materials into the borehole, a 20/40 sieve-size clean silica filter sand will be placed in the annulus between the borehole and the screened zone to a minimum depth equivalent to 2 feet above the top of the well screen (if feasible). A bentonite pellet seal will be placed above the sand and extend to the ground surface. Adequate time will be allotted for sufficient hydration of the bentonite. The temporary piezometers will be developed via surface pumping or bailing until the groundwater indicator parameters stabilize.

Prior to sampling, a water level measurement will be made using a tape measure or electronic indicator with accuracy to ± 0.01 feet. The water level will be measured to a surveyed permanent mark such as top of casing. Groundwater samples will be collected from the temporary piezometers after purging at least three well volumes from each well, and after the specific conductivity, temperature and pH measurements of the purged water have stabilized. If the zone does not recharge within 24 hours, less than 3 volumes may be purged prior to sampling. Purging and sampling will be accomplished with a dedicated bailer and bailer cord. All purging and sampling activities will be recorded on groundwater sampling forms. The purged water will be drummed and stored on site for future disposal pending analytical results.

6.4.3.2 **Temporary Well Points.** Temporary well points will be completed using hand augering equipment. The auger hole will be advanced one auger-bucket at a time. For each well point, a large diameter PVC surface casing will be installed in the uppermost soils sufficient to seal off surface water and to minimize the potential for cross contamination from shallow impacted soils. The casing will be installed by pushing the casing to a predetermined depth and reaming out soils and standing water prior to proceeding with the well point. Each temporary well point will consists of 1-inch diameter, flush-threaded, Schedule 40 PVC casing and screen. The well screen will consist of 5 feet of 1-inch diameter Schedule 40 PVC pipe with 0.010-inch slots. The blank/riser pipe will consist of 1-inch Schedule 40 blank PVC pipe. The temporary groundwater monitor well construction materials will be installed through the surface casing. Upon completion of the installation of the well construction materials into the borehole, a 20/40 sieve-size clean silica filter sand will be placed in the annulus between the borehole and the screened zone to a minimum depth equivalent to 2 feet above the top of the well screen (if feasible). A bentonite pellet seal will be placed above the sand and extend to the ground surface. Adequate time will be allotted for sufficient hydration of the bentonite prior to sampling (minimum of 12 hours).

Alternative methods may be used to install well points depending on field conditions. These alternatives will include: (a) installing prepackaged screen intervals (screens with pre-made filter pack assembly) in the boring and placing bentonite above the screen to the surface; or (b) pushing or hammering the well point into the uppermost groundwater zone, eliminating the filter pack.

6.4.3.3 **Groundwater Sampling.** Groundwater samples and water level measurements will be collected from piezometers and temporary well points as described in Section 6.4.3.1. Evidence of free phase product and thickness will be recorded in the field logbook and boring log forms. Water level measurements will be taken in both piezometers and temporary well points during the same period (within 24 hours) in order to obtain overall groundwater flow direction information. Additional measurements may be taken over time, if necessary, to verify flow directions.

6.5 Grouting

In accordance with LDOTD Guidelines "Construction of Geotechnical Boreholes and Monitoring Systems Handbook" May, 1993, each completed soil boring will be plugged and abandoned by filling the borehole from bottom to top with a cement bentonite grout. The grout will consist of Portland cement and powdered sodium bentonite. The grout mix will consist of a pumpable cement/bentonite slurry. The grout will be mixed in a clean, above ground, rigid container with an appropriate quantity of water. The grout will be mixed by recirculation with the grout pump or by mechanical paddle device until a smooth, lump-free consistency is achieved. The cement/bentonite mixture design will be a 4 to 7 percent ratio as per Exhibit 1 of the referenced handbook:

- Cement 1-94 lb. sack
- Bentonite 3.8 to 6.6 lb.
- Water 7.8 to 9.8 gal.
- Mud weight 14.1 lb./gal. to 13.3 lb./gal.

The grout mixture will be pumped or poured through a rigid tremie pipe placed approximately 6 inches above the bottom of the hole. The grout mixture will be pumped or poured until undiluted grout flows from the borehole at the ground surface. The tremie pipe will be slowly withdrawn during grouting operations.

The specifications for the materials making up the grout are:

- Bentonite will be powdered sodium montmorillonite furnished in moisture resistant sacks and without additives.

- Cement will be a Portland cement, Type I or API Class A without additives.

A qualified WCC representative will be present during the drilling and grouting and will direct and document the work.

6.6 Decontamination

Sample containers will be kept in limited access areas or locked storage until they are used. Latex gloves will be worn during all sampling activities and changed between sampling locations. Clean sampling equipment will be wrapped in aluminum foil prior to use. Clean sheets of plastic will be laid out in the sampling area and all equipment will be placed on these sheets. This plastic will be discarded after each use. All wash water, excess soil, discarded gloves, etc., will be contained on-site in steel 55-gallon drums for subsequent disposal by Marathon.

Equipment decontamination procedures are described below:

- The equipment that comes in contact with soil but not in direct contact with samples (drill rods, etc.) will be cleaned (inside and out) by thoroughly washing with a steam cleaner and/or high-pressure hot water washer.

- All non-dedicated equipment that comes in direct contact with the sample (e.g., knives, hand sampling tools, auger buckets, etc.) will be decontaminated using the following decontamination procedure:

    - Washing in a detergent solution (Alconox or equivalent) to remove any particulate matter and/or surface films;
    - Triple rinse with organic free deionized water; and
    - Air dry.

6.7 Field Documentation

All field sample identifications, field records and chain-of-custody records shall be in waterproof non-erasable ink. If errors are made in these documents, corrections will be made by simply crossing a single line through the error and entering the correct information. All corrections will be initialed and dated by the person making the corrections. If possible, corrections should be made by the individual making the error.

6.7.1 Field Sampling Log Book

All information pertaining to the sampling activities will be recorded in a bound field log book with consecutively numbered pages. Entries in the field log book will include the following information as it applies to the task at hand:

- Location of sampling activity
- Purpose of sampling activity
- Number and approximate volume of samples taken
- Description of sampling point
- Date and time of sample collection
- Sample or soil boring identification number(s)
- Sample preservative, if any
- Field observations
- Weather conditions
- References to any appropriate field logs or forms for details of activities performed
- Signature of Project Manager or designee

6.7.2 Boring Log

Lithologic descriptions of subsurface borings will be documented on a soil boring log. Soil boring logs will be recorded directly in the field. If a typed copy is prepared later it will be checked to verify that it accurately reproduces the field log.

The soil classification will be in general accordance with the Unified Soil Classification System (equivalent to ASTM D 2487 and 2488). Soil classifications will be prepared in the field at the time of sampling by a qualified representative and may be subject to change based upon laboratory tests and/or subsequent review. The field representative will thoroughly describe and classify each stratum. The locations of strata changes will be clearly defined on the logs at the appropriate depth. Depths will be recorded to the nearest tenth of a foot. When depths are estimated, the estimated range will be noted. The secondary features or changes within each stratum will also be recorded at the appropriate depth on the boring log where the change occurs. The strata descriptions will include the following parameters:

Parameter	Example
Classification	Sandy clay
Unified soil classification	CL
Secondary components	Sand: (fine sand, coarse sand)
Color	Dark gray
Secondary sedimentary structures, inclusions, staining	Iron staining calcareous nodules, oyster shells
Consistency (cohesive soil)	Stiff
Density (noncohesive soil)	Loose
Moisture content. Use relative term. Do not express as a percentage unless a value has been measured.	Dry, moist, wet, etc.

6.7.3 Document Maintenance

Field personnel are responsible for daily recording field activities on the appropriate field documentation form and forwarding the documents to the Project Manager or designee to ensure that all documents are complete and legible.

The field documentation forms or equivalent records that may be used during this project include:

- Chain-of-Custody Forms
- Daily field report (in logbook or on a separate form)
- Boring log
- Temporary piezometer development forms
- Groundwater Sample Collection Forms
- Field sampling log (in logbook or on a separate form)
- Equipment calibration log

Examples of chain-of-custody, boring log and groundwater sample collection forms are provided in Appendix B.

Each completed form (or copy) will be maintained on-site in chronological order with other completed forms of the same type until completion of the field activities. Copies of specific forms will be sent to the project office weekly for management review unless waived by the Project Manager. File and working copies will be retained by project personnel for data evaluation and report preparation, as necessary.

6.8 Sample Custody

Chain-of-custody provides an accurate written record documenting the possession and handling of a sample from collection, through storage and analysis, to reporting. Chain-of-custody will be maintained for each sample (including QC samples) collected in this project. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view after being in physical possession;
- In a designated secure area; or
- Placed in a locked container by an authorized individual.

6.8.1 Chain-of-Custody Forms

Chain-of-custody forms will be used to document the possession and transfer of custody of all samples. Typical information that will be supplied on the forms includes:

- Field sample identification;
- Sample date and time;
- Type of sample;
- Sample location and depth where appropriate;
- Number of containers;
- Analyses required; and
- Signature of sample personnel.

The chain-of-custody form will be initiated and signed by a member of the field sampling team. The method of shipment, name of the courier, and any other pertinent information should be entered in the "remarks" section. The original copy accompanies the sample shipment, and a copy is retained by the sampling crew. The completed chain-of-custody form will be placed in a Ziploc® plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form. If used, a copy of the carrier airbill will be retained as part of the permanent chain-of-custody documentation.

When relinquishing custody, the transferor and transferee must sign, date, and time the chain-of-custody form. Each person accepting custody of sample(s) will note their condition on the form.

6.8.2 Custody Seals

Custody seals are preprinted adhesive-backed seals designed to break if the seals are disturbed. Custody seals will be placed on sample shipping containers as necessary to detect tampering. Seals will be signed and dated prior to using. Strapping tape will be placed over the seals to ensure that the seals are not accidentally broken during shipment.

6.8.3 Field Procedures

The following chain-of-custody procedures will be used by field personnel:

- Precleaned sample containers will be used and the coolers and/or boxes containing the empty sample containers should be sealed with a custody seal during transportation to the field and while in storage prior to use. In the field, the precleaned sample containers will be stored in a secure location.

- The sample collector is responsible for the care and custody of the collected samples until they are transferred to another person or shipped under chain-of-custody rules.

- As few individuals as possible should handle the samples.

- The sample collector will record sample data in a field notebook.

- A completed chain-of-custody record must accompany each cooler in which samples are shipped. The samples must be shipped to the laboratory as soon as practical and may be shipped by overnight carrier or courier for next-day delivery.

6.9 Sample Containers, Preservation and Holding Time

Glass sample containers with teflon-lined caps will be certified clean and supplied by the laboratory. The samples for analysis will be placed in a cooler provided by the laboratory and maintained on ice at approximately 4° C until tested. Table 1 summarizes the sample containers, volumes, preservatives and holding times.

6.10 Sample Identification and Labeling

Sample labels and identity are of crucial importance in the collection of samples. All data for a sample will be keyed to its unique designation. This sample designation, which will be on all sample containers and associated field data forms, will be used for data recall from the database system.

Field personnel will attach a sample label to each sample container either before or immediately after filling each container. Each sample label will contain the following information, at a minimum:

- The project name and number.
- A unique sample identification code.
- Date and time of collection.
- Designation of the sampling procedure (i.e., composite, grab, etc.).
- Identification of preservatives used.
- Analysis requested.
- Sampler's initials.

The sample labels will be placed on the sample containers so as not to obscure markings on the containers. All sample information must be printed legibly using waterproof ink. The label must contain sufficient information so that the sample can be identified on the sampling information form or sample collection log.

6.11 Sample Packaging and Shipping

The handling and shipping of samples will be accomplished in a manner that protects the integrity of the sample. This includes packing the samples to avoid breakage, contamination, and shipping at the proper temperature. The following sample packaging and shipping requirements will be followed:

- Sample container lids will not be mixed. All sample lids must stay with the original containers.
- Sample containers will be placed in sealed plastic (Ziploc®) bags to minimize the potential for contamination from packing material and to prevent water damage to the sample label.
- Sample bottles will be packaged in the cooler in a manner that prevents breakage. Empty space in the shipping container will be filled with an inert packing material such as cardboard or "bubble wrap". Materials such as sand, sawdust, Styrofoam peanuts, or vermiculite will not be used as a packing material. Ice will not be substituted for packing material.
- Samples that require refrigeration will be kept at approximately 4°C using ice. The ice will be placed in water tight Ziploc® plastic bags to prevent leakage from the cooler as the ice melts.
- A copy of the chain-of-custody form will be placed in a water tight plastic bag and taped to the underside of the lid of the cooler containing the samples designated on the form.
- Samples will be shipped to the laboratory in sufficient time so that holding times are not exceeded. Prior coordination with the receiving

laboratory is required to insure that the samples arrive on a day in which the laboratory has personnel present to receive the samples.

7.0 ANALYTICAL PROGRAM

As discussed previously, the COCs have been identified based on the nature of the product released and the relatively recent age of the release. Based on these factors, the analytical program will consist of the following analyses on all samples collected during the project.

- BTEX via EPA SW 846 Method 8020
- TPH-GRO via EPA SW 846 Method 8015 with quantification of entire envelope, with percentages proportioned above and below C_8

In addition, a certain number of representative groundwater samples will be collected and analyzed for evaluating intrinsic soil and groundwater natural attenuation conditions. Three (3) groundwater samples will be selected from each of the 3 potential receptor areas for these purposes (a total of 9 samples). Samples will not be collected for these parameters from groundwater exhibiting free product. These analyses will include the following parameters.

- pH
- Temperature
- Specific Conductance
- Nitrate
- Sulfate
- Oxidation/Reduction Potential
- Manganese
- Alkalinity
- Carbon Dioxide
- Ferrous Iron

8.0 QA/QC PROGRAM

Quality Assurance and Quality Control (QA/QC) requirements were evaluated as part of the DQO process. The primary objective of the field QA/QC will be to evaluate the influence of outside factors on the results. This will be done by collecting the following field samples:

- Equipment Blanks (also known as rinsate blanks). These blanks are used to check the sampling equipment cleanliness. Equipment blanks are obtained by pouring analyte-free water over or through the sampling device, collecting the water in a sample container, and returning to the laboratory for analysis with the samples. One equipment blank should be obtained for each major piece of sampling equipment.

- Field Blanks (one per shipment). Organic-free water will be poured in the field directly into sample containers to measure interference from ambient air, if any.

- Duplicates (one per twenty of each matrix). A duplicate sample of each matrix will be collected to measure accuracy and variability of sample results.

- Trip blanks. Trip blanks will only be obtained whenever samples are obtained for BTEX. These blanks are used to determine contamination resulting from transportation and storage of the samples. Each trip blank will be prepared by filling two 40 ml VOA vials with reagent water prior to the sampling trip, transported to the field, handled like a sample, and returned to the laboratory for analysis without being opened in the field. One trip blank should be prepared for each cooler containing BTEX samples.

- Matrix Spikes and Matrix Spike Duplicates (1 per 20 samples per matrix) to measure matrix interferences.

The laboratory will provide a QA/QC summary with the report. For the BTEX and TPH-GRO results, the report will include results on calibrations, surrogate standards and recoveries, method blanks, matrix spike and matrix spike duplicate relative percent differences, and chromatograms for TPH-GRO and BTEX analyses as well as employed standards. Chain-of-custody documents, laboratory bench sheets and relevant log book pages will be submitted with the report.

The laboratory data package will be reviewed for completeness, holding times, achievement of laboratory internal QA/QC limits, and overall acceptability of the data for the intended purposes of this phase of work. A written summary of the data review will be completed by the data reviewer. Given that the analyses are not contract laboratory procedures, the use of functional guidelines for organic analyses is not applicable; however, the review will be similar in terms of determining whether the data is useable for establishing whether the concentrations are representative of site conditions.

9.0 REPORTING

A report will be submitted summarizing the sampling objectives, methods, sample locations, field results, laboratory results, QA/QC findings, and conclusions, as appropriate. The report will include a comparison of COC exposure point concentrations to calculated RBSLs and will identify areas of exceedances. A qualitative assessment of ecological impacts will be included in the report as well. Data needs, uncertainties and recommendations will be included. Supporting documents will include summary tables of results, figures showing sample locations and COC distributions, laboratory reports, boring logs, piezometer/temporary well schematics, the laboratory report with chain of custody and data review summaries.

10.0 FUTURE PHASES OF WORK

As discussed in the technical approach, this scope of work is designed to evaluate the completeness of the identified exposure pathways and to quantify exposure pathways that are determined to be complete. Depending on the findings, additional phases of work may be necessary. Some of these data needs may be as follows:

- Additional characterization of COC distributions above RBSLs
- Baseline risk assessment using site-specific information, including submittal of risk assessment workplan, if needed
- Groundwater aquifer characteristics for fate and transport modeling
- air sampling
- Further ecological characterization
- Collection of data for remedial alternatives evaluation

If necessary, a Phase II Workplan will be provided for LDEQ's review following their review and comments to this initial assessment. In addition to some of the above potential data needs, it is anticipated the Phase II Workplan will include procedures for conducting a baseline risk assessment as a basis of determining site-specific risks and where additional assessment may be warranted.

At the completion of the assessment work, a remedial evaluation and feasibility study may be warranted. Such a study will incorporate the natural attenuation findings and a cost/benefit review of potential future remedial activities on the ecosystem as well as possible institutional controls (e.g., fencing). The final corrective measures will be summarized in a Corrective Action Plan for the site.

11.0 REFERENCES

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U.S. EPA, SW-846 3rd Edition

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U.S. Geological Survey, 7.5-Minute Quadrangles Convent and Lutcher, Louisiana, 1962

U.S. Geological Survey, Dial and Kilburn, 1980, "Groundwater Resources of Gramercy Area"

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TABLES

TABLE 1

SAMPLE CONTAINERS, VOLUMES, PRESERVATIVES AND HOLDING TIMES

Laboratory Analysis	Matrix	Methodology Method	Preservative[1]	Container[2]	Analytical Hold Time
Chemicals of Concern					
BTEX	Soil	SW 846 Method 8020	None	4 oz. CWM	14 days
	Water	SW 846 Method 8020	Hcl to pH <2	2 - 40 ml glass vials	14 days
TPH	Soil	SW 846 Method 8015/Mod Cal GRO	None	4 oz. CWM	14 days
	Water	SW 846 Method 8015/Mod Cal GRO	None	1 L AGJ	14 days
Natural Attenuation Parameters					
pH	Groundwater	Field Parameter	--	--	--
Temperature	Groundwater	Field Parameter	--	--	--
Conductivity	Groundwater	Field Parameter	--	--	--
Nitrate	Groundwater	EPA Method 353.3	None	250 ml HDPE	48 hours
Sulfate	Groundwater	EPA Method 375.4	None	125 ml HDPE	28 days
Manganese	Groundwater	EPA Method 200.7	HNO_3	500 ml HDPE	6 months
Alkalinity	Groundwater	EPA Method 310.1	None	250 ml HDPE	14 days
Ferrous Iron	Groundwater	Field Parameter	--	--	--
Oxidation/Reduction Potential	Groundwater	Field Parameter	--	--	--

1 All samples must be cooled to approximately 4°C; additional preservatives are noted

2 Container abbreviations are as follows:

AGJ - amber glass jar

CWM - clear wide-mouth glass bottle with teflon lined screen cap

HDPE - high density polyethylene bottle

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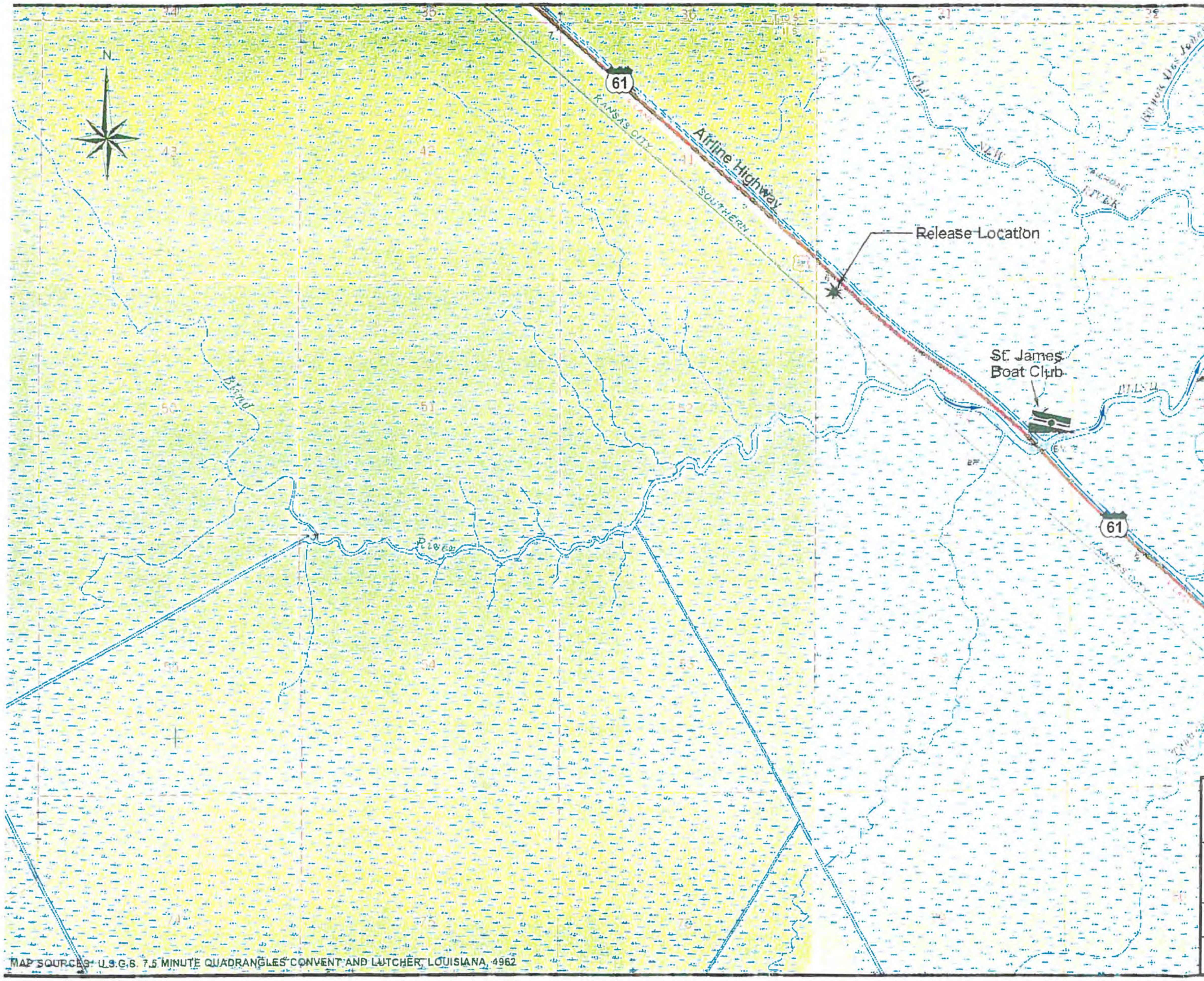
FIGURES



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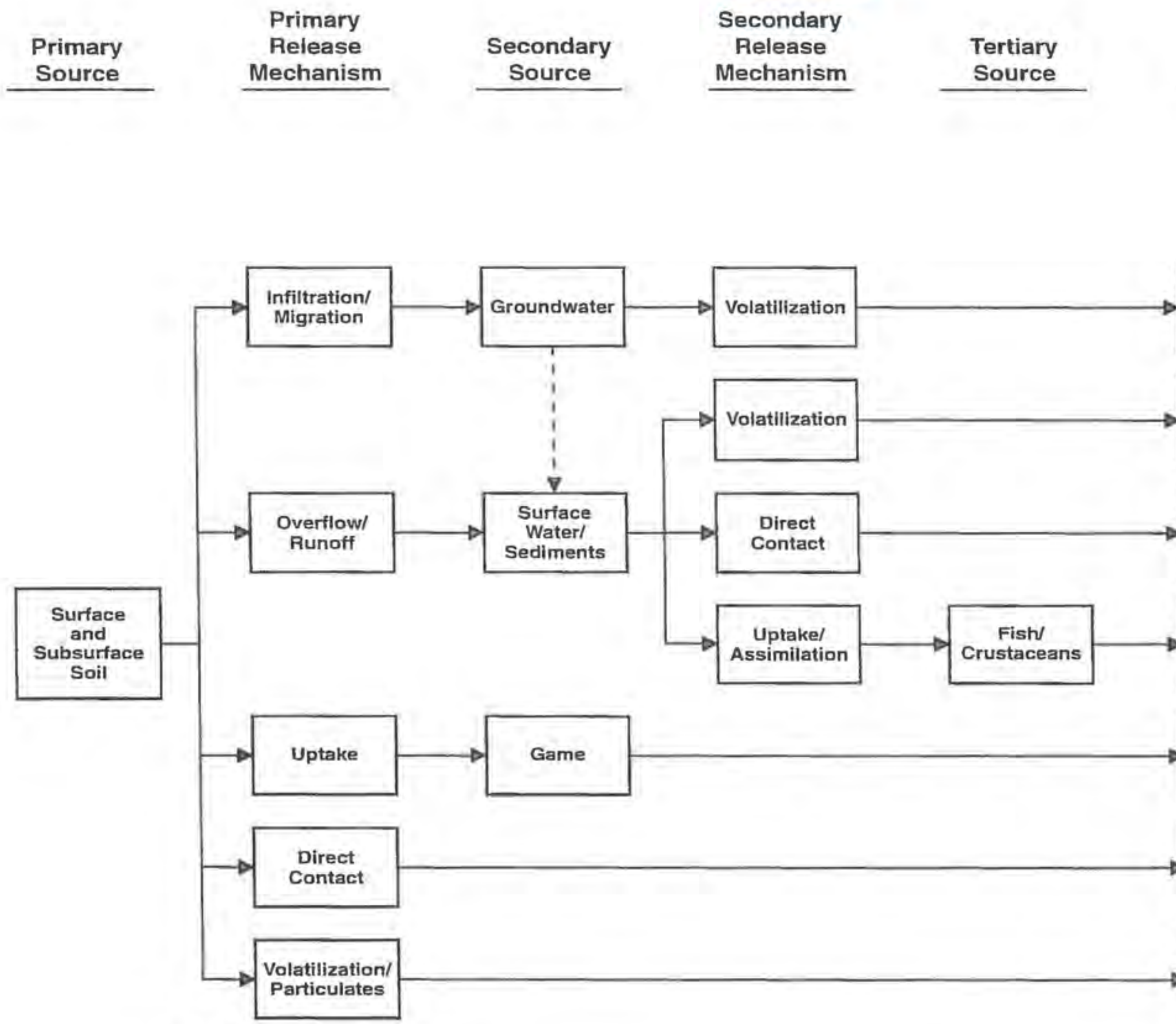
SCALE:	DRAWN BY: D.P. OLSON	DATE: 07/26/96	FILE NO.	FIGURE:
1" = 2000'	CHECKED BY: J. HEBERT	DATE: 07/29/96	96B195-3	1

AIRLINE HIGHWAY RELEASE SITE
LOCATION MAP

Figure 2

Preliminary Site Conceptual Human Health Exposure Model
Marathon Pipeline Company

MARATHON



Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	NA	NA	NA
Ingestion	NA	NA	NA
Inhalation	O	●	O

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	NA	NA	NA
Ingestion	NA	NA	NA
Inhalation	O	NA	O

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	O	●	O
Ingestion	O	●	O
Inhalation	NA	NA	O

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	NA	NA	NA
Ingestion	O	NA	O
Inhalation	NA	NA	NA

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	NA	NA	NA
Ingestion	O	NA	O
Inhalation	NA	NA	NA

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	●	●	●
Ingestion	●	●	●
Inhalation	NA	NA	NA

Exposure Pathway	Trespasser	Pipeline Construction Worker	Recreational Camper
Dermal	NA	NA	NA
Ingestion	NA	NA	NA
Inhalation	●	●	●

● = Complete Exposure Pathway
O = Potentially Complete Exposure Pathway
NA = Exposure Pathway Not Applicable

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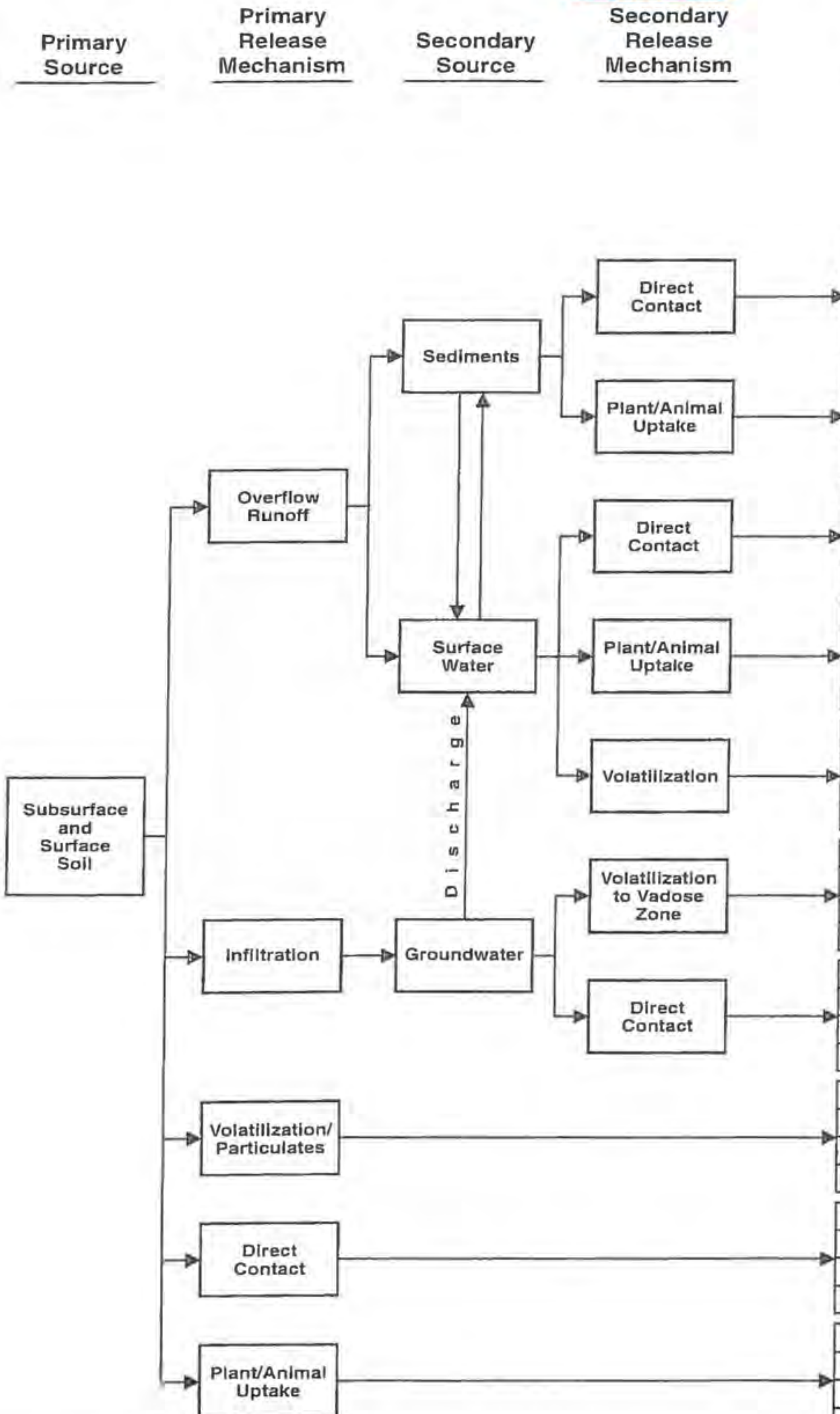
Figure 3

Preliminary Site Conceptual Ecological Exposure Model
Marathon Pipeline Company



Source / Release Mechanism	Exposure Pathway	Terrestrial Plants	Aquatic Plants	Terrestrial Animals	Aquatic Animals
Sediments – Direct Contact	Dermal	NA	●	●	●
	Ingestion	NA	NA	●	●
	Inhalation	NA	NA	NA	NA
	Plant Uptake	NA	●	NA	NA
Sediments – Plant/Animal Uptake	Dermal	NA	NA	NA	NA
	Ingestion	NA	NA	●	●
	Inhalation	NA	NA	NA	NA
	Plant Uptake	NA	NA	NA	NA
Surface Water – Direct Contact	Dermal	NA	●	●	●
	Ingestion	NA	NA	●	●
	Inhalation	NA	NA	NA	NA
	Plant Uptake	NA	●	NA	NA
Surface Water – Plant/Animal Uptake	Dermal	NA	NA	NA	NA
	Ingestion	NA	NA	●	●
	Inhalation	NA	NA	NA	NA
	Plant Uptake	NA	NA	NA	NA
Surface Water – Volatilization	Dermal	NA	NA	NA	NA
	Ingestion	NA	NA	NA	NA
	Inhalation	NA	NA	●	NA
	Plant Uptake	NA	●	NA	NA
Groundwater – Volatilization to Vadose Zone	Dermal	NA	NA	NA	NA
	Ingestion	NA	NA	NA	NA
	Inhalation	NA	NA	NA	NA
	Plant Uptake	●	NA	NA	NA
Groundwater – Direct Contact	Dermal	●	NA	NA	NA
	Ingestion	NA	NA	NA	NA
	Inhalation	NA	NA	NA	NA
	Plant Uptake	●	NA	NA	NA
Volatilization/Particulates	Dermal	NA	NA	NA	NA
	Ingestion	NA	NA	NA	NA
	Inhalation	NA	NA	●	NA
	Plant Uptake	●	NA	NA	NA
Direct Contact	Dermal	●	NA	●	NA
	Ingestion	NA	NA	●	NA
	Inhalation	NA	NA	NA	NA
	Plant Uptake	●	NA	NA	NA
Plant/Animal Uptake	Dermal	●	NA	NA	NA
	Ingestion	NA	NA	●	●
	Inhalation	NA	NA	NA	NA
	Plant Uptake	NA	NA	NA	NA

● = Complete Exposure Pathway
NA = Exposure Pathway Not Applicable

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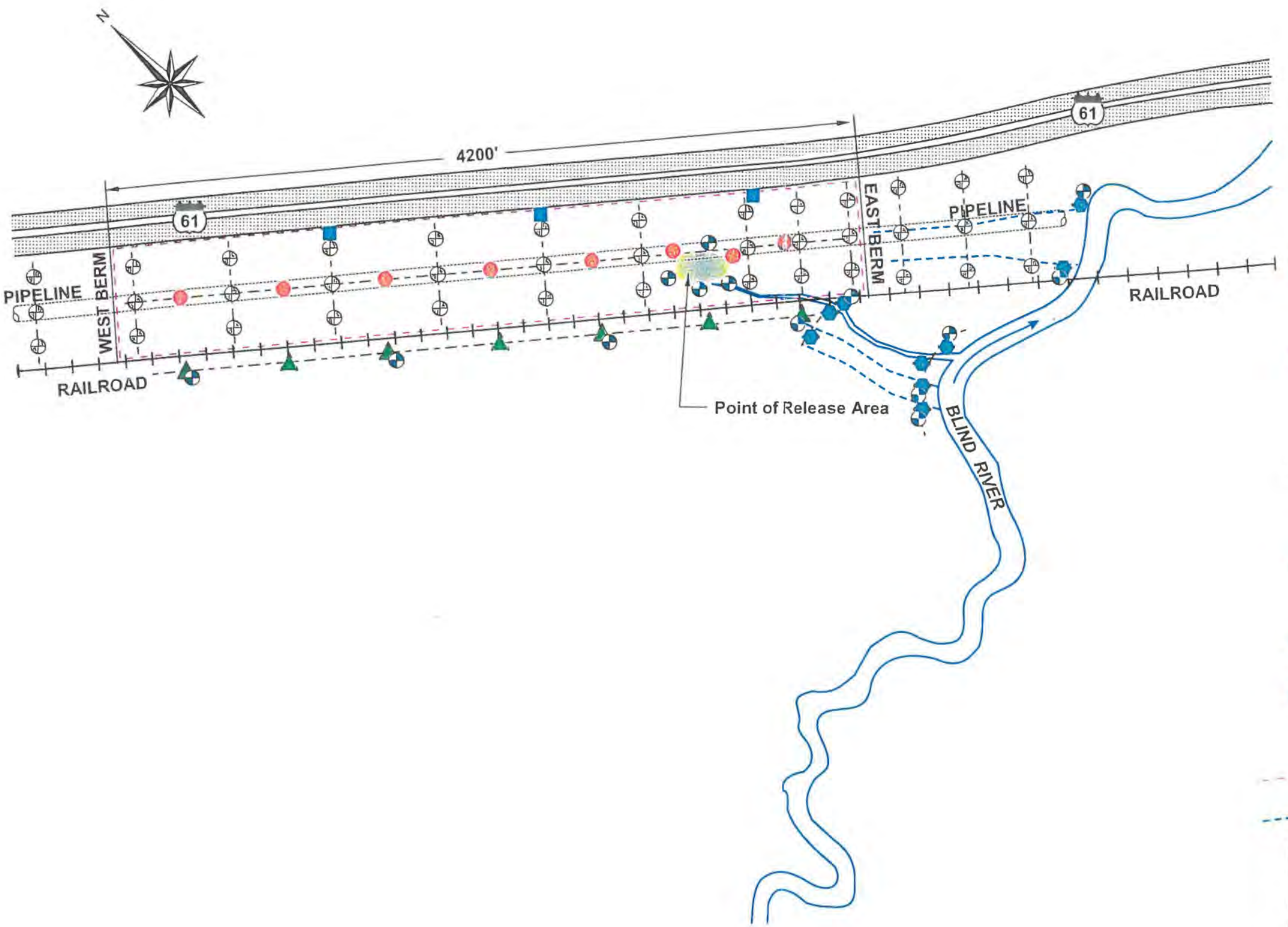

LEGEND

- Exploratory Boring/Temporary Piezometer Location
  - 1 - Groundwater (Temporary Well Point)
- Pipeline Worker Transect Sample Locations - at each location:
  - 1 - Surface Soil
  - 1 - Subsurface Soil (Highest OVA)
  - 1 - Groundwater (Temporary Well Point)
- Trespasser Transect Sample Locations Within the Area of Impact:
  - 1 - Surface Water (if present)
  - 1 - Sediment/Surface Soil
- Railroad Transect Sample Locations:
  - 1 - Surface Water (if present)
  - 1 - Sediment/Surface Soil
- Groundwater Sample Locations:
  - 1 - Groundwater Temporary Well Point
- Recreational Camper Sample Locations:
  - 1 - Surface Water
  - 1 - Sediment
- Denotes Area of Impact
- Intermittent Stream

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Garyville, Louisiana

SCALE:	DRAWN BY: D.P. OLSON	DATE: 07/26/96	FILE NO.	FIGURE:
NTS	CHECKED BY: J. HEBERT	DATE: 07/29/96	96B195-3	4

PROPOSED WORKPLAN AIRLINE HIGHWAY SAMPLING LOCATIONS

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APPENDIX A

MARATHON PIPELINE UNLEADED GASOLINE CHEMICAL PROFILE

The list of component concentrations for a typical Garyville Regular Unleaded gasoline came from a report authored by Dennis Sutton (now Texas City Refinery Lab Supervisor) and Axel Lubeck (Advanced Senior Chemist, Petroleum Technology Center). In addition to the component concentrations through C_8, there is additional data on that specific gasoline and on the refinery streams used to blend that gasoline that indicate the other 19.2 % of the Garyville Regular Unleaded gasoline is composed of the following:

14.4%	C_9 to C_{12} Aromatics
0.1%	C_9 to C_{12} Olefins
4.7%	C_9 to C_{12} Saturates

No further breakdown is available from existing data. The component concentrations through C_8 were determined by capillary GC analyses on a Garyville Regular Unleaded gasoline, sampled in 1989. Although from time to time we have tried to extend the component analysis beyond C_8 for special projects, we have not performed a careful identification of the individual gasoline components in the C_9 to C_{12} range. Thus, we can not give you a detailed listing of components in that carbon number range.

Of the aromatic hydrocarbons listed as "Chemicals of Concern for Sites Contaminated with Petroleum Products", Garyville Regular Unleaded gasoline contains a number of single and 2-ring aromatic compounds including benzene, toluene, ethyl benzene, xylenes (para-, meta-, and ortho-) and naphthalene. Gasolines do not contain any 3-ring or larger polycyclic aromatics. Thus, none of the following aromatic compounds would be present: anthracene, acenaphthene, benzo(a)pyrene, pyrene, chrysene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene, fluorene, fluoranthene, benzo(b)fluoranthene, benzo(a)anthracene, and dibenzo(ah)anthracene. Of the saturate hydrocarbons in the list of "Chemicals of Concern ... ", typical Garyville Regular Unleaded gasoline would contain n-hexane and n-nonane. Gasoline does not contain n-eicosane.

As Garyville is not making reformulated gasoline (RFG) or adding oxygenates for any other purpose, none of their gasolines would contain methanol, MTBE, MEK (methyl ethyl ketone), MIBK (methyl iso-butyl ketone), or TBA (t-butanol).

EDC (ethylene dichloride) and EDB (ethylene dibromide) are halogenated organic compounds that in the past were included as lead scavengers in anti-knock packages added to leaded gasolines. These compounds are not found in unleaded gasolines.

None of the inorganic compounds in the list of "Chemicals of Concern ... " are present in unleaded gasolines.

TABLE 24. GARYVILLE REFINERY STREAMS - COMPONENT ANALYSES

All component concentrations are in liquid volume percent.

COMPONENT	REGULAR GASOLINE 4.01
Methane	0.00
Ethane & Ethylene	0.00
Propane & Propylene	0.03
Iso-Butane	0.48
Butene-1 & Isobutylene	0.14
n-Butane	10.40
trans-Butene-2	0.30
2,2-Dimethyl-propane	0.12
cis-Butene-2	0.30
Butadiene	0.00
3-Methyl-butene-1	0.13
Iso-Pentane	11.68
Pentene-1	0.38
2-Methyl-butene-1	0.87
n Pentane	4.34
Isoprene	0.01
trans-Pentene-2	1.02
cis-Pentene-2	0.57
2-Methyl butene-2	1.68
trans-1,3-Pentadiene	0.00
cis-1,3-Pentadiene & Cyclopentadiene	0.01
2,2-Dimethyl-butane	1.80
Cyclopentene	0.14
4-Methyl-pentene-1	0.06
3-Methyl pentene-1	0.10
Cyclopentane	0.30
2,3-Dimethyl-butane	1.65
2 Methyl pentane	5.03
3 Methyl pentane	2.91
n Hexane	2.29
3-Methyl-cyclopentene	0.07
C6 di- or cyclo-olefins	0.05
C6 mono-olefins	2.34

TABLE 24. GARYVILLE REFINERY STREAMS - COMPONENT ANALYSES (cont'd)

All component concentrations are in liquid volume percent.

COMPONENT	REGULAR GASOLINE
	4.01
2,2-Dimethyl-pentane	0.11
Methyl-cyclopentane	1.46
2,4-Dimethyl-pentane	0.93
Cyclopentadienes	0.03
2,2,3-Trimethyl-butane	0.04
Unknown	0.03
Benzene	0.73
1-Methyl-cyclopentene	0.28
3,3-Dimethyl-pentane	0.13
Cyclohexane	0.54
Hexadienes	0.01
2-Methyl-hexane	1.62
2,3-Dimethyl-pentane	1.71
Cyclohexene	0.04
3-Methyl-hexane	1.60
3-Ethyl-pentane	0.22
2,2,4-Trimethyl-pentane & 2-Ethyl pentene-1	2.13
n Heptane	1.08
C7 mono-olefins	1.51
C7 Naphthenes	1.79
2,3,4-TMP & olefin	0.78
2,3,3-Trimethyl pentane	0.00
Toluene	3.78
2-Methyl-heptane	0.61
4-Methyl heptane	0.30
3-Methyl heptane & cct-1,2,3-TMCP	0.69
Other C8 Paraffins	1.28
C8 Naphthenes thru nC8	0.41
C8 Unknowns thru nC8	1.25
n-Octane	0.43
C8 Aromatics	5.06
TOTAL OF ABOVE COMPOUNDS	80.84

APPENDIX B

FIELD FORM EXAMPLES

LOG OF BORING

PROJECT:
LOCATION:

CLIENT:

DRILLER:

BORING:
FILE:
DATE:
TECHNICIAN:
APPROVED:
PAGE: 1 of 1

DEPTH (FEET)	SYMBOL	SAMPLE	S.P.T.(b/ft) or P.Pen.(tsf)	OVA (ppm)	Recovery (inch)	Description of Stratum
0						
5						
10						
15						
20						
25						
30						

Woodward-Clyde Consultants

Project: ______________________________
______________________________ Made by: __________ File: __________ Date: __________
Well Number: ______________________________ Checked by: __________ Date: __________

GENERAL CONDITIONS:

Depth (ft. TOC/bottom):	Stick-up (ft. TOC/pad):
WCC Representatives:	

PURGING DATA:

Purging (2 min. cycles)			Pressures (psi)		Water Level (ft. TOC)	
Date	Start	Stop	Tank	Working	Before	After

METHODS:

PUMPING DATA:

Pumping			Pressures		Water Level		Production (gpm)	Quantity (gallons)	Conditions
Date	Start	Stop	Tank	Working	Before	After			

STABILIZATION DATA:

Time											
Temperature											
Conductivity											
pH											

RECOVERY DATA:

Time (min)	2	5	7	10	15	20	25	30	40	50	60	90	120	240	24hr	final
Level (ft.)																

REMARKS:

WOODWARD-CLYDE CONSULTANTS

GROUNDWATER COLLECTION REPORT

PROJECT NUMBER AND NAME________________________________ LOCATION______________
COLLECTOR/OPERATOR____________________________________ WELL NO.______________
TYPE OF SAMPLE _______ ( ) GRAB ( ) COMPOSITE ( ) OTHER ______________________

MONITOR WELL INFORMATION

EVACUATION: DATE/TIME____________________ METHOD OF EVACUATION ______________
INITIAL DEPTH TO WATER LEVEL__________ TOP OF CASING TO BOTTOM______________
GALLONS PER WELL VOLUME__________ TOTAL GALLONS EVACUATED______________
FINAL DEPTH TO WATER__________ ELEVATION TOP OF CASING______________

SAMPLING: DATE/TIME____________________ METHOD OF SAMPLING______________
DEPTH TO WATER LEVEL______________

SAMPLE DATA

FIELD REPLICATE #1 TEMP.______________ pH __________ CONDUCTIVITY ______________
FIELD REPLICATE #2 TEMP.______________ pH __________ CONDUCTIVITY ______________
FIELD REPLICATE #3 TEMP.______________ pH __________ CONDUCTIVITY ______________
FIELD REPLICATE #4 TEMP.______________ pH __________ CONDUCTIVITY ______________

GENERAL INFORMATION

WEATHER CONDITIONS AT TIME OF SAMPLING ______________________________
SAMPLING CHARACTERISTICS ______________________________
CONTAINERS AND PRESERVATIVES______________________________
____
RECOMMENDATIONS/OBSERVATIONS ______________________________
____
____
____

SAMPLE ID NUMBERS ______________________________

SAMPLING PERSONNEL TIME__________ TO __________

______________________________ DATE ______________
(SIGNED)

LOCK OR SEAL NUMBER ______________________ REPLACEMENT SEAL NUMBER ______________

WOODWARD-CLYDE CONSULTANTS

CHAIN-OF-CUSTODY RECORD

Sample No.	Matrix	YR: 95 DATE MM/DD	Time	Sample Depth From	Sample Depth To	Station Location						

SAMPLE COLLECTION:

PROJECT NO. AND NAME: ______

LOCATION OF SAMPLE: ______

TEAM LEADER: ______ TELEPHONE: (504) 751-1873

COMPANY NAME: Woodward-Clyde Consultants (WCC)

ADDRESS: 2822 O'Neal Lane Baton Rouge, LA 70816

WITNESS: ______ COMPANY NAME: ______

FIELD INFORMATION:

TYPES OF SAMPLES: (MATRIX) LIQUID (LI) WIPE (WI) FISH (FI) SEDIMENT(SE) SLUDGE (SL) OTHER (SPECIFY) ______ SOIL (SO)

FIELD NOTES: ______

TRANSPORTER: ______ AIRBILL/INVOICE: ______ DESTINATION: ______

SAMPLE TRANSFER (Original must be retained with sample at all times)

		RELINQUISHED BY	DATE/TIME	RECEIVED BY	DATE/TIME
1	NAME:				
	COMPANY:				
2	NAME:				
	COMPANY:				
3	NAME:				
	COMPANY:				

TERMINATION OF CHAIN-OF-CUSTODY:

AUTHORIZED BY: ______ DATE: ______ TIME: ______

COMPANY NAME: ______

SAMPLE DISPOSITION STORAGE ______ DISPOSAL ______ OTHER ______