Survey of the neighborhood re: Health Issues
may check w Health Dept.

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Merrian Haynes

ADDRESS 397 Sam Rayburn Drive

CITY H'burg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

A possible resource for area of flow of drainage
Can a Survey be performed of illness in the area.

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME JAMES Rogers

ADDRESS 113 Baxter St.

CITY HAttiesBurg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ____ Undecided ____

Lived in area for 74 years - Flow now to Gorkett Creek Was area tested?

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Mrs. Vermell Jackson (601) 582-4467

ADDRESS 801 Martin Luther King ave

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

Direct Exposure?

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Mary L. Watts

ADDRESS 40 Oak Street

CITY H'burg STATE MS. ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ____ Undecided ____

Direct Exposure Health Issue?

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Rev. Carol E. Grimmett

ADDRESS 300 Parkdale Dr.

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ____ Undecided ____

Possible Resource regarding area flow of ditches

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME George Johnson Jr

ADDRESS ______________________

CITY ____________ **STATE** ________ **ZIP CODE** ________

Do you wish to publicly ask a question or make a comment?

Yes X **No** ___ **Undecided** ___

Request additional testing in possible other identifiable areas.

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Beverly Shaw

ADDRESS 814 Martin L. King Ave.

CITY Hattiesburg **STATE** MS **ZIP CODE** 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

? on the identifiable stream.
Lake existed behind Old Gibson Bldg back to old
Budman's Place

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Jerry L. Spann

ADDRESS 23 Sharmont Dr.

CITY Hattiesburg **STATE** MS **ZIP CODE** 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

Z, on identifiable area

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Dolly D Hendricks

ADDRESS 1108 Aledge St

CITY Hattiesburg **STATE** Miss **ZIP CODE** 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

Worked at the Plant Resource

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Bessie Lee Richardson 5984-7942

ADDRESS 608 ML K

CITY HATTIBURG **STATE** MIS **ZIP CODE** ______

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

How far ~~tested~~ West on the site
Dirt was pushed as far as Old Budweiser Bldg.

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME G.W. & Clara Clark

ADDRESS 20 Jasmine Drive

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Ques What ~~time~~ period tested?,
Length ~~of time~~ for creosote to dissipated so no longer detectable at harmful level? Mississippi Department of Environmental Quality
Justification for not ~~taking~~ ~~to~~ South of the area.

MEETING REGISTRATION

NAME Lue B. Bell

ADDRESS 112 Continental Drive

CITY H'Burg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided X

Resource - Water stood along tracks they swam in & used to water animals. Retest South side of tracks?

? Health Issue

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Jarvis Walker

ADDRESS 1611 Country Club Rd

CITY H'burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ___ Undecided ___

Survey of 2000 in residential area
South of Tack.
Father worked at plant. Had a Well & played in area

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Laura Ball

ADDRESS 407 Columbia Street

CITY H Burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Edward Coleman

ADDRESS 406 McNair St

CITY MS STATE Petal ZIP CODE 39465

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ____ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Willie Horton

ADDRESS 216 Westover Dr.

CITY Hattiesburg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Michelle Milton

ADDRESS 714 James St

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided X

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Henry E. Naylor

ADDRESS 204 Jervis Mims Rd

CITY H'burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME DAVID DEARMAN

ADDRESS 20 Blueberry Lane

CITY Purvis **STATE** MS **ZIP CODE** 39475

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** X

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Latonia L. Shaw

ADDRESS 1609 Vernon St

CITY H'burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided X

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Faye N. Sanders

ADDRESS 210 Barry St

CITY H'bur STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** ____ **Undecided** ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Leroy Shelton

ADDRESS 907 Dossett Ave

CITY H'burg STATE Miss. ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Francis Bell

ADDRESS 915 Bell Ave

CITY Hattiesburg STATE Miss ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Catherine Montgomery McMickle

ADDRESS 1005 Country Club Rd

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Melchester Woodhall JR

ADDRESS 613 Ronie St

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided √

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Cynthia Glass

ADDRESS 714 woodland ct

CITY H'burg n STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ✓

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Deborah Diemel

ADDRESS 301 ½ Katie Ave.

CITY H[illegible] STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ✓ No ___ Undecided ___

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Linda G. Montgomery

ADDRESS 1007 Country Club Road

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided X

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Steven Williams / WDAM-TV

ADDRESS Highway 11 North

CITY Hattiesburg STATE MS ZIP CODE 39404

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Roger McDowell

ADDRESS 203 South 22nd Ave

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ___ No X Undecided ___

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Aretha C hudson

ADDRESS 301 Bowling St.

CITY Hattiesburg STATE miss ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ___ No ✓ Undecided ___

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME [handwritten signature]

ADDRESS 3 [handwritten]

CITY [handwritten] STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ___ No X Undecided ___

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Carolyn Hudnall Williams

ADDRESS 125 Tuscan Avenue

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ✓ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Leoletta M Feazell

ADDRESS 301 1/2 Katie Ave

CITY Hattiesburg STATE Ms ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Emma B. Pope

ADDRESS 123 Tuscan Ave.

CITY H'burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ✓ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME hela Spann

ADDRESS ~~205~~ 710 Claiborne Av

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ✓ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Beverly Gayle Commodore

ADDRESS 200 Forrest St

CITY Hattiesburg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Prentiss Carson

ADDRESS 706 Woodland Cr.

CITY H'burg STATE MS ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ✓ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Ardessie Eatman

ADDRESS 3107 Watson Dr

CITY Hattiesburg STATE Miss ZIP CODE 39401

Do you wish to publicly ask a question or make a comment?

Yes ____ No ____ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Sandy Riley

ADDRESS 38 Emerald Row

CITY Hattiesburg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ No ✓ Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Teejay Riley

ADDRESS 9 Cane Cove

CITY H'burg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Jan Hammond

ADDRESS 112 Sheffield Loop, Suite D-1

CITY Hattiesburg **STATE** MS **ZIP CODE** 39402

Do you wish to publicly ask a question or make a comment?

Yes ____ **No** X **Undecided** ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Winston Russell

ADDRESS 600 N. 26th Ave

CITY Hattiesburg STATE MS ZIP CODE 39402

Do you wish to publicly ask a question or make a comment?

Yes ___ No ___ Undecided X

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Johnny L. DuPree

ADDRESS P.O. Box 1898

CITY Hattiesburg STATE MS ZIP CODE 39403

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Don Barrett

ADDRESS Bx 987

CITY Lexington STATE MS ZIP CODE

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME ~~J.~~ J. B. Van Slyke

ADDRESS P. O. Box 1506

CITY Hattiesburg STATE MS. ZIP CODE 39403

Do you wish to publicly ask a question or make a comment?

Yes ___ No ✓ Undecided ___

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Lawrence Holliday

ADDRESS 572 Covenant Holliday Rd

CITY Poplarville STATE Ms ZIP CODE 39470

Do you wish to publicly ask a question or make a comment?

Yes ____ No X Undecided ____

Mississippi Department of Environmental Quality

MEETING REGISTRATION

NAME Bennie J. Sellers, Director of Public Service

ADDRESS P.O. Box 1898

CITY Hattiesburg STATE MS ZIP CODE 39403

Do you wish to publicly ask a question or make a comment?

Yes ___ No ✓ Undecided ___

ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

FILE COPY

ECOLOGICAL RISK ASSESSMENT

FOR THE FORMER GULF STATES CREOSOTING FACILITY,

HATTIESBURG, MISSISSIPPI

January 14, 2000

Prepared for:

KERR-MCGEE CHEMICAL LLC
123 Robert S. Kerr Avenue
P.O. Box 25861
Oklahoma City, OK 73125-0861

Prepared by:

ENVIRONMENTAL STANDARDS, INC.
1140 Valley Forge Road
P.O. Box 810
Valley Forge, PA 19482-0810

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ENVIRONMENTAL STANDARDS, INC.
VALLEY FORGE, PA
www.EnvStd.com
1140 Valley Forge Road, P.O. Box 810, Valley Forge, PA 19482-0810 • 610-935-5577 • OffNPL@EnvStd.com
1111 Kennedy Place, Suite 2, Davis, CA 95616 • 530-758-1903 • ENVSTDWEST@AOL.com
Copper Bend Centre, 956 South 59th Street, Belleville, IL 62223 • 618-257-3800 • MIDWEST@EnvStd.com

TABLE OF CONTENTS

Executive Summary

An ecological risk assessment (ERA) was conducted for the Former Gulf States Creosoting facility in Hattiesburg, Mississippi. The ERA was performed in accordance with Mississippi Commission on Environmental Quality's (MCEQ's) *Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi* (1999); US EPA's *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments* (1997), US EPA's *Guidelines for Ecological Risk Assessment* (1998); US EPA Region 4 *Ecological Risk Assessment Bulletins* (1999); and other relevant US EPA guidance documents.

Much of the former creosoting process area is currently covered with asphalt or large building structures; however, three exposure units (EU1, EU2, and EU3) on the Site provide potential habitat for ecological receptors. Based on a tiered approach recommended by MCEQ (1999) for assessing ecological risks, it was determined that constituents of potential ecological concern for the Former Gulf States Creosoting facility are chemicals comprised of polycyclic aromatic hydrocarbons (PAHs), including benzo(a)pyrene.

Exposure pathways evaluated for ecological receptors include surface water ingestion, incidental soil ingestion, incidental sediment ingestion, ingestion of terrestrial vegetation, and ingestion of terrestrial invertebrates. Quantitative evaluation of these exposure pathways indicates that residual concentrations of PAHs in soil, sediment, and surface water do not pose unacceptable hazard to ecological receptors at the Site. No ecologically-based remedial measures are warranted in EU1, EU2, or EU3, based on ecological considerations, because ecological hazards have been determined to be below the *de minimis* risk level.

1.0 Introduction

Environmental Standards, Inc. (Environmental Standards) was retained by Kerr-McGee Chemical Corporation LLC (Kerr-McGee) to perform an ecological risk assessment (ERA) to evaluate the potential hazards that may result from residual levels of chemicals present at the Former Gulf States Creosoting Facility (Site). The Site, located near the intersection of US Highways 49 and 11 in Hattiesburg, Mississippi, was formerly a wood treating facility that operated between the early 1900s and 1960. In the early 1960s, the Site was redeveloped for commercial and light industrial uses (Michael Pisani & Associates, 1997).

Operations at the Site before 1960 consisted of a small-scale wood preserving process using creosote. The creosoting process was confined primarily to a 2.5-acre area in the northeast corner of the Site: this area is known as the Process Area and is currently occupied by Courtesy Ford. Construction debris (*e.g.*, broken concrete, asphalt, *etc.*) was apparently relocated to the southwestern corner of the Site along Gordon's Creek during the redevelopment of the Site in the early 1960s. This area is known as the Fill Area and currently remains undeveloped.

This report addresses the potential for on-Site exposures to ecological receptors and has been written as a result of an agreement between Kerr-McGee, the Mississippi Department of Environmental Quality (MDEQ), and the Mississippi Commission on Environmental Quality (MCEQ) pursuant to the Uncontrolled Site Voluntary Evaluation Program. The MDEQ Office of Pollution Control, Uncontrolled Sites Section has been providing oversight and review of investigations and reports relating to the former Gulf States Creosoting facility.

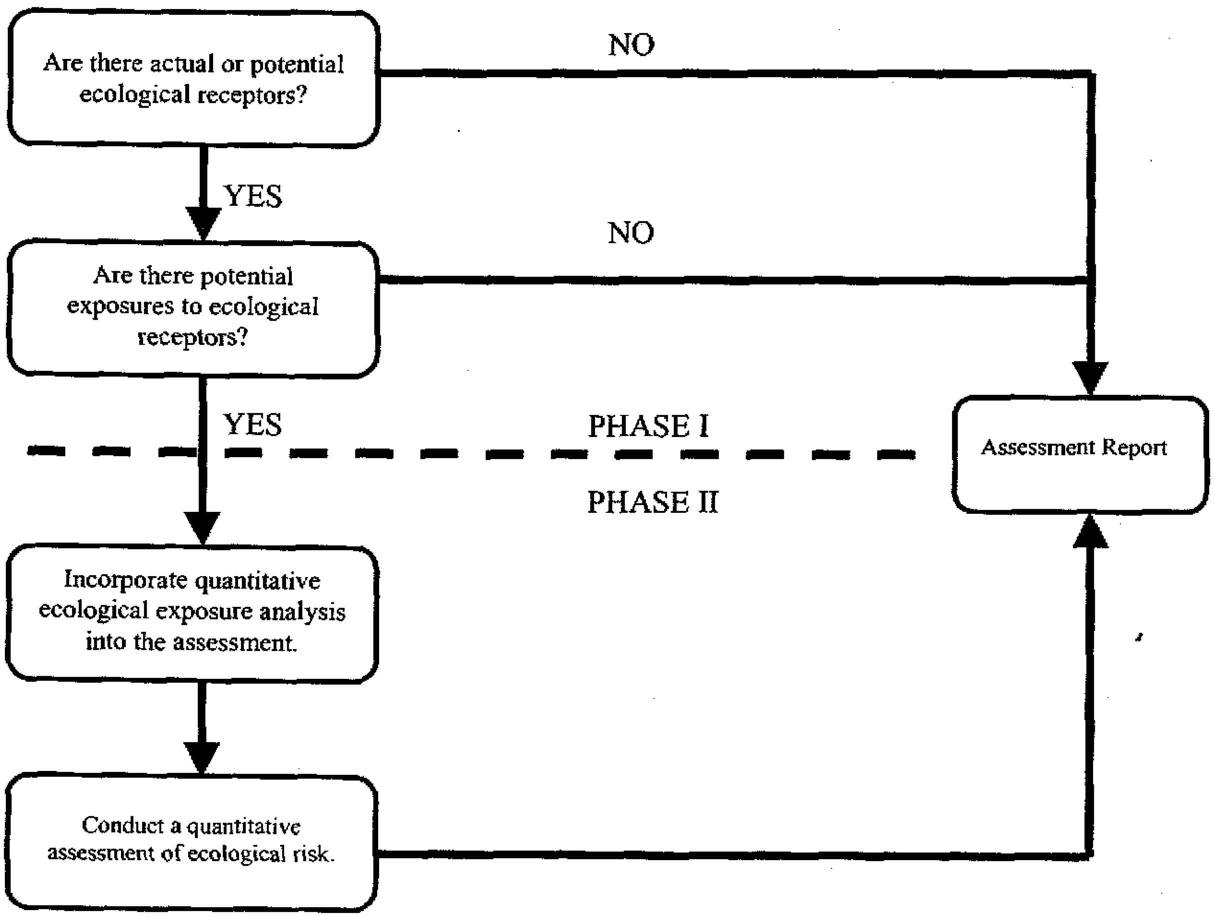
The primary guidances used to develop this qualitative risk assessment included:

- MCEQ *Final Regulations Governing Brownfields Voluntary Cleanup and Redevelopment in Mississippi* (1999);
- US EPA *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments* (1997);
- US EPA *Guidelines for Ecological Risk Assessment* (1998); and

- US EPA Region 4 *Ecological Risk Assessment Bulletins – Supplement to RAGS* (1999).

2.0 Ecological Screening Assessment

At the request of MDEQ, an ecological evaluation was conducted using a tiered approach, starting with a qualitative assessment of ecological risks (Phase I). If this assessment determines that there may be unacceptable ecological risks associated with the site, a quantitative evaluation is then conducted (Phase II). The purpose of the Phase I assessment is to determine if there are actual or potential ecological receptors on or near the site and whether or not there is a potential for unacceptable receptor exposure to site-related constituents. If either of these conditions does not exist, there is no need to proceed further except to document the findings. The diagram below depicts the ecological assessment process used in this evaluation.



3.0 Phase I Screening Assessment

The Phase I screening assessment addressed whether or not ecological receptors are expected to be present at or near the site and if so, whether or not there is a significant potential for unacceptable ecological risk. For the purposes of this investigation, this likelihood was evaluated by determining whether specific areas of the Site contained suitable habitat for ecological receptors. Those areas with suitable ecological habitat were retained for further evaluation (Phase II). To accomplish this, the Former Gulf States Creosoting Facility was divided into five exposure units (EUs), which correspond to the areas of concern evaluated in the Human Health Risk Assessment.

EUs were delineated based upon the presence of residual constituents in environmental media. Areas of the Site most affected were included in at least one of the five EUs; areas with relatively low or non-detectable concentrations of residuals were not included in an EU. By limiting Site-wide exposures to the EUs most affected by historical activities at the Site, worst-case scenarios were created.

EU 1

EU1 outlines the on-Site areas in, adjacent to, and downstream of the Fill Area along Gordon's Creek (Figure 1). This area contains habitat suitable for some types of aquatic species. It should be noted, however, that the aquatic habitat is very marginal, at best, because of the high incidence of anthropogenic trash (shopping carts, used tires, litter, *etc.*) that is found along this stretch of Gordon's Creek. In addition, a site survey revealed that aquatic organisms were depauperate in this section of the creek. Nonetheless, because this area does contain aquatic habitat, it was retained for further evaluation. Surface water and sediment were evaluated in this exposure unit.

EU 2

EU2 delineates the upland areas of the Fill Area and adjacent woody and grassy areas (Figure 1). This area contains suitable habitat for upland terrestrial species and, thus, was retained for further evaluation. Surface soils (zero to one foot below ground surface [bgs]) in this area were evaluated.

EU 3

EU3 is situated in the southwest corner of the Site and contains a grassy field and scattered wooded areas located east of West Pine Street between Henson Auto Sales and Eagan Cars and Trucks (Figure 1). There is a small drainage ditch that flows intermittently; however, the ditch does not provide suitable habitat for aquatic species. EU3 does contain suitable habitat for upland terrestrial species and was, therefore, retained for further evaluation. Surface soils (zero to one foot bgs) in this area were evaluated.

EU 4

EU4 encompasses the grassy, drainage ditch area along the fenceline behind Courtesy Ford in the northeast corner of the Site (Figure 1). This small area does not contain habitat suitable for either terrestrial or aquatic species; consequently, this area was eliminated from further evaluation.

EU 5

EU5, which encompasses EU4, outlines the Process Area and the historical drip track areas of the Former Gulf States Creosoting Facility (Figure 1). This area is highly developed with buildings and paved areas and does not contain any ecologically suitable habitats; consequently, this area was eliminated from further evaluation.

4.0 Phase II Screening Assessment

A Phase II evaluation was performed for EU1, EU2, and EU3 because these EUs contained suitable habitat for potential ecological receptors. In this evaluation, the nature and extent of contamination was evaluated for each EU to determine if potentially unacceptable exposures to ecological receptors exist.

Residual levels of constituents found in each applicable environmental medium for each EU were evaluated based on the potential to cause adverse toxicological effects. A comparison of maximum concentrations to criteria derived for toxicity screening purposes was conducted to determine whether a quantitative assessment of ecological risk was necessary. If the constituent of interest was present at a concentration below a conservative screening criterion (*e.g.*, AWQC), then it was considered to be of "*de minimis*" risk and was eliminated from further analysis. If any constituent was greater than the applicable benchmark, the constituent was retained for quantitative assessment.

Site analytical data used in this assessment were collected during the Phase I (Michael Pisani & Associates, 1997) and Phase II (Michael Pisani & Associates, 1998) remedial investigations. These data were fully validated by qualified technical professionals using standard data validation protocols, as required by the MCEQ (1999). The validated laboratory data were compiled into data sets representing areas of potential exposure (EUs). Each data set was analyzed statistically using SiteStat®, a commercially available software package, to calculate the minimum, maximum, arithmetic mean, logarithmic mean, standard error of the mean, and the 95% upper confidence limit of the mean concentration (95% UCL) for each constituent based on distributional analysis of the data (*i.e.*, utilizing goodness-of-fit statistical tests to determine whether the data are distributed normally or lognormally). The location of the maximum detected concentration for each EU was also determined. Summaries of the statistical analyses for each of the EUs discussed above are presented in Tables 1 through 4.

Constituent concentrations in EU2 and EU3 surface soils were screened against unrestricted target remediation goals (TRG), as per MCEQ (1999) guidance. Exposure-point concentrations for soils were conservatively considered as the smaller of either the 95% UCL of the mean concentration or the maximum concentration, even though the US EPA justifies the use of an average concentration as the exposure-point concentration (*Supplemental Guidance to RAGS: Calculating the Concentration Term*, 1992) and considers long-term contact with maximum concentrations as an unreasonable assumption (*Risk Assessment Guidance for Superfund, Part A*, 1989). MCEQ guidance (1999) does not specify screening levels for sediments; therefore, EU1 sediment data were compared to unrestricted soil TRGs.

For surface water, the exposure-point concentration of a constituent in an EU was compared to its respective US EPA Region 4 Chronic Freshwater Surface Water Screening Value (CSV), (US EPA, *Region 4 Ecological Risk Assessment Bulletins*, 1999). If a CSV was not available, the exposure-point concentration was compared to the US EPA freshwater Ambient Water Quality Criterion (AWQC) for that chemical. If the exposure-point concentration of a constituent in surface water was less than the CSV (or AWQC), then that constituent was eliminated from the quantitative evaluation. If the exposure-point concentration of a constituent in surface water exceeded the CSV (or AWQC), then that constituent was retained for quantitative analysis.

The results of the screening process are presented in Tables 1 through 4. All detected constituents in EU1 surface water, EU1 sediment, and EU2 and EU3 soils were eliminated from further consideration with the exception of Group B2 polycyclic aromatic hydrocarbons (PAHs). Collectively, and for determination of ecological exposure, PAH compounds can be grouped into a single, representative chemical (a benzo(a)pyrene equivalent) based on their relative toxicities to benzo(a)pyrene. Exposure-point concentrations of these PAHs were combined according to the relative potency factors (RPFs) set forth in US EPA guidance (*Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons*, 1993). RPFs for these compounds range from 0.001 and 1.0 and are listed below:

Compound	RPF
Benzo(a)pyrene	1.0
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001

Compound	RPF
Dibenz(a,h)anthracene	1.0
Indeno(1,2,3-c,d)pyrene	0.1

4.1 Problem Formulation

Currently, the majority of the Site is used for commercial and light industrial purposes and contains paved surfaces comprised of roads and parking lots. As stated previously, only EU1, EU2, and EU3 contain potential habitat for ecological receptors; therefore, assessments of exposure to ecological receptors were confined to these exposure units only. Chemical data from each of the three EUs of concern were combined with EU-specific exposure parameter values and receptor scenarios to determine the chemical intake for each receptor dwelling or foraging there.

Based on current conditions at the Site, ecological receptors are expected to contact surface water and sediment in EU1 and surficial soils in EU2 and EU3. Receptors may be exposed directly to potentially contaminated media through dermal contact, inhalation, or incidental ingestion, or indirectly through potentially contaminated food items. Ecological exposure through dermal and inhalation pathways is generally considered insignificant (Sample *et al.*, 1997); thus, only direct and indirect ingestion pathways are the focus of ecological assessments.

Assessment endpoints are "explicit expressions of [an] actual environmental value that is to be protected, operationally defined by an ecological entity and its attributes" (US EPA, *Guidelines for Ecological Risk Assessment*, 1998). Selection of assessment endpoints was based on the contaminants present and their concentrations, the mode of toxicity of contaminants to various receptors, the presence of sensitive or highly susceptible ecological receptors, and the completeness of exposure pathways (US EPA, *Ecological Risk Assessment Guidance for Superfund*, 1997). Based on these criteria, the primary assessment endpoint for this investigation was the maintenance of abundance or reproduction of mammalian herbivores and omnivores.

The stream in EU1 does not provide quality habitat for aquatic organisms and, thus, does not provide a suitable foraging area for terrestrial or semi-aquatic receptors. As a result, mammalian receptors, which spend the majority of time residing and foraging in upland habitat, were considered to be the most appropriate for quantitative risk analysis. Furthermore, the browsing and rooting foraging nature of many species within these trophic groups may result in potentially high levels of soil ingestion. These groups are also more likely to be at higher risk from potential bioaccumulative effects stemming from ingestion of terrestrial organisms and soil-dwelling vegetation.

Ecological receptors selected for quantitative analysis included the white-tailed deer (*Odocoileus virginianus*) and the raccoon (*Procyon lotor*). The white-tailed deer is the most abundant big-game mammal in the United States and can be found in a diversity of habitats such as meadows, thickets, riparian areas, and urban locales. Because of its cosmopolitan distribution in Mississippi and throughout the United States and its capacity to dwell or forage in a variety of upland and lowland habitats, the white-tailed deer is susceptible to a variety of potential exposure sources. As such, the white-tailed deer was selected as a receptor for this investigation and was considered representative of other terrestrial herbivores likely to be present at the Site. Exposure routes for the white-tailed deer included ingestion of surface water and soil-dwelling vegetation, as well as incidental ingestion of soil and sediment.

The raccoon is also found in a range of habitats including fields, farmlands, wetlands, and suburban areas and is a representative species of a terrestrial omnivorous guild. Diet preferences include a wide range of fruits and nuts, insects, eggs, and small mammals. The omnivorous nature of its diet and wide-ranging distribution rendered the raccoon a suitable receptor for this risk assessment. Exposure sources for the raccoon may include indirect exposure through the ingestion of terrestrial invertebrates and plant material and direct exposure through the ingestion of surface water and incidental ingestion of soil and sediment.

Both the raccoon and white-tailed deer are expected to forage in upland areas because the ecological value of the stream in EU1 is extremely limited. Conservative exposure assumptions for both receptors should produce exposure estimates representative and sufficiently protective of other species comprising their respective trophic guilds.

4.2 Exposure Assessment

Characteristics of terrestrial and semi-aquatic ecological receptors such as habitat needs, food preference, reproductive cycles, seasonal activities such as migration, and selective use of resources influence their exposure to constituents. These factors were considered in the exposure assessment to further refine species-specific intake rates. The following general equation incorporated these factors and was utilized in the ecological risk assessment to estimate a mass-specific, time-weighted average intake for each medium or food source:

$$\text{Intake} = \frac{C \times IR \times EF \times ED \times SFF}{BW \times AT}$$

where:

C	=	chemical concentration at the exposure point (*e.g.*, mg/kg or mg/L);
IR	=	food/water intake rate (kg/day or L/day);
EF	=	exposure frequency (expressed as an areal proportion of EUs);
ED	=	exposure duration (days);
SFF	=	site foraging factor (unitless);
BW	=	body weight of exposed individual (kg); and
AT	=	averaging time (period over which exposure is averaged), (days).

The following sub-sections describe the species-specific exposure parameters incorporated into the white-tailed deer and raccoon exposure models.

Exposure Frequency

The exposure frequency (EF) describes the number of times per year an event is likely to occur. It is often expressed in days/year; however, EF is expressed as a proportion of time spent in a particular EU based on the intrinsic characteristics of the EU in this assessment. In other words, a receptor is conservatively assumed to be present in either EU1, EU2, EU3, or a combination of the three EUs every day of every year because of the suitability of the habitats in these areas for providing forage and drinking water. The percentage of time spent in each exposure unit of concern is a function of the total area of each of the EUs.

The EF values for the white-tailed deer and raccoon were obtained by measuring the areal coverage of all the EUs of concern and determining the percentage each EU contributes to the total area (see Figure 1). EU1 represents 5.3% (36,271 ft^2) of the ecologically relevant area. Similarly, EU2 represents 72.8% (498,082 ft^2) and EU3 represents 21.9% (149,625 ft^2) of this area. Exposure to sediment or soil was based on the areal extent of each medium because both the white-tailed deer and raccoon are assumed to utilize an EU with a frequency directly related to its area. That is, exposure to sediment is limited to EU1, which encompasses 5.3% of the total area. Similarly, soil exposure can occur only in EU2 and EU3, which encompass 72.8% and 21.9% of the total area, respectively. Therefore, the exposure frequency for a receptor to environmental media is 0.53 in EU1, 0.728 in EU2, and 0.219 in EU3.

Exposure Duration

Exposure doses for the white-tailed deer and raccoon were adjusted to account for spatial and temporal variation in their association with their respective exposure units. As such, the exposure duration (ED) for these receptors was prorated based on the total number of days per year the receptor can be expected to be in the exposure unit and to account for migration patterns, avoidance and other behavioral adaptations, and seasonal pattern related to reproduction, among others. For this risk assessment, the white-tailed deer and raccoon were conservatively assumed to spend their entire lives within the EUs of concern. The Pennsylvania Game Commission has determined that the longevity for a white-tailed deer is 2008 (Merritt,

1987) days. Raccoons are reasonably anticipated to live for 894 days (US EPA, *Wildlife Exposure Factors Handbook*, 1993). These values were utilized as ED values in the white-tailed deer and raccoon exposure models.

Averaging Time

The averaging time (AT) parameter is the time period over which exposure is averaged and accounts for species differences in longevity, and consequently, the total possible exposure period. In most cases, the averaging time is equivalent to the exposure duration (ED). Thus, for the white-tailed deer and raccoon, AT was set equal to 2008 and 894 days, respectively.

Site Foraging Factor

The site foraging factor (SFF) accounts for the proportion of time that an organism spends in the EU during the time period of possible expsoure. This factor discounts the exposure time by the ratio of the EU area to the home range of each receptor. For the white-tailed deer, Merritt (1987) reports a home range of 321-1,628 acres. The mean home range for the raccoon varies from 96 to 2,560 acres (US EPA, *Wildlife Exposure Factors Handbook*, 1993). Both values are vastly greater than the total area of EU1, EU2, and EU3 combined (15.7 acres). To maintain a conservative screening-level approach (*i.e.*, if no unacceptable hazards result on the basis of worse than worst-possible case assumptions, then a high confidence exists that even with uncertainties in the assessment, no endangerment is likely to occur) for assessing exposure, however, the SFF was set equal to 1.0 (100%) for both receptors.

Body Weight

For the white-tailed deer, a body weight of 56.5 kg was extracted from Sample and Suter (1994). US EPA (*Wildlife Exposure Factors Handbook*, 1993) reports a range of body weights for raccoons from a variety of field studies, with a mean body weight of 5.78 kg; this value was used in this assessment.

Ingestion Rate

A necessary step in estimating exposure rates for terrestrial wildlife is the calculation of food ingestion rates. For the white-tailed deer, Sample and Suter (1994) report a food ingestion rate of 1.7 kg/day. For the raccoon, US EPA's *Wildlife Exposure Factors Handbook* (US EPA, 1993) provides an allometric equation, from Nagy (1987), to estimate food intake based on body mass, as follows:

$$FI = 0.0687\,(BW^{0.822})$$

where:

FI	=	food intake rate (kg/day); and
BW	=	body weight (kg).

For herbivorous and omnivorous receptors such as the white-tailed deer and raccoon, bioaccumulation of PAHs from plant ingestion was evaluated based on chemical-specific plant tissue concentrations. A steady-state plant concentration resulting from sediment-to-plant transfer of PAHs was calculated based on the following algorithm:

$$C_{plant} = C_d * UF_{s\text{-}p}$$

and

$$\log UF_{s\text{-}p} = 1.588 - 0.578(\log K_{ow}) \qquad \text{(Travis and Arms, 1988)}$$

where:

C_{plant}	=	chemical-specific plant tissue concentration (mg/kg-dry weight);
C_d	=	concentration in sediment (mg/kg); and
$UF_{s\text{-}p}$	=	sediment-plant uptake factor (unitless).

To account for the biotransfer of PAHs in terrestrial invertebrate prey, uptake factors directly correlated with a constituent's octanol-water partition coefficient (K_{ow}) were utilized. Uptake of PAHs from soil followed the relationship described in Connell (1990):

$$UF_{s\text{-}i} = 0.44\,K_{ow}^{0.05}$$

where:

$UF_{s\text{-}i}$	=	soil-to-invertebrate uptake factor (unitless); and
K_{ow}	=	octanol-water partition coefficient (unitless).

Water ingestion rates for the white-tailed deer and raccoon were calculated from methodologies described in US EPA's *Wildlife Exposure Factors Handbook* (US EPA, 1993). For mammalian species for which empirical drinking water data are unavailable, this document provides an allometric equation to estimate water intake as a function of body mass (Calder and Braun, 1983), as follows:

$$WI = 0.099\ (BW^{0.90})$$

where:

WI	=	water intake rate (kg/day); and
BW	=	body weight (kg).

Soil ingestion rates for both the white-tailed deer and the raccoon were obtained from Beyer *et al.* (1994).

4.3 Measures of Effect

Because risk assessments attempt to quantify potential risks and it is not always possible to take meaningful measurements of assessment endpoints (such as community productivity), surrogate measures of effect (measurement endpoints) are usually chosen as measurable characteristics that are related to specific assessment endpoints. Measures of effect are measurable responses to a stressor that are related to the valued characteristics chosen as assessment endpoints (US EPA *Framework for Ecological Risk Assessment*, 1992, *Guidelines for Ecological Risk Assessment*, 1998). Assessment endpoints generally refer to broader characteristics of populations and ecosystems, and it is usually impractical to measure changes in these characteristics as part of an assessment (Suter, 1993); consequently, the appropriate measures of effect are those measurement endpoints that can be measured and extrapolated to predict effects on assessment endpoints (US EPA, *Framework for Ecological Risk Assessment*, 1992, *Guidelines for Ecological Risk Assessment*, 1998).

As with assessment endpoints, measures of effect at and above the individual-level were selected. The measures of effect for this assessment are primarily no-observed-adverse-effect-levels (NOAELs, derived from Lowest-Observed-Adverse-Effect-Levels [LOAELs]). LOAELS represent the minimum concentration of a constituent that resulted in an observable adverse effect to any member of a test population. NOAELs are constituent levels at which an entire test population exhibited no observable adverse effects. That is, although a specific constituent may produce some response, there is no observable adverse outcome to that response or other unrelated responses by any member of the study population. NOAEL values are generally extremely conservative, and in many cases, grossly underestimate the actual threshold dose below which no adverse effect is observed. The white-tailed deer and raccoon are abundant locally and nationally; thus, less conservative measures of effect are generally appropriate because protection of the population rather than protection of individual organisms is the primary focus of the assessment endpoint. The US EPA recognizes that, in an ecological risk assessment, the primary concern is the health of the population, not of the weaker, more sensitive individuals within a population (US EPA, *Supplemental Risk Assessment Guidance for the Superfund Program, Part 2: Guidance for Ecological Assessment*, 1989).

NOAELs selected for both the white-tailed deer and raccoon are based upon reproductive effects induced in mice (Table 5); consequently, these literature-derived measures of effects must be appropriately modified to account for differences in body mass. For mammals, an equivalent dose level based on body weight allometry follows the relationship:

$$NOAEL_w = NOAEL_t \left(\frac{bw_t}{bw_w} \right)^{\frac{1}{4}} \qquad \text{(Sample } et\ al.\text{, 1996)}$$

where:

$NOAEL_w$	=	NOAEL for wildlife species (mg/kg-day);
$NOAEL_t$	=	NOAEL for test species (mg/kg-day);
bw_t	=	body weight of test species (kg); and
bw_w	=	body weight of wildlife species (kg).

Care was taken to select a measurement endpoint (*e.g.*, NOAEL) that reflected the same exposure pathway (oral exposure) as the assessment endpoint it represents, as US EPA guidance mandates (US EPA, *Ecological Risk Assessment Guidance for Superfund*, 1997).

4.4 Risk Characterization

The objective of the risk characterization is to determine potential risk to receptors by combining the results of the exposure and toxicity assessments. The format for quantitative risk estimation for this assessment involves the construction of a ratio of the chemical-specific exposure-point concentration and a literature-derived toxicity endpoint (NOAEL) to create an ecological hazard quotient (EHQ).

The EHQ method can be utilized to estimate impacts at both the individual and population level. Quotients of varying magnitude are generally interpreted as follows:

Quotient < 1	No significant impact is indicated.
Quotient > 1	Potential ecological threat at the individual level; a threshold of no observed adverse effect has been exceeded. These values do not indicate that an adverse ecological threat has occurred at either the individual or population level; these values only indicate that it is possible and should be evaluated in more detail.
Quotient > 10	Potential ecological threat at the population level.

Hazard quotients based on all applicable routes of exposure for the white-tailed deer and the raccoon are presented in Tables 6 through 19. To determine the total hazard posed to these receptors from ingestion of Site-related media, individual hazard quotients were summed to arrive at a total EHQ (Table 20). Neither the white-tailed deer nor the raccoon total EHQ exceeds unity; thus, the predicted ecological risks from site-related constituents are negligible at the individual level and, consequently, the population level. Accordingly, the risks posed to potential ecological receptors within the exposure units of concern is within acceptable limits because the white-tailed deer and raccoon were selected to reflect the most likely receptors to be exposed (US EPA, *Ecological Risk Assessment Guidance for Superfund*, 1997).

4.5 Uncertainty Analysis

Uncertainty factors associated with characterizing ecological effects evolve primarily from the derivation of toxicological benchmarks. For the most part, toxicological benchmarks are unavailable for each receptor of concern and are derived either through extrapolation from: (1) acute or subchronic NOAEL values; (2) LOAEL values; or (3) different taxonomic groups (*i.e.*, extrapolation from mammals to birds or *vice versa*).

The toxicity benchmark for benzo(a)pyrene used in this risk assessment was a NOAEL based on an experimental study of mice exposed through oral intubation (MacKenzie and Angevine, 1981, referenced in Sample et al., 1996). The exposures conducted were of a short duration but were applied during a critical lifestage. Sample and his colleagues (1996) consider such exposure as chronic; thus, uncertainty associated with an acute to chronic extrapolation is minimized. This study did apply an uncertainty factor of 10 to derive a chronic NOAEL from a chronic LOAEL, in accordance with US EPA guidance (US EPA, *Final Water Quality Guidance for the Great Lakes System; Final Rule*, 1995). This is conservative in that a safety factor of 5 is generally applied for LOAEL to NOAEL extrapolations for terrestrial wildlife (Ford *et al.*, 1992). Uncertainty in the toxicity assessment is also manifested in the extrapolation of dose responses from surrogate species to those of the target species. The scaling algorithm discussed in *Measures of Effect* (see above) and recommended by Sample et al. (1996) is intended to account for taxonomic dissimilarities based on body size. While toxicity has generally been shown to bear an allometric relationship to body weight raised to the 0.75 power in mammals, interspecies differences in the uptake, distribution, and metabolism for some chemicals may "behave" according to different mathematical functions (Mineau *et al.*, 1996).

When data are available for a given species, the data are often obtained from laboratory testing which introduces uncertainty associated with extrapolation from a laboratory setting to a field setting. In addition, information for many exposure parameters such as avoidance behavior, species-specific absorption of food and constituents through the gut, bioavailability of a constituent according to its form, and potential biotransformation of a constituent is not attainable. Therefore, avoidance and biotransformation is assumed to be negligible whereas constituent absorption through the gut and bioavailability are assumed to be 100%. These assumptions are conservative and should result in an overestimation of risk related to these parameters.

5.0 Conclusions

The results of the ecological risk assessment indicate that no unacceptable risks are posed to either the white-tailed deer or the raccoon resulting from exposure to residual concentrations of benzo(a)pyrene equivalents in surface water and sediment in EU1 and in soils in EU2 and EU3. Other constituent concentrations were below federal and state benchmarks protective of ecological organisms and exposures were thus considered insignificant. The receptors selected for study and subjected to quantitative hazard analysis were those expected to be maximally exposed to media in these exposure units; therefore, other species that may venture, forage, or dwell within the perimeter of any of these EUs should not be at risk. Ecological hazards generated from this assessment have been determined to be below *de minimis* risk levels; consequently, no remedial measures for the protection of ecological receptors are necessary in EU1, EU2, or EU3.

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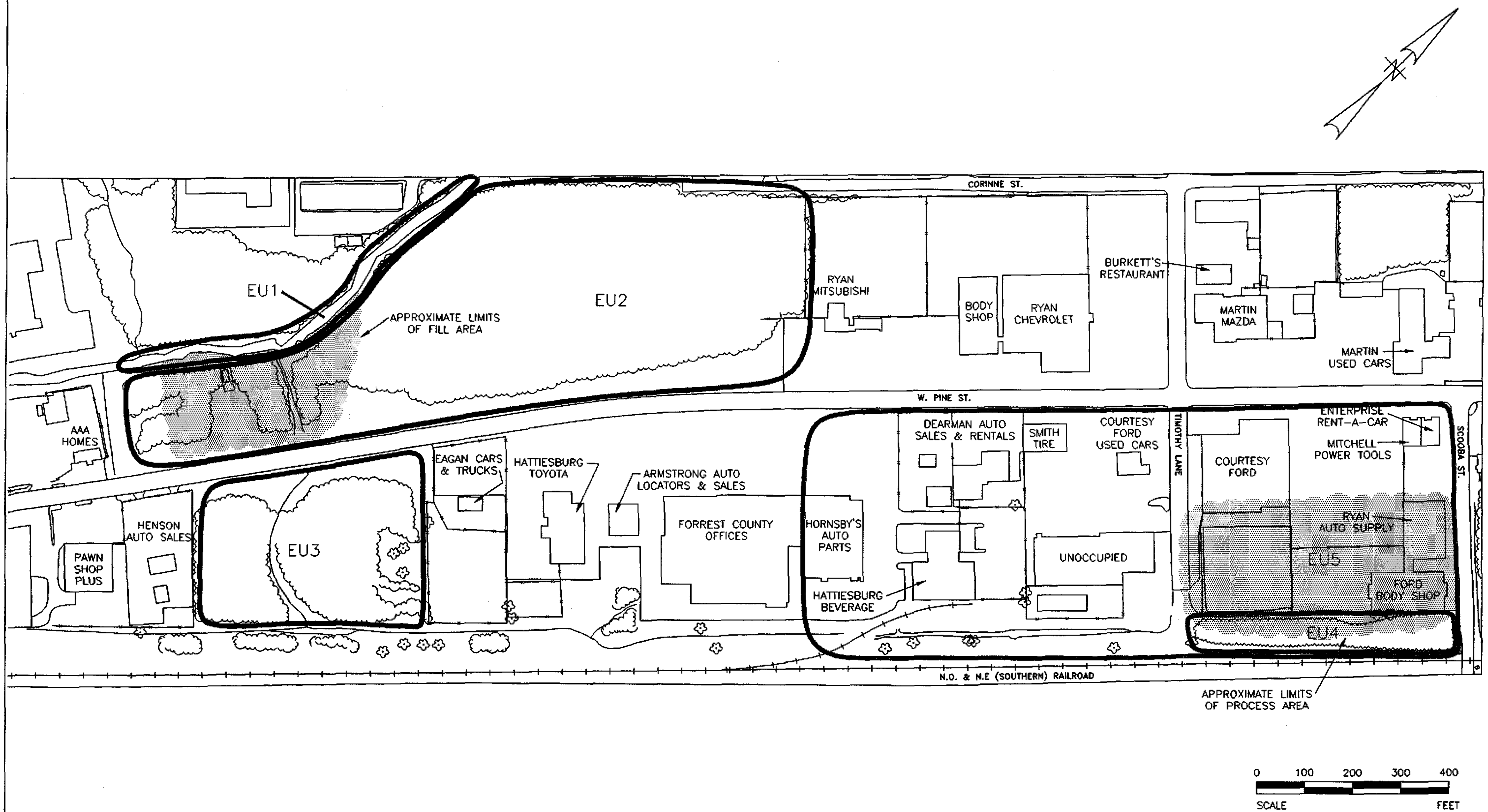

BASE MAP FROM ATLANTIC TECHNOLOGIES, LTD.,
HUNTSVILLE, ALABAMA, APRIL 1, 1996
BASED ON A MAP PROVIDED BY MICHAEL PISANI AND ASSOCIATES

ENVIRONMENTAL STANDARDS, INC. 1140 VALLEY FORGE ROAD · VALLEY FORGE, PA 19482-0810 · (610) 935-5577	
TITLE: FIGURE 1 SITE MAP AND EXPOSURE UNIT DELINEATION	
PROJECT: FORMER GULF STATES CREOSOTING SITE	
LOCATION: HATTIESBURG, MISSISSIPPI	
SCALE: 1"=200'	DWG. NO.: 21-02/318

Table 1
Statistical Summary and Ecological Screening of COPCs in EU1 Surface Water
Kerr McGee, Hattiesburg, MS

Constituent	CAS Number	Total Number of Samples	Hits	Hit Frequency %	Minimum Detection Limit mg/L	Maximum Detection Limit mg/L	Minimum Detected mg/L	Mean mg/L	Logarithmic Mean mg/L	Maximum Detected mg/L	Standard Deviation mg/L
Semivolatiles											
Benzo(a)Pyrene Equiv.	-	2	1	50	NA	NA	1.21E-03	1.18E-03	1.18E-03	1.21E-03	3.54E-05
Fluoranthene	206-44-0	2	1	50	1.00E-03	1.00E-03	7.50E-03	4.00E-03	1.94E-03	7.50E-03	4.95E-03
Pyrene	129-00-0	2	1	50	1.00E-03	1.00E-03	1.00E-03	7.50E-04	7.07E-04	1.00E-03	3.54E-04

NA - Not Available

Table 1
Statistical Summary and Ecological Screening of COPCs in EU1 Surface Water
Kerr McGee, Hattiesburg, MS

Constituent	95% UCL mg/L	Lognormal 95% UCL mg/L	Distribution 99% Confidence	Exposure Point Concentration mg/L	Region IV Chronic Freshwater Surface Water Screening Value mg/L	Is the Maximum Concentration > the Screening Criteria?
Semivolatiles						
Benzo(a)Pyrene Equiv.	1.34E-03	1.31E-03	Unknown	1.21E-03	1.40E-05	YES - COPC
Fluoranthene	2.61E-02	2.90E+42	Unknown	7.50E-03	3.98E-01	no
Pyrene	2.33E-03	4.37E-01	Unknown	1.00E-03	9.60E-01	no

Table 2
Statistical Summary and Ecological Screening of COPCs in EU1 Sediment
Kerr McGee, Hattiesburg, MS

Constituent	CAS Number	Total Number of Samples	Hits	Hit Frequency %	Minimum Detection Limit mg/kg	Maximum Detection Limit mg/kg	Minimum Detected mg/kg	Mean mg/kg	Logarithmic Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Semivolatiles											
2-Methylnaphthalene	91-57-6	2	2	100	NA	NA	7.40E-02	2.92E-01	1.94E-01	5.10E-01	3.08E-01
Acenaphthene	83-32-9	2	2	100	NA	NA	1.80E-01	3.15E-01	2.85E-01	4.50E-01	1.91E-01
Acenaphthylene	208-96-8	2	1	50	4.00E-02	4.00E-02	7.80E-02	4.90E-02	3.95E-02	7.80E-02	4.10E-02
Anthracene	120-12-7	2	2	100	NA	NA	2.60E-01	3.60E-01	3.46E-01	4.60E-01	1.41E-01
Benzo(a)Pyrene Equiv.	-	2	2	100	NA	NA	1.83E-01	3.88E-01	3.29E-01	5.93E-01	2.90E-01
Benzo(ghi)perylene	191-24-2	2	2	100	NA	NA	6.50E-02	1.23E-01	1.08E-01	1.80E-01	8.13E-02
Carbazole	86-74-8	2	2	100	NA	NA	1.60E-01	3.65E-01	3.02E-01	5.70E-01	2.90E-01
Dibenzofuran	132-64-9	2	2	100	NA	NA	1.50E-01	2.80E-01	2.48E-01	4.10E-01	1.84E-01
Fluoranthene	206-44-0	2	2	100	NA	NA	6.80E-01	1.19E+00	1.08E+00	1.70E+00	7.21E-01
Fluorene	86-73-7	2	2	100	NA	NA	2.30E-01	4.25E-01	3.78E-01	6.20E-01	2.76E-01
Naphthalene	91-20-3	2	2	100	NA	NA	1.80E-01	6.40E-01	4.45E-01	1.10E+00	6.51E-01
Phenanthrene	85-01-8	2	2	100	NA	NA	7.20E-01	1.21E+00	1.11E+00	1.70E+00	6.93E-01
Pyrene	129-00-0	2	2	100	NA	NA	4.80E-01	9.40E-01	8.20E-01	1.40E+00	6.51E-01

NA - Not Available

Table 2
Statistical Summary and Selection of COPCs in EU1 Sediment
Kerr McGee, Hattiesburg, MS

Constituent	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Mississippi TRG Value (mg/kg)	Is the Maximum Concentration > the Screening Criteria?
Semivolatiles						
2-Methylnaphthalene	1.67E+00	1.60E+22	Unknown	5.10E-01	3.13E+03	no
Acenaphthene	1.17E+00	3.23E+04	Unknown	4.50E-01	4.69E+03	no
Acenaphthylene	2.32E-01	8.34E+09	Unknown	7.80E-02	4.69E+03	no
Anthracene	9.91E-01	2.23E+01	Unknown	4.60E-01	2.35E+04	no
Benzo (a) Pyrene Equiv.	1.68E+00	9.30E+07	Unknown	5.93E-01	8.75E-02	YES - COPC
Benzo(ghi)perylene	4.86E-01	2.08E+05	Unknown	1.80E-01	2.35E+03	no
Carbazole	1.66E+00	2.15E+09	Unknown	5.70E-01	3.19E+01	no
Dibenzofuran	1.10E+00	3.27E+05	Unknown	4.10E-01	3.13E+02	no
Fluoranthene	4.41E+00	1.22E+05	Unknown	1.70E+00	3.13E+03	no
Fluorene	1.66E+00	3.35E+05	Unknown	6.20E-01	3.13E+03	no
Naphthalene	3.54E+00	6.10E+19	Unknown	1.10E+00	6.45E+02	no
Phenanthrene	4.30E+00	2.92E+04	Unknown	1.70E+00	3.30E+02	no
Pyrene	3.84E+00	7.40E+06	Unknown	1.40E+00	3.30E+02	no

Table 3
Statistical Summary and Selection of COPCs in EU2 Surface Soil (0-1' bgs)
Kerr McGee, Hattiesburg, MS

Constituent	CAS Number	Total Number of Samples	Hits	Hit Frequency %	Minimum Detection Limit mg/kg	Maximum Detection Limit mg/kg	Minimum Detected mg/kg	Mean mg/kg	Logarithmic Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Semivolatiles											
2-Methylnaphthalene	91-57-6	14	2	14.29	3.30E-02	3.30E-02	7.00E-02	3.06E-02	2.15E-02	1.60E-01	3.99E-02
Acenaphthene	83-32-9	14	1	7.14	3.30E-02	3.30E-02	4.90E-02	1.88E-02	1.78E-02	4.90E-02	8.69E-03
Acenaphthylene	208-96-8	14	6	42.86	3.30E-02	3.30E-02	3.70E-02	1.59E-01	4.29E-02	1.30E+00	3.52E-01
Anthracene	120-12-7	14	7	50	3.30E-02	3.30E-02	4.10E-02	1.89E-01	5.00E-02	1.60E+00	4.28E-01
Benzo(a)anthracene	56-55-3	13	11	84.62	3.30E-02	3.30E-02	4.10E-02	4.52E-01	1.76E-01	2.30E+00	6.38E-01
Benzo(a)pyrene	50-32-8	13	10	76.92	6.70E-02	6.70E-02	8.40E-02	4.95E-01	2.25E-01	2.40E+00	6.81E-01
Benzo(b)fluoranthene	205-99-2	13	11	84.62	6.70E-02	6.70E-02	1.10E-01	1.27E+00	4.82E-01	5.20E+00	1.61E+00
Benzo(k)fluoranthene	207-08-9	13	8	61.54	1.30E-01	1.30E-01	1.90E-01	4.78E-01	2.38E-01	2.30E+00	6.38E-01
Benzo(ghi)perylene	191-24-2	14	10	71.43	6.70E-02	6.70E-02	1.70E-01	5.17E-01	2.20E-01	2.30E+00	6.95E-01
Carbazole	86-74-8	14	4	28.57	3.30E-02	3.30E-02	4.30E-02	6.28E-02	2.94E-02	3.50E-01	1.05E-01
Chrysene	218-01-9	13	11	84.62	3.30E-02	3.30E-02	6.20E-02	6.67E-01	2.42E-01	3.40E+00	9.55E-01
Dibenz(a,h)anthracene	53-70-3	13	6	46.15	6.70E-02	6.70E-02	7.20E-02	1.29E-01	7.42E-02	6.40E-01	1.71E-01
Di-n-butylphthalate	84-74-2	14	9	64.29	3.30E-02	7.20E-02	3.60E-02	4.30E-02	3.68E-02	1.10E-01	2.50E-02
Dibenzofuran	132-64-9	14	2	14.29	3.30E-02	3.30E-02	7.20E-02	2.63E-02	2.08E-02	9.80E-02	2.54E-02
Fluoranthene	206-44-0	14	12	85.71	3.30E-02	3.30E-02	6.60E-02	1.40E+00	3.00E-01	1.20E+01	3.16E+00
Fluorene	86-73-7	14	2	14.29	3.30E-02	3.30E-02	4.50E-02	4.38E-02	2.21E-02	3.70E-01	9.42E-02
Indeno(1,2,3-cd)pyrene	193-39-5	13	9	69.23	6.70E-02	6.70E-02	9.60E-02	4.25E-01	1.92E-01	2.10E+00	5.70E-01
Naphthalene	91-20-3	14	2	14.29	3.30E-02	3.30E-02	8.80E-02	3.26E-02	2.20E-02	1.70E-01	4.39E-02
Phenanthrene	85-01-8	14	8	57.14	3.30E-02	3.30E-02	3.70E-02	1.28E-01	5.30E-02	7.40E-01	2.08E-01
Pyrene	129-00-0	14	12	85.71	6.70E-02	6.70E-02	9.80E-02	1.70E+00	4.60E-01	1.40E+01	3.66E+00

Table 3
Statistical Summary and Selection of COPCs in EU2 Surface Soil (0-1' bgs)
Kerr McGee, Hattiesburg, MS

Constituent	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Mississippi TRG Value (mg/kg)	Is the Maximum Detected > TRG Value?
Semivolatiles						
2-Methylnaphthalene	4.95E-02	4.29E-02	Unknown	4.29E-02	3.13E+03	no
Acenaphthene	2.29E-02	2.17E-02	Unknown	2.17E-02	4.69E+03	no
Acenaphthylene	3.26E-01	4.99E-01	Unknown	4.99E-01	4.69E+03	no
Anthracene	3.91E-01	6.29E-01	Unknown	6.29E-01	2.35E+04	no
Benzo (a) anthracene	7.67E-01	3.72E+00	Lognormal	2.30E+00	8.75E-01	YES - COPC
Benzo (a) pyrene	8.31E-01	2.39E+00	Lognormal	2.39E+00	8.75E-01	YES - COPC
Benzo (b) fluoranthene	2.07E+00	1.49E+01	Lognormal	5.20E+00	8.75E-01	YES - COPC
Benzo (k) fluoranthene	7.93E-01	1.64E+00	Lognormal	1.64E+00	8.75E+00	no
Benzo(ghi)perylene	8.46E-01	2.74E+00	Lognormal	2.30E+00	2.35E+03	no
Carbazole	1.12E-01	1.24E-01	Unknown	1.24E-01	3.19E+01	no
Chrysene	1.14E+00	7.16E+00	Lognormal	3.40E+00	8.75E+01	no
Dibenz (a,h) anthracene	2.14E-01	2.87E-01	Unknown	2.87E-01	8.75E-02	YES - COPC
Di-n-butylphthalate	5.48E-02	6.30E-02	Normal/Lognormal	6.30E-02	2.28E+03	no
Dibenzofuran	3.83E-02	3.57E-02	Unknown	3.57E-02	3.13E+02	no
Fluoranthene	2.89E+00	1.66E+01	Lognormal	1.20E+01	3.13E+03	no
Fluorene	8.84E-02	5.84E-02	Unknown	5.84E-02	3.13E+03	no
Indeno (1,2,3-cd) pyrene	7.07E-01	2.26E+00	Lognormal	2.10E+00	8.75E-01	YES - COPC
Naphthalene	5.34E-02	4.71E-02	Unknown	4.71E-02	6.45E+02	no
Phenanthrene	2.26E-01	3.96E-01	Lognormal	3.96E-01	2.35E+03	no
Pyrene	3.43E+00	1.25E+01	Lognormal	1.25E+01	2.35E+03	no

Table 4
Statistical Summary and Selection of COPCs in EU3 Surface Soil (0-1' bgs)
Kerr McGee, Hattiesburg, MS

Constituent	CAS Number	Total Number of Samples	Hits	Hit Frequency %	Minimum Detection Limit mg/kg	Maximum Detection Limit mg/kg	Minimum Detected mg/kg	Mean mg/kg	Logarithmic Mean mg/kg	Maximum Detected mg/kg	Standard Deviation mg/kg
Semivolatiles											
2-Methylnaphthalene	91-57-6	3	1	33.33	3.30E-02	3.30E-02	2.30E-01	8.77E-02	3.97E-02	2.30E-01	1.23E-01
Acenaphthylene	208-96-8	3	2	66.67	3.30E-02	3.30E-02	1.20E-01	1.02E-01	6.96E-02	1.70E-01	7.83E-02
Anthracene	120-12-7	3	2	66.67	3.30E-02	3.30E-02	1.20E-01	1.02E-01	6.96E-02	1.70E-01	7.83E-02
Benzo(a)anthracene	56-55-3	3	3	100	0.00E+00	0.00E+00	5.60E-02	3.62E-01	2.46E-01	5.40E-01	2.66E-01
Benzo(a)pyrene	50-32-8	3	2	66.67	6.70E-02	6.70E-02	5.60E-01	4.35E-01	2.37E-01	7.10E-01	3.55E-01
Benzo(b)fluoranthene	205-99-2	3	3	100	0.00E+00	0.00E+00	1.90E-01	9.30E-01	6.83E-01	1.40E+00	6.49E-01
Benzo(k)fluoranthene	207-08-9	3	2	66.67	1.30E-01	1.30E-01	4.70E-01	3.42E-01	2.46E-01	4.90E-01	2.40E-01
Benzo(ghi)perylene	191-24-2	3	3	100	NA	NA	8.00E-02	6.53E-01	4.03E-01	1.20E+00	5.60E-01
Carbazole	86-74-8	3	2	66.67	3.30E-02	3.30E-02	4.60E-02	5.75E-02	4.37E-02	1.10E-01	4.78E-02
Chrysene	218-01-9	3	3	100	0.00E+00	0.00E+00	1.10E-01	5.93E-01	4.25E-01	8.70E-01	4.20E-01
Di-n-butylphthalate	84-74-2	3	3	100	NA	NA	4.00E-02	8.30E-02	7.58E-02	1.10E-01	3.76E-02
Dibenz(a,h)anthracene	53-70-3	3	2	66.67	6.70E-02	6.70E-02	1.40E-01	1.11E-01	9.09E-02	1.60E-01	6.80E-02
Dibenzofuran	132-64-9	3	2	66.67	3.30E-02	3.30E-02	3.60E-02	4.85E-02	3.81E-02	9.30E-02	3.98E-02
Fluoranthene	206-44-0	3	3	100	NA	NA	1.20E-01	5.27E-01	3.99E-01	7.80E-01	3.56E-01
Naphthalene	91-20-3	3	1	33.33	3.30E-02	3.30E-02	1.60E-01	6.43E-02	3.52E-02	1.60E-01	8.28E-02
Phenanthrene	85-01-8	3	2	66.67	3.30E-02	3.30E-02	1.30E-01	1.32E-01	8.12E-02	2.50E-01	1.17E-01
Pyrene	129-00-0	3	3	100	NA	NA	1.20E-01	6.90E-01	4.85E-01	1.00E+00	4.94E-01

NA - Not Available

Table 4
Statistical Summary and Selection of COPCs in EU3 Surface Soil (0-1' bgs)
Kerr McGee, Hattiesburg, MS

Constituent	95% UCL mg/kg	Lognormal 95% UCL mg/kg	Distribution 99% Confidence	Exposure Point Concentration mg/kg	Mississippi TRG Value (mg/kg)	Is the Maximum Detected > TRG?
Semivolatiles						
2-Methylnaphthalene	2.95E-01	2.43E+08	Unknown	2.30E-01	3.13E+03	no
Acenaphthylene	2.34E-01	3.45E+05	Normal/Lognormal	1.70E-01	4.69E+03	no
Anthracene	2.34E-01	3.45E+05	Normal/Lognormal	1.70E-01	4.69E+03	no
Benzo (a) anthracene	8.11E-01	2.15E+06	Normal/Lognormal	5.40E-01	8.75E-01	no
Benzo (a) pyrene	1.03E+00	3.82E+11	Normal/Lognormal	7.10E-01	8.75E-01	no
Benzo (b) fluoranthene	2.02E+00	1.13E+05	Normal/Lognormal	1.40E+00	8.75E-01	YES - COPC
Benzo (k) fluoranthene	7.46E-01	1.06E+05	Normal/Lognormal	4.90E-01	8.75E+00	no
Benzo(ghi)perylene	1.60E+00	1.70E+08	Normal/Lognormal	1.20E+00	2.35E+03	no
Carbazole	1.38E-01	2.81E+02	Normal/Lognormal	1.10E-01	3.19E+01	no
Chrysene	1.30E+00	2.63E+05	Normal/Lognormal	8.70E-01	8.75E+01	no
Di-n-butylphthalate	1.46E-01	1.52E+00	Normal/Lognormal	1.10E-01	2.28E+03	no
Dibenz (a,h) anthracene	2.26E-01	1.35E+02	Normal/Lognormal	1.60E-01	8.75E-02	YES - COPC
Dibenzofuran	1.16E-01	5.59E+01	Normal/Lognormal	9.30E-02	3.13E+02	no
Fluoranthene	1.13E+00	1.59E+04	Normal/Lognormal	7.80E-01	3.13E+03	no
Naphthalene	2.04E-01	6.64E+05	Unknown	1.60E-01	6.45E+02	no
Phenanthrene	3.29E-01	2.65E+07	Normal/Lognormal	2.50E-01	2.35E+03	no
Pyrene	1.52E+00	7.45E+05	Normal/Lognormal	1.00E+00	2.35E+03	no

Table 5
Toxicity Values for the White-Tailed Deer and Raccoon
Kerr McGee, Hattiesburg, MS

White-tailed Deer

Analyte	Benchmark Toxicity Value	Units	Safety Factor	Surrogate Toxicity Value	Source	Reference
Benzo(a)pyrene	1.52E-01	mg/kg-day	NA	1	NOAEL for mouse based on reproduction	Sample et al., 1996

Raccoon

Analyte	Benchmark Toxicity Value	Units	Safety Factor	Surrogate Toxicity Value	Source	Reference
Benzo(a)pyrene	2.68E-01	mg/kg-day	NA	1	NOAEL for mouse based on reproduction	Sample et al., 1996

NA - Not Applicable

Table 6
Ingestion of Surface Water in EU1 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Surface Water			
Intake (mg/kg-day) =	$\frac{C_w * IngR_w * ED * SFF}{BW * AT}$		
C_w - Concentration in surface water =	mg/L	chem spec.	
$IngR_w$ - Ingestion rate for surface water =	L/day	3.7	Sample & Suter, 1994
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	**Concentration in Surface Water mg/L**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles				
Benzo[a]pyrene Equiv.	1.21E-03	7.89E-05	1.52E-01	5.20E-04
			Total Hazard Index =	5.20E-04

Table 7
Ingestion of Sediment in EU1 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Sediment			
Intake (mg/kg-day) =	$\frac{C_d*IngR_f*CF*PD*EF_d*ED*SFF}{BW*AT}$		
C_d - Concentration in sediment =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	1.7	Sample & Suter, 1994
CF - Plant wet-to-dry weight conversion factor =		0.20	USEPA 1993, WEFH
PD - Percentage of sediment consumed while drinking =		0.05	Reasonable assumption
EF_d - Proportion of time exposed to sediment =		0.053	EU-specific
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	Concentration in Sediment mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values (mg/kg)	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	5.93E-01	9.46E-06	1.52E-01	6.23E-05
			Total Hazard Index =	6.23E-05

Table 8
Ingestion of Surface Soil in EU2 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Soil			
Intake (mg/kg-day) =	$\frac{C_s*IngR_f*CF*PS*EF_s*ED*SFF}{BW*AT}$		
C_s - Concentration in soil =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	1.7	Sample & Suter, 1994
CF - Plant wet-to-dry weight conversion factor =		0.20	USEPA 1993, WEFH
PS - Soil consumed as a proportion of food intake =		0.02	Beyer et al. 1994
EF_s - Proportion of time exposed to soil =		0.728	EU-specific
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	8.11E+00	7.11E-04	1.52E-01	4.68E-03
			Total Hazard Index =	4.68E-03

Table 9
Ingestion of Surface Soil in EU3 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Soil

$$\text{Intake (mg/kg-day)} = \frac{C_s * IngR_f * CF * PS * EF_s * ED * SFF}{BW * AT}$$

C_s - Concentration in soil =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	1.7	Sample & Suter, 1994
CF - Plant wet-to-dry weight conversion factor =		0.20	USEPA 1993, WEFH
PS - Soil consumed as a proportion of food intake =		0.02	Beyer et al. 1994
EF_s - Proportion of time exposed to soil =		0.219	EU-specific
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	1.12E+00	2.96E-05	1.52E-01	1.95E-04
			Total Hazard Index =	1.95E-04

Table 10
Ingestion of Vegetation in EU2 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Vegetation

$$\text{Intake (mg/kg-day)} = \frac{C_v * IngR_f * PV * EF_s * ED * SFF}{BW * AT}$$

C_v - Concentration in vegetation =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	1.7	Sample & Suter, 1994
PV - Percent of plants in receptor diet =		1.00	Sample & Suter, 1994
EF_s - Proportion of time exposed to soil =		0.728	EU-specific
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	**Concentration in Soil mg/kg**	**Concentration in Vegetation mg/kg**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles					
Benzo[a]pyrene Equiv.	8.11E+00	1.10E-01	2.41E-03	1.52E-01	1.59E-02
				Total Hazard Index =	1.59E-02

Table 11
Ingestion of Vegetation in EU3 by a White-Tailed Deer
Kerr McGee, Hattiesburg, MS

Ingestion of Vegetation

Intake (mg/kg-day) = $\frac{C_v * IngR_f * PV * EF_s * ED * SFF}{BW * AT}$

C_v - Concentration in vegetation =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	1.7	Sample & Suter, 1994
PV - Percent of plants in receptor diet =		1.00	Sample & Suter, 1994
EF_s - Proportion of time exposed to soil =		0.219	EU-specific
ED - Exposure duration =	days	2008	Merritt, 1987
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	56.5	Sample & Suter, 1994
AT - Averaging time =	days	2008	Merritt, 1987

Constituent	Concentration in Soil mg/kg	Concentration in Vegetation mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles					
Benzo[a]pyrene Equiv.	1.12E+00	1.52E-02	1.00E-04	1.52E-01	6.61E-04
				Total Hazard Index =	6.61E-04

Table 12
Ingestion of Surface Water in EU1 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Surface Water

$$\text{Intake (mg/kg-day)} = \frac{C_w * IngR_w * ED * SFF}{BW * AT}$$

C_w - Concentration in surface water =	mg/L	chem spec.	
$IngR_w$ - Ingestion rate for surface water =	L/day	0.47	USEPA 1993, WEFH
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	Concentration in Surface Water mg/L	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	1.21E-03	9.80E-05	2.68E-01	3.65E-04
			Total Hazard Index =	3.65E-04

Table 13
Ingestion of Sediment in EU1 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Sediment

Intake (mg/kg-day) = $\frac{C_d * IngR_f * CF * PD * EF_d * ED * SFF}{BW * AT}$

C_d - Concentration in sediment =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
CF - wet-to-dry weight conversion factor =		0.20	USEPA 1993, WEFH
PD - Percentage of sediment consumed while drinking =		0.05	Reasonable assumption
EF_d - Proportion of time associated with sediment =		0.053	EU-specific
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	Concentration in Sediment mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values (mg/kg)	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	5.93E-01	1.58E-05	2.68E-01	5.88E-05
			Total Hazard Index =	5.88E-05

Table 14
Ingestion of Surface Soil in EU2 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Soil

$$\text{Intake (mg/kg-day)} = \frac{C_s*IngR_f*CF*PS*EF_s*ED*SFF}{BW*AT}$$

C_s - Concentration in soil =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
CF - wet-to-dry weight conversion factor =		0.20	USEPA 1993, WEFH
sumedSoil consumption as a proportion of food intake =		0.094	Beyer et. al 1994
EF_s - Proportion of time associated with soil =		0.728	EU-specific
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	Concentration in Soil mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles				
Benzo[a]pyrene Equiv.	8.11E+00	5.57E-03	2.68E-01	2.08E-02
			Total Hazard Index =	2.08E-02

Table 15
Ingestion of Surface Soil in EU3 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Soil				
Intake (mg/kg-day) =	$\frac{C_s * IngR_f * CF * PS * EF_s * ED * SFF}{BW * AT}$			
C_s - Concentration in soil =		mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =		kg/day	0.29	USEPA 1993, WEFH
CF - wet-to-dry weight conversion factor =			0.20	USEPA 1993, WEFH
PS - Soil consumption as a proportion of food intake =			0.094	Beyer et. al 1994
EF_s - Proportion of time associated with soil =			0.219	EU-specific
ED - Exposure duration =		days	894	USEPA 1993, WEFH
SFF - Site foraging factor =			1.00	Maximum
BW - Body weight =		kg	5.78	USEPA 1993, WEFH
AT - Averaging time =		days	894	USEPA 1993, WEFH

Constituent	**Concentration in Soil mg/kg**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles				
Benzo[a]pyrene Equiv.	1.12E+00	2.32E-04	2.68E-01	8.66E-04
			Total Hazard Index =	8.66E-04

Table 16
Ingestion of Vegetation in EU2 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Vegetation

$$\text{Intake (mg/kg-day)} = \frac{C_v*IngRf*PV*EF_s*ED*SFF}{BW*AT}$$

C_v - Concentration in soil-dwelling vegetation =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
PV - Percent of vegetation in receptor diet =		0.4	USEPA 1993, WEFH
EF_s - Proportion of time associated with soil =		0.728	EU-specific
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	**Concentration in Soil mg/kg**	**Concentration in Soil-Dwelling Vegetation mg/kg**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles					
Benzo[a]pyrene Equiv.	8.11E+00	1.10E-01	1.60E-03	2.68E-01	5.98E-03
				Total Hazard Index =	5.98E-03

ENVIRONMENTAL STANDARDS

Table 17
Ingestion of Vegetation in EU3 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Vegetation

Intake (mg/kg-day) = $\frac{C_v * IngRf * PV * EF_s * ED * SFF}{BW * AT}$

C_v - Concentration in soil-dwelling vegetation =	mg/kg	chem. spec.	
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
PV - Percent of vegetation in receptor diet =		0.4	USEPA 1993, WEFH
EF_s - Proportion of time associated with soil =		0.219	EU-specific
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	Concentration in Soil mg/kg	Concentration in Soil-Dwelling Vegetation mg/kg	Average Daily Intake mg/kg-day	Benchmark Toxicity Values mg/kg	Ecological Hazard Quotient
Semivolatiles					
Benzo[a]pyrene Equiv.	1.12E+00	1.52E-02	6.69E-05	2.68E-01	2.49E-04
				Total Hazard Index =	2.49E-04

Table 18
Ingestion of Soil Invertebrates in EU2 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Terrestrial Invertebrates

$$\text{Intake (mg/kg-day)} = \frac{C_s * SI * IngR_f * PI_T * ED * SFF}{BW * AT}$$

C_s - Concentration in soil =	mg/kg	chem. spec.	
SI - soil-to-invertebrate uptake factor =		chem. spec	Connell 1990
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
- Proportion of terrestrial invertebrate in receptor diet =		0.3	USEPA 1993, WEFH
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	**Concentration in Soil mg/kg**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles				
Benzo[a]pyrene Equiv.	8.11E+00	1.07E-01	2.68E-01	3.99E-01
			Total Hazard Index =	3.99E-01

ENVIRONMENTAL STANDARDS

Table 19
Ingestion of Soil Invertebrates in EU3 by a Raccoon
Kerr McGee, Hattiesburg, MS

Ingestion of Terrestrial Invertebrates

$$\text{Intake (mg/kg-day)} = \frac{C_s*SI*IngR_f*PI_T*ED*SFF}{BW*AT}$$

C_s - Concentration in soil =	mg/kg	chem. spec.	
SI - soil-to-invertebrate uptake factor =		chem. spec	Connell 1990
$IngR_f$ - Food ingestion rate for receptor =	kg/day	0.29	USEPA 1993, WEFH
- Proportion of terrestrial invertebrate in receptor diet =		0.3	USEPA 1993, WEFH
ED - Exposure duration =	days	894	USEPA 1993, WEFH
SFF - Site foraging factor =		1.00	Maximum
BW - Body weight =	kg	5.78	USEPA 1993, WEFH
AT - Averaging time =	days	894	USEPA 1993, WEFH

Constituent	**Concentration in Soil mg/kg**	**Average Daily Intake mg/kg-day**	**Benchmark Toxicity Values mg/kg**	**Ecological Hazard Quotient**
Semivolatiles				
Benzo[a]pyrene Equiv.	1.12E+00	1.48E-02	2.68E-01	5.52E-02
			Total Hazard Index =	5.52E-02

Table 20
Summary of Hazards Posed to Ecological Receptors
Kerr McGee, Hattiesburg, MS

White-Tailed Deer

Exposure Unit	Exposure Pathway	Ecological Hazard Quotient
1	Surface Water Ingestion	5.20E-04
1	Incidental Sediment Ingestion	6.23E-05
2	Incidental Soil Ingestion	4.68E-03
2	Ingestion of Vegetation	1.59E-02
3	Incidental Soil Ingestion	1.95E-04
3	Ingestion of Vegetation	6.61E-04
	Total Hazard =	**2.20E-02**

Raccoon

Exposure Unit	Exposure Pathway	Ecological Hazard Quotient
1	Surface Water Ingestion	3.65E-04
1	Incidental Sediment Ingestion	5.88E-05
2	Incidental Soil Ingestion	2.08E-02
2	Ingestion of Vegetation	5.98E-03
2	Ingestion of Invertebrates	3.99E-01
3	Incidental Soil Ingestion	8.66E-04
3	Ingestion of Vegetation	2.49E-04
3	Ingestion of Invertebrates	5.52E-02
	Total Hazard =	**4.82E-01**

THE NATURE OF POLYCYCLIC AROMATIC HYDROCARBON (PAH) IN SOILS FROM THE NORTHEAST DRAINAGE DITCH, HATTIESBURG MISSISSIPPI

Prepared for

FILE COPY

Kerr McGee Chemical LLC
123 R.S. Kerr Avenue
Oklahoma City, OK 73125

September 13, 2004

Prepared by

Allen D. Uhler, Ph.D.
NewFields Environmental Forensics Practice LLC
100 Ledgewood Place
Rockland, MA 02367

NEWFIELDS

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1.0 INTRODUCTION

A wood treating facility, referred to today as the former Gulf States Creosoting Site, operated in Hattiesburg, Mississippi from the early 1900s to the early 1960s, after which the property was redeveloped for commercial and light industrial use. In January 1997, Kerr-McGee Chemical LLC (KMCLLC), the Mississippi Department of Environmental Quality (MDEQ) and the Mississippi Commission on Environmental Quality entered into an agreement for the investigation and remediation of the Gulf States Creosoting Site in Hattiesburg, Mississippi, pursuant to the Uncontrolled Site Voluntary Evaluation Program. To date, significant progress has been made on cleanup efforts at the site[1].

As part of the agreement, KMCLLC investigated the Northeast Drainage Ditch, an unlined ditch and culvert system running through an urban residential area. Investigation of the Ditch was completed in May 2001; KMCLLC submitted a *Removal Action Work Plan* to address affected sediment and soils within and beneath the Ditch in August 2001. The specific objectives of the removal action were to:

- eliminate the potential for exposure to impacted sediments and soils in the Ditch;
- eliminate the potential for surface runoff to come in contact with impacted sediments and soils; and
- eliminate or greatly reduce the potential for infiltration of precipitation through impacted sediments and soils to shallow ground water.

MDEQ approved the *Removal Action Work Plan* in early 2003. KMCLLC and the City of Hattiesburg completed over 95 percent of the work specified in the work plan in 2003; a small portion of the project could not be completed due to site access issues. KMCLLC did not perform confirmation sampling, as the MDEQ-approved remedy was a source removal/containment and control remedy and the *Removal Action Work Plan* did not specify numerical cleanup standards.

The MDEQ did carry out post-remediation evaluation of the Northeast Drainage Ditch area. This work included an environmental survey between Scooba Street and Katie Street, in which 75 soil samples from the study area were collected and analyzed for polycyclic aromatic hydrocarbon (PAH) compounds. The results from this survey found that some of the soils contained low levels of PAH (Attachment 1).

NewFields was retained by KMCLLC to examine the MDEQ survey data in an effort to reconcile the findings of the low level PAH in the Ditch soils with likely sources. NewFields evaluation included two critical assessments of the MDEQ data: (1) a comparison of the concentrations of PAH found in the Ditch versus published concentrations in rural and urban soils (background conditions) and a comparison with creosote-impacted sites, and (2) a determination of the type or types of materials that could give rise to the PAH found in the Ditch soils based on PAH chemical distribution profiles.

[1] Mississippi Department of Environmental Quality. 2003. Status and Cleanup Activity for the former Gulf States Creosote Site in Hattiesburg.

2.0 PAH—BACKGROUND

The principal analyses carried out in this report are comparisons of the concentrations and distributions of PAH compounds measured in the soils from the Northeast Drainage Ditch versus published data for PAH concentrations and compound distributions in creosote, creosote-impacted soils, and unimpacted (background) soils. In order to best place NewField's analyses in context, a brief background about the nature and sources of PAH in creosote waste and in general environmental media is provided in this section.

2.1 PAH Distributions in Potential Source Materials

Polycyclic aromatic hydrocarbons are ubiquitous contaminants in the environment. They originate from a large number of sources which can be broadly classified as either (1) diagenetic, (2) petroleum-derived, or (3) combustion-derived:

- Diagenetic sources are natural sources of PAH that are not ordinarily recognized as significantly impacting environmental quality.
- Petroleum-derived sources are anthropogenic sources of PAH arising directly from crude oil or refined petroleum products.
- Combustion-derived sources are anthropogenic sources of PAH which include those derived from fires, combustion of petroleum products, combustion and conversion of coal, and metallurgical processing. (Creosote is a derivative of combustion-derived coal or oil tar). Notably, urban air and urban soils are impacted by PAHs that arise from tailpipe exhausts and controlled and uncontrolled combustion typical of urban areas.

PAH as their name implies, are polycyclic aromatic hydrocarbons. Literally, this means that PAH (1) contain multiple 'ring' structures, (2) which are aromatic in nature, and (3) comprised of hydrogen and carbon. The arrangement and number of rings is used to distinguish different PAH. Chemical structures for the most common 2- through 6-ring PAH of environmental concern are shown in Figure 1.

In addition to the ring structures, many PAH contain carbon side-chains of varying numbers, lengths, and locations. Those PAH without any side-chains are considered as "parent" or C_0-PAH. PAH with one, single carbon side chain are said to be C_1-PAH, two additional carbons attached are C_2-PAH, and so on. Assessing the distribution of the PAH containing C_1 to C_4 alkyl side chains relative to the unsubstituted (C_0) parent PAH is a useful means to distinguish among different types of PAH-bearing materials, because petroleum derived PAH have an abundant amount of these substituted PAH, while combustion-derived materials like creosote contain much lower relative amounts of the alkylated PAH[2].

Compliance-driven investigations of PAH contamination utilize standard EPA methods of analysis for PAH compounds (such as used by MDEQ in the Northeast Drainage Ditch survey) that do not routinely measure these alkylated PAH compounds, so some forensic chemistry

[2] Sauer, T.C. and A.D. Uhler. 1994. Pollutant source identification and allocation: Advances in hydrocarbon fingerprinting. Remediation, Winter 1994/1995, pp. 25-50.

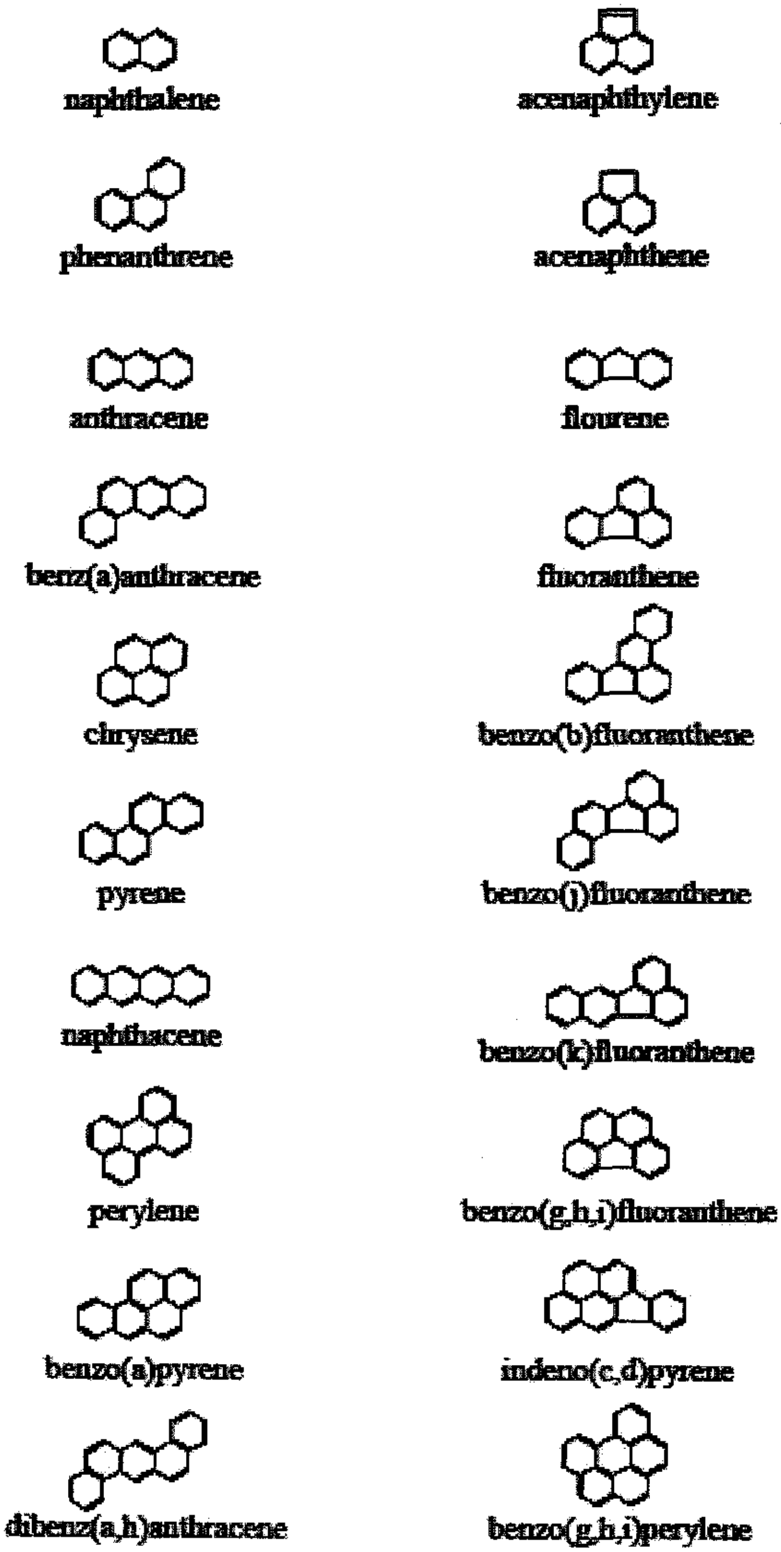

Figure 1. Chemical structures of the most common PAH measured in environmental media.

information about the source of PAHs found in such environmental samples is inevitably lost in such measurement programs. However, the information about the relative distribution of the major parent PAH (which are measured in compliance programs using standard EPA methods of analysis) can yield important insight into the nature of the PAH in environmental samples. The PAH compounds measured in the MDEQ program are shown in Table 1.

Table 1. PAH compounds Measured in Soils from the Northeast Drainage Ditch
Naphthalene
C1-naphthalenes
Acenaphthene
Acenaphthylene
Fluorene
Phenanthrene
Anthracene
Fluoranthene
Pyrene
Benz(a)anthracene
Chrysene
Benzo(b)fluoranthene
Benzo(j/k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-c,d)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene

Because of the unique ways in which PAH are formed, groups of source-specific (e.g. combustion-derived or petroleum-derived) PAH co-occur in distinguishable patterns. A significant body of literature has developed over the last 25 years describing the nature of PAH assemblages in waste streams, petroleum, and urban soil and air, as well as for techniques to link these patterns with their likely sources [e.g. 3,4,5,6]. For example, the parent (C_0) PAH patterns for three PAH-bearing materials, diesel fuel, creosote, and urban dust are obviously different from one another (Figure 2); such differences in the patterns of PAH are used by forensic chemists to identify the source of PAH found in environmental samples.

In order to determine the nature and origin of the materials responsible for PAH in environmental samples, forensic environmental chemists examine the distributions of PAH found in samples, and compare these patterns against those patterns that have been documented for likely source materials, for example, creosote or other tar products, petroleum, or atmospheric fallout responsible for urban background PAH[7,8]. This comparison can be done either by comparing patterns using histograms plots (akin to Figure 2), or using mathematical methods such as diagnostic ratio cross plots to determine differences or similarities among PAH found in environmental samples and their likely sources. This latter methodology will be used later in this report to help deduce the nature of PAH found in the Ditch soil samples.

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[3] Stout, S.A., Uhler, A.D., McCarthy, K.J. and Emsbo-Mattingly, S.D. 2002. Chemical Fingerprinting of Hydrocarbons. In: Introduction to Environmental Forensics, (B. Murphy and R. Morrison, Eds.), Academic Press, 137 pp.

[4] Lao, R.C., R.S. Thomas, and J.L. Monkman. 1975. Computerized gas chromatographic-mass spectrometric analysis of polycyclic aromatic hydrocarbons in environmental samples. J. Chromatog., 112:681-700.

[5] Lee, M.L., G.P. Prado, J.B. Howard, and R.A. Hites. (1977) Sources identification of urban airborn polycyclic aromatic hydrocarbons by gas chromatography, mass spectrometry and high resolution mass spectrometry. Biomed. Mass Spectrom. 4(3): 182-186.

[6] Takada, H., Tomoko, O., Mamoru, H. and Norio, O. 1991. Distribution and sources of polycyclic aromatic hydrocarbons (PAHs) in street dust from the Tokyo metropolitan area. The Science of the Total Environment. 17, 45-69.

[7] Raia, J.C., C.R. Blakley, A.N. Fuex, D.C. Cillalanti, and P.D. Fahrenhold. 2004. Evaluation of environmental samples containing heavy hydrocarbon components in environmental forensics investigations. J. Environ. Forensics 5:21-32.

[8] Stout, S.A., Uhler, A.D., and McCarthy, K.J. 1998. PAH can provide a unique forensic fingerprint for hydrocarbon products. Contam. Soil Sed. Groundwater. Oct. Issue.

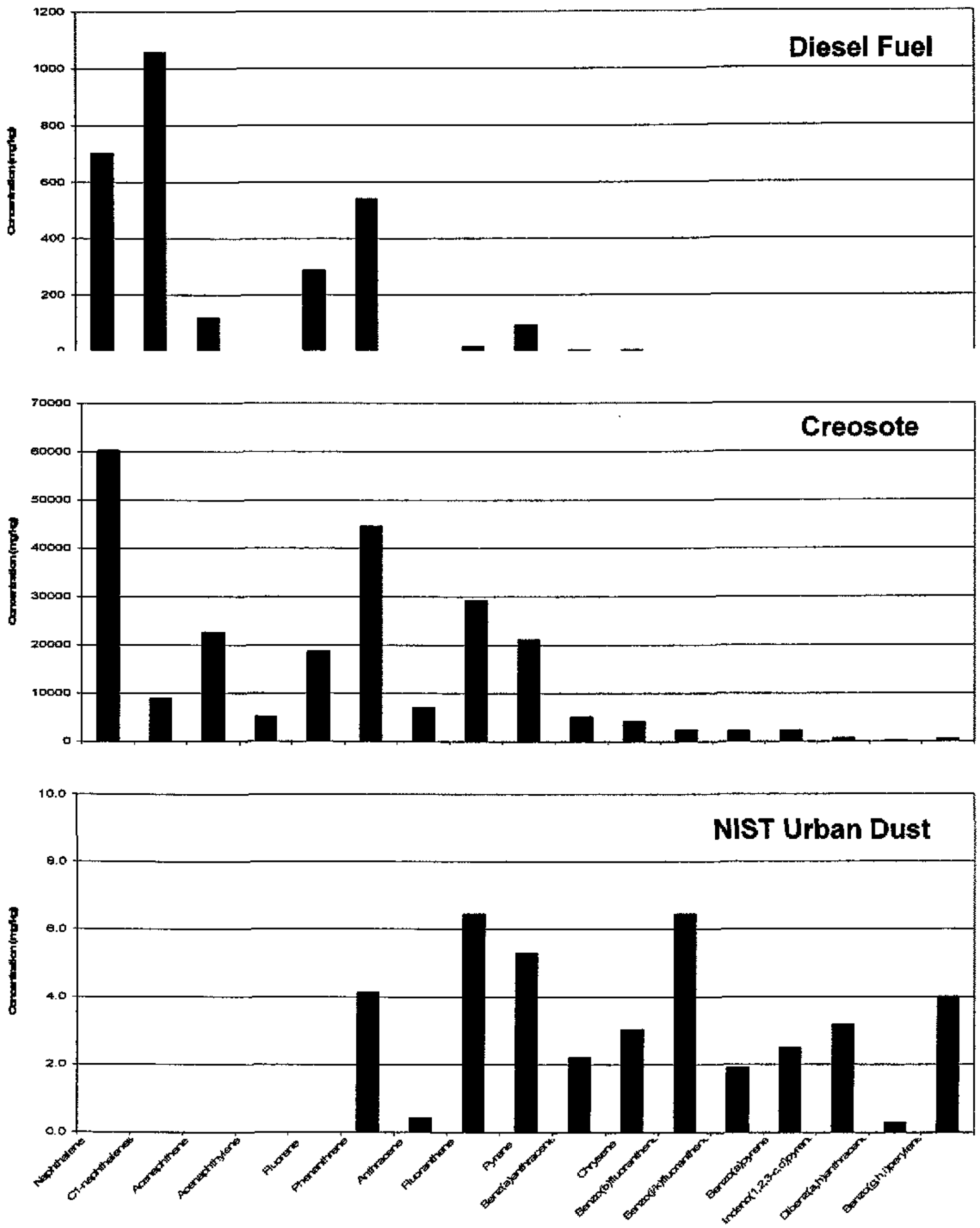

Figure 2. PAH distributions for three different PAH-bearing materials: diesel fuel, creosote, and urban dust. Note the differences in the relative distributions of the various PAH compounds that differentiate one material from another.

2.2 Concentrations of PAH in Soils and Sediments

PAH are ubiquitous environmental contaminants, and can be found in measurable concentrations in soils and sediments virtually everywhere in the world. As suggested above, PAHs are released to the environment through natural process and from man's activities. Natural sources include emissions from volcanoes and forest fires. Man-derived sources provide a much greater release volume than natural sources; the largest single source is the burning of wood in homes[9,10]. Automobile and truck emissions are also major sources of PAHs. Hazardous waste sites can be concentrated sources of PAHs on a local scale. Examples of such sites include abandoned wood-treatment plants such as the former Gulf States Creosoting Site. PAHs can enter surface water through atmospheric deposition and from discharges of industrial effluents (including wood-treatment plants), municipal waste water, and improper disposal of used motor oil[11,12], and ultimately deposit in sediments.

Two important points relevant to this report can be made from these documented observations:

1. There is a modern pervasive background of PAH found in rural and urban soils and sediments that is a composite of natural and anthropogenic sources.
2. There can be localized source of PAH contamination to soils and sediments from operating and/or former industrial sites.

2.2.1 Background PAH in rural and urban soils

A recent report on PAH in the environment compiled by the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) has documented the typical concentration ranges of PAH in rural and urban soils[13]—so-called anthropogenic PAH. Table 2, excerpted from the ATSDR report summarizes the range of PAH and total PAH for soils from these environments. The total PAH concentration in agricultural and rural soils can be expected to range from about 0.1 parts per million (mg/Kg) to about 3 mg/Kg; urban soils—exposed to higher concentrations of PAH arising from atmospheric fallout from fossil fuel combustion—can be expected to range as high as 500 mg/Kg. These data help frame our understanding of the characteristic ranges of anthropogenic PAH in rural and urban settings, against which we can compare and contrast site-specific findings of PAH such as in the Northeast Drainage Ditch.

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[9] Ramdahl T, Alfheim I, Bjorseth A. 1982. Nitrated polycyclic aromatic-hydrocarbons in urban air particles. Environ Sci Technol 16:861-865.

[10] Freeman DJ, Cattell CR. 1990. Woodburning as a source of atmospheric polycyclic aromatic hydrocarbons. Environ Sci Technol 24(10):1581-1585.

[11] Eganhouse, R.P., D.L. Blumfield, and I.R. Kaplan. 1982. "Petroleum hydrocarbons in stormwater runoff and municipal wastes: input to coastal waters and fate in marine sediments". Thalassia Jugoslavica. 18(1-4):411-431.

[12] Stout, S.A., Uhler, A.D., and Emsbo-Mattingly, S.D. (2004) Comparative evaluation of background anthropogenic hydrocarbons in surficial sediments from nine urban waterways. Environ. Sci. Technol., 38(11): 2987-2994.

[13] Agency for Toxic Substances and Disease Registry. 1995. Toxicological Profile For Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry Division of Toxicology/Toxicology Information Branch 1600 Clifton Road NE, E-29 Atlanta, Georgia 30333

Table 2. Background Soil Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs)[14]

Compound	Concentrations (μg/kg)		
	Rural soil	Agricultural soil	Urban soil
Acenaphthene	1.7	6	
Acenaphthylene		5	
Anthracene		11-13	
Benz(a)anthracene	5-20	56-110	169-59,000
Benzo(a)pyrene	2-1,300	4.6-900	165-220
Benzo(b)fluoranthene	20-30	58-220	15,000-62,000
Benzo(e)pyrene		53-130	60-14,000
Benzo(g,h,i)perylene	10-70	66	900-47,000
Benzo(k)fluoranthene	10-110	58-250	300-26,000
Chrysene	38.3	78-120	251-640
Fluoranthene	0.3-4.0	120-210	200-166,000
Fluorene		9.7	
Indeno(1,2,3-c,d)pyrene	10-15	63-100	8,000-61,000
Phenanthrene	30.0	48-140	
Pyrene	1-19.7	99-150	145-147,000

2.2.2 PAH in soils proximal to former wood treating facilities

PAH is perhaps the most important persistent class of contaminants found at wood treating facilities that utilize creosote as a preservative. Creosote can contain upwards of 30% by weight total PAH[15]; thus, creosote is a potent source of PAH contamination if accidentally discharged or disposed in the environment.

Significant concentrations of PAH have been documented in soils at and immediately proximal to certain former wood preserving and wood treating operations in the United States; for example, as part of its assessment of the sources of PAH in the environment, the ATSDR has documented ranges of PAH measured in surface and subsurface soils at contaminated former wood preserving facilities that while variable, can contain concentrations of total PAH as high as many thousands of parts per million[13]. Similarly, in setting where sediments have been

[14] Table excerpted from Agency for Toxic Substances and Disease Registry. 1995. Toxicological Profile For Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry Division of Toxicology/Toxicology Information Branch 1600 Clifton Road NE, E-29 Atlanta, Georgia 30333, and references therein.

[15] International Agency for Research on Cancer (IARC) 1984. Coal- Tars and Derived Products. In, IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Vol. 35, pp 83-100.

impacted by former wood treating facility creosote wastes, concentrations of many thousands of parts per million PAH in near-facility sediments have been documented [16].

Comparisons of soil and/or sediment concentrations is one means of assessing if the impacts of PAH at a site are due to specific nearby industrial activities, other point sources, or if the PAH are more likely consistent with modern anthropogenic background. When this concentration data is combined with an assessment of PAH distributions (discussed above in Section 2.1), scientifically defensible conclusions can be drawn regarding the nature and sources of PAH found in soils and sediments.

3.0 MDEQ HATTIESBURG NORTHEAST DRAINAGE DITCH SURVEY

NewFields was provided with a spreadsheet summarizing the PAH analytical results from MDEQ's Northeast Drainage Ditch soil survey, along with a site map depicting where each of the 75 sampling points were located. The samples were analyzed for the 17 PAH compounds listed in Table 1; detection limits for the measurement program were approximately 0.1 mg/Kg per compound. Summary statistics for the data set is presented in Table 3.

Table 3. Summary Statistics for MDEQ Northeast Drainage Ditch Survey PAH Data

Number of Samples	75
Minimum Concentration (mg/Kg)	<0.1
Maximum Concentration (mg/Kg)	100
Mean Concentration (mg/Kg)	3.46
Samples with non-detected PAH	43 (57%)

3.1 PAH Concentrations

Thirty-two of the 75 soils contained low concentrations of PAH; the majority of the samples (57%) contained no detectable PAH. The average PAH concentration in the 75 soil samples was 3.46 mg/Kg; the highest concentration sample (Florence 375-A) contained 100 mg/Kg total PAH. The total PAH concentration distributions in the Ditch soils can be seen graphically in Figure 3. All of the samples contained total PAH that fell below or within the ATSDR documented range for Urban Background Soil PAH Concentrations; most of the samples (n=60 or 80%) were within or below the range ATSDR documents for Agricultural and Rural Background Soil PAH Concentrations. Evaluated strictly on a soil concentration basis, the data strongly suggest that the PAH found in the Ditch soils from this survey are typical of anthropogenic background.

[16] Brenner, R.C., Magar, V.S., Ickes, J.A., Abbott, J.E., Stout, S.A., Crecelius, E.A. and Bingler, L.S. (2002) Characterization and fate of PAH-contaminated sediments at the Wycoff/Eagle Harbor Superfund site. Env. Sci Technol. 36(12): 2605-2613.

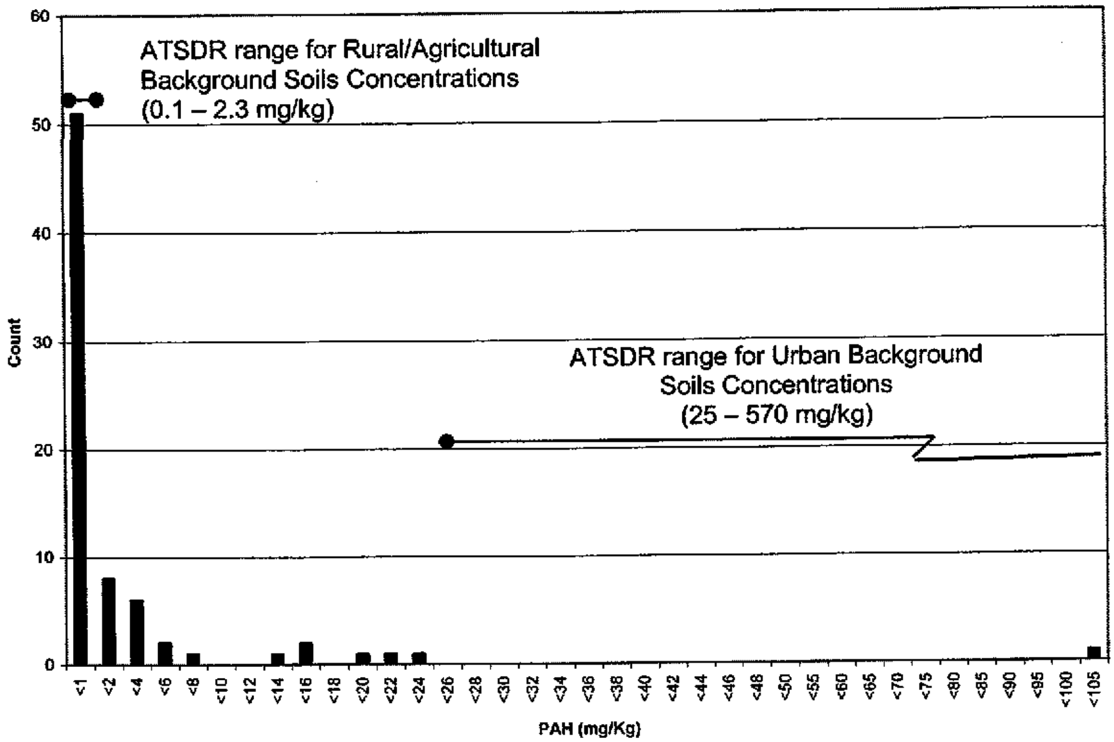

Figure 3. Distributions of PAH concentrations in soils from the MDEQ Northeast Drainage Ditch Survey. All of the samples contained total PAH that fell below the ATSDR documented range for Urban Background Soil PAH Concentrations.

3.2 PAH Compound Distributions

A fundamental part of determining the nature and origin of PAH in environmental samples is evaluation of the relative distribution of the compounds found in the samples, and comparing those chemical signatures or "fingerprints" to patterns that have been documented for various types of PAH-containing materials, e.g. creosote, various petroleum products, urban background.

PAH distribution histograms for the Northeast Drainage Ditch samples were prepared and examined as part of NewFields' data analysis. The PAH distributions in virtually all of the samples had notably similar features,

- Very low or non-detectable relative amounts of 2- and 3-ring PAH compounds like naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, and anthracene.
- Elevated relative amounts of 4-, 5- and 6- ring PAH compounds like fluoranthene, pyrene, chrysene, benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(j/k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene.

Virtually all of the 32 soil samples from MDEQ survey that had measurable PAH (except Florence 025-A, discussed later), shared these features, regardless of total PAH concentration. In other words, when there were detectable PAH in the soil samples, they had very similar PAH compound profiles. A typical example of such a PAH distribution can be seen in Figure 4.

The PAH distribution typical of the samples that contained measurable PAH (shown above in Figure 4) are inconsistent with that for creosote—either fresh or weathered. The relative distribution of PAH compounds in creosote, shown in Figure 2, is dominated by lower molecular weight, 2- and 3- and some 4- ring PAH (particularly naphthalene, phenanthrene, anthracene, fluoranthene, and pyrene). Significantly lower relative concentrations of other 4- 5-, and 6-ring PAH is typical of PAH distributions in creosote. Importantly, even in the face of potential environmental weathering (e.g. evaporation and biodegradation), creosote maintains a PAH profile that is dominated by the lower and mid-molecular weight PAH (e.g. phenanthrene, fluoranthene, pyrene), with substantially lesser amounts of the higher molecular weight 4-, 5- and 6-ring PAH[17].

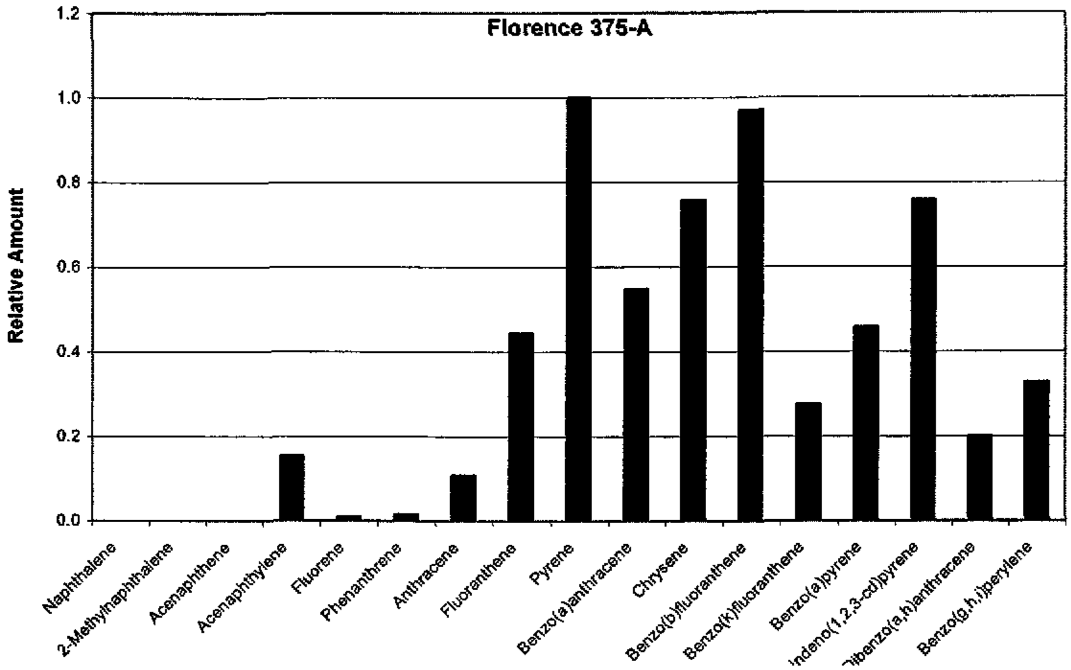

Figure 4. PAH distribution typical for the Northeast Drainage Ditch soil samples. PAH in soils from the Ditch are typified by relatively higher amounts of 4-, 5- and 6-ring PAH.

In fact, the relative distribution of the PAH observed in the Northeast Drainage Ditch sample are most consistent with PAH patterns for urban background. Figure 5 shows the relative distribution of PAH compounds in the U.S. National Institute of Standards and Technology (NIST) Standard Reference Material # 1649A *Urban Dust*. Note how this urban dust is dominated by relatively elevated amounts of the 4-, 5- and 6- ring PAH. These so-called

[17]Emsbo-Mattingly, S. and Boehm, P., Principal Investigators. Identifying PAHs from Manufactured Gas Plant Sites. Palo Alto, CA: EPRI; 2003 Mar.

pyrogenic (combustion) derived PAH are typical of urban soils and sediments that are enriched in the PAH, which arise largely from fossil fuel and wood combustion[11, 18, 19]. In fact that the PAH pattern seen in the NIST *Urban Dust* is most consistent with patterns seen in the typical Ditch soil sample. A further, synoptic comparison of PAH characteristics of all the MDEQ Ditch soil samples is presented below in Section 3.3.

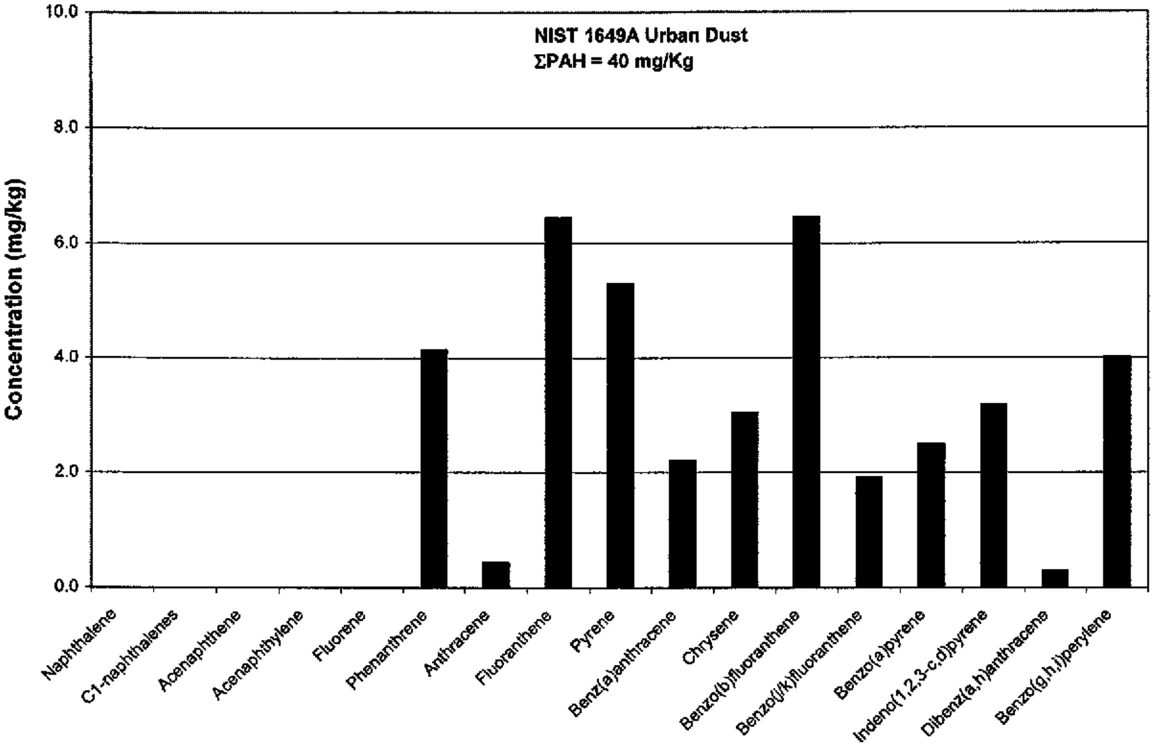

Figure 5. PAH distribution in U.S. National Institute of Standards and Technology (NIST) Standard Reference Material 1649A *Urban Dust.*

As mentioned above, one of the MDEQ Ditch soil samples was found to contain a PAH distribution pattern distinct from the remaining 31 that contained measurable PAH. Sample Florence-025A had a PAH distribution that was relatively enriched in lower molecular weight PAH, particularly fluorene, phenanthrene, anthracene, fluoranthene and pyrene (Figure 6). This PAH pattern is inconsistent with urban background (which is dominated by higher molecular weight 4-, 5- and 6-ring combustion-derived PAH). Rather, this PAH distribution pattern is more consistent with a weathered creosote, where the very light 2- and 3-ring PAH such as naphthalene, acenaphthene and acenaphthylene have evaporated, resulting in a PAH pattern dominated by mid-molecular weight PAH.

[18] Harrison, R.M., Smith, D.J.T., and Luhana, L. (1996). Source apportionment of atmospheric polycyclic aromatic hydrocarbons collected from an urban location in Birmingham, U.K. Environ. Sci. Technol. 30, 835-832.

[19] Marr, L.C., Kirchstetter, T.W., Harley, R.A., Miguel, A.H., Hering, S.V., and Hammond, S.K. (1999). Characterization of PAH in motor vehicle fuels and exhaust emissions. Environ. Sci. Technol. 33, 3091-3099.

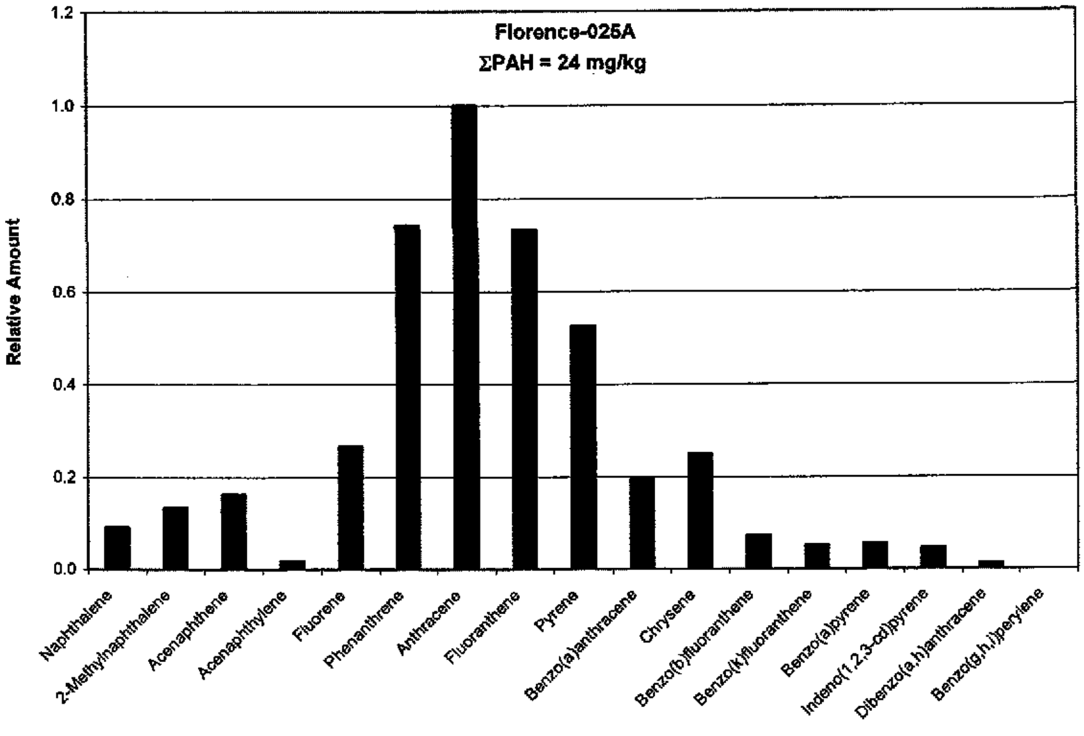

Figure 6. PAH distribution for soil Florence-025A. The patten, dominted by mid-molecular weight PAH, is consistent with weathered creosote.

3.3 Synoptic perspective of PAH Patterns in Soils from the Northeast Drainage Ditch

A convenient means of comparing and contrasting the PAH patterns measured for all the Drainage Ditch soil samples that contained measurable PAH is through graphical data analysis. While more complex forensic chemistry data sets are amenable to advanced numerical analysis techniques, the relatively basic data set collected by MDEQ warrants a straightforward analysis—in this case, diagnostic cross-plots.

As noted above, creosote-derived PAH are enriched in relatively lower molecular weight, 2-, 3- and 4-ring PAH. Conversely, urban soils are dominated by higher molecular weight, 4-, 5- and 6-ring PAH. Thus, a straightforward cross-plot of representative PAH ratios using compounds from each of these molecular weight ranges provides a convenient means to separate PAH source signatures.

In this analysis, we use the following diagnostic ratios:

- (anthracene + fluoranthene)/benzo(b)fluoranthene + indeno(1, 2, 3-c,d)pyrene: AN+PHEN/BBF+IND

- (fluoranthene + pyrene)/(benzo(k)fluoranthene + benzo(a)pyrene:
  FL + PY/BKF+BAP

As the proportion of creosote (enriched in lower molecular weight PAH) in a hypothetical sample increases relative to urban background, the value of each diagnostic ratio increases. Thus, in a cross plot of these variables, creosote-derived PAH plot in the upper right quadrant, and urban background-derived PAH plot in the lower left of a cross plot of these diagnostic ratios.

A cross-plot of these diagnostic ratio pairs for the Northeast Drainage Ditch soil samples that contained measurable PAH and two laboratory reference samples (shown in red: creosote and the NIST 1649A *Urban Dust*) is shown in Figure 7. Here, it is evident that the all but one of the samples cluster in the lower left quadrant of the plot, coincident with that for the NIST 1649 *Urban Dust*. The only sample that plots coincident with the creosote reference standard is Florence-025A. This numerical analysis supports the hypothesis that the PAH signatures found in all but one of the soil samples that contained measurable PAH taken from the Northeast Drainage Ditch are consistent with anthropogenic background. These PAH do not arise from creosote waste.

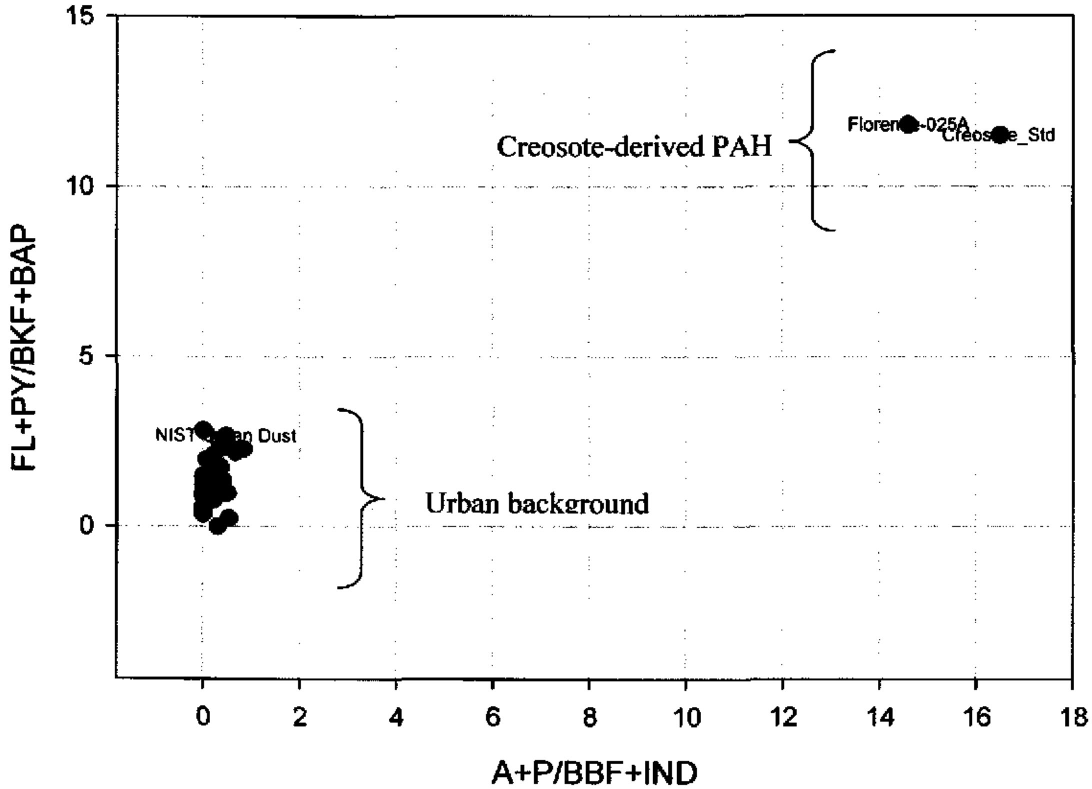

Figure 7. Cross-plot of diagnostic PAH ratios for 75 Northeast Drainage Ditch soil samples and the laboratory reference standards for creosote and NIST *Urban Dust.* Samples with creosote-derived PAH plot in the upper right quadrant; samples with urban background-derived PAH plot in the lower left.

In addition to the MDEQ data discussed in this report, NewFields reviewed the results of PAH analyses of soil taken from Northeast Drainage Ditch prior to the 2003 soil removal action. A total of 13 soil samples, taken in 1998 and 2000 were reviewed. Of these 13 samples, four contained obviously elevated concentrations of PAH that were attributable to creosote contamination (total PAH of ~2,000-15,000 mg/Kg). When the data for these samples (shown in blue) are plotted along with the 32 MDEQ Northeast Drainage Ditch samples that contained measurable PAH and the laboratory reference samples, the pre-remediation soils containing creosote-derived PAH plot in the quadrant of the graph with the creosote laboratory reference standard (Figure 8) and Florence-025A.

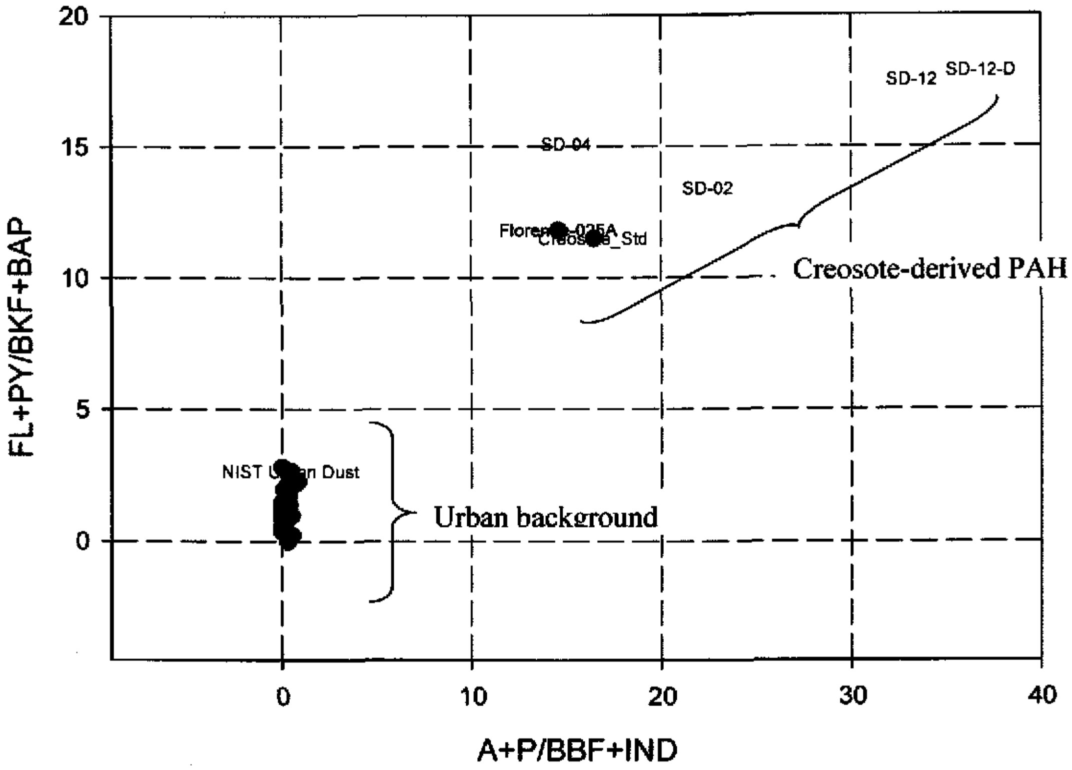

Figure 8. Cross-plot of diagnostic PAH ratios for 75 Northeast Drainage Ditch soil samples (black circles) , 1998 and 2000 pre-removal action soil analyses (blue), and laboratory reference standards for creosote and NIST *Urban Dust* (red).

While sample Florence-025A contained what appears to be creosote PAH at a low 25 mg/Kg, it is worthy to note that samples collected immediately proximal to its location contained non-detectable PAH or very low PAH with distribution patterns consistent with urban background (Figure 9). Thus, the low levels of creosote-derived PAH measured in Florence-025A do not represent geographically extensive creosote contamination, rather a discrete location that contains low-level residues of creosote PAH.

Sample	ΣPAH (mg/Kg)
Florence 025-A	23.8
Florence 000A	ND
Florence 000B	2.2
Florence 175A	1.55
Florence 175B	1.18
Florence 075A	12.9
Florence 075B	2.87
Harrell 175A	ND
Harrell 175B	ND

Figure 9. Distribution of total PAH in soils from the Northeast Drainage Ditch immediately proximal to Florence-025A.

4.0 CONCLUSIONS

Seventy-five post-remediation shallow soil samples from the Northeast Drainage Ditch near the Former Gulf States Creosoting Site were collected by Mississippi Department of Environmental Quality, and analyzed for polycyclic aromatic hydrocarbons (PAH). The concentration of total PAH in all the soils was low. The soils contained an averaging of 3.46 ppm (mg/Kg) total PAH. Fully 57% of the samples contained no detectable PAH (<0.1 ppm); the maximum PAH concentration measured was 100 ppm. The concentrations of PAH that were detected fell well within the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) documented ranges for PAH in rural (0.1 – 2.3 ppm) and urban background soils (up to 570 ppm).

The patterns of the PAH compounds measured in the overwhelming number (all but one of the soil samples that contained detectable PAH) of the soil samples was most consistent with urban background PAH, not creosote. Only one of the 75 soil samples (Florence-025A) contained a PAH chemical distribution pattern consistent with creosote. This soil sample contained only 23.8 ppm of total PAH, and was surrounded by nine other sampling locations that contained no detectable or very low (<15 ppm) total PAH. The chemical signature of the PAH in the nine soil samples immediately surrounding Florence-025A were consistent urban background. Thus, soil from Florence-025A was not indicative of pervasive creosote contamination, rather a localized residue of some material (either site- or non-site derived) that contained PAH consistent with a creosote signature.

The preponderance of evidence indicates that the soils from the Northeast Drainage Ditch that were collected and analyzed by MDEQ are consistent with urban background concentrations and chemical features of PAH, and are not attributable to creosote waste that could have arisen from the former Gulf States Creosoting Site.

Attachment 1.

Summary of MDEQ Northeast Drainage Ditch Soil PAH Analytical Data

Laboratory Sample ID: Field Sample ID: Parameter	BB68628 MLK 175 B mg/kg	BB68629 MLK 275 A mg/kg	BB68630 MLK 275 B mg/kg	BB68631 MLK 375 A mg/kg	BB68632 MLK 375 B mg/kg	BB68633 Francis 000 A mg/kg	BB68634 Francis 000B mg/kg	BB68635 Florence 000-A mg/kg	BB 68636 Florence 000-B mg/kg	BB68637 Florence-025A mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.885
Acenaphthylene	0.656	ND	ND	0.231	0.289	ND	0.711	ND	ND	0.1
Anthracene	1.26	ND	0.113	0.465	0.427	ND	1.29	ND	0.272	5.45
Benzo(a)anthracene	2.03	ND	0.274	0.577	0.632	ND	1.47	ND	0.246	1.07
Benzo(a)pyrene	1.77	ND	0.473	0.48	0.789	ND	1.18	ND	0.216	0.299
Benzo(b)fluoranthene	3.01	ND	0.529	0.668	1.14	ND	1.94	ND	0.359	0.399
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	1.58	ND	0.351	0.491	0.543	ND	1.56	ND	ND	0.283
Chrysene	2.51	ND	0.444	0.755	1.05	ND	1.72	ND	0.322	1.36
Dibenzo(a,h)anthracene	0.485	ND	0.116	0.154	0.217	ND	0.439	ND	ND	0.066
Fluoranthene	1.74	ND	0.324	0.577	0.545	ND	1.35	ND	0.234	4
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.45
Indeno(1,2,3-cd)pyrene	1.77	ND	0.466	0.537	0.901	ND	1.49	ND	0.279	0.252
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.733
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.501
Phenanthrene	ND	ND	0.101	ND	ND	ND	ND	ND	ND	4.05
Pyrene	2.76	ND	0.32	0.756	0.78	ND	1.98	ND	0.268	2.87
Total PAH	19.57	0.00	3.51	5.69	7.31	0.00	15.13	0.00	2.20	23.77

Laboratory Sample ID: Field Sample ID: Parameter	BB63638 Florence 025-B mg/kg	BB68639 Florence 075-A mg/kg	BB 68640 Florence 075-B mg/kg	BB 68641 Florence 175-A mg/kg	BB68642 Florence 175-B mg/kg	BB68643 Florence 275-A mg/kg	BB 68644 Florence 275-B mg/kg	BB 68645 Florence 375-A mg/kg	BB 68646 Florence 375-B mg/kg	BB68647 Harrell 000A mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	0.201	ND	ND	ND	ND	ND	2.56	ND	0.69
Anthracene	ND	0.516	ND	ND	ND	ND	ND	1.79	ND	1.82
Benzo(a)anthracene	ND	1.36	0.331	0.155	0.12	ND	ND	9.1	0.293	1.1
Benzo(a)pyrene	ND	0.769	0.181	0.147	0.146	ND	0.121	7.59	0.187	7.6
Benzo(b)fluoranthene	ND	1.35	0.24	0.221	0.218	ND	0.162	16.1	0.286	1.5
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	5.47	ND	ND
Benzo(k)fluoranthene	ND	0.981	0.246	0.153	0.105	ND	0.115	4.6	0.279	1.2
Chrysene	ND	1.71	0.414	0.248	0.204	0.154	0.145	12.6	0.413	1.4
Dibenzo(a,h)anthracene	ND	0.273	ND	0.062	ND	ND	ND	3.35	ND	0.19
Fluoranthene	ND	2.1	0.544	0.113	ND	ND	ND	7.37	0.259	1
Fluorene	ND	ND	ND	ND	ND	ND	ND	0.165	ND	ND
Indeno(1,2,3-cd)pyrene	ND	0.903	0.211	0.25	0.164	ND	0.143	12.6	0.31	2.4
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	0.989	0.231	ND	ND	ND	ND	0.263	ND	0.256
Pyrene	ND	1.72	0.468	0.2	0.224	0.181	0.202	16.6	0.342	1.1
Total PAH	0.00	12.87	2.87	1.55	1.18	0.34	0.89	100.16	2.37	20.26

Laboratory Sample ID: Field Sample ID: Parameter	BB 68648 Harrell 000B mg/kg	BB68649 Harrell 025A mg/kg	BB 68650 Harrell 025B mg/kg	BB68651 Harrell 075A mg/kg	BB68652 Harrell 075B mg/kg	BB68653 Harrell 175 A mg/kg	BB68654 Harrell 175B mg/kg	BB68655 Eastside 000A mg/kg	BB68656 Eastside 025A mg/kg	BB68657 Eastside 050A mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	0.142	ND	ND	ND	0.31	ND	ND
Benzo(a)anthracene	ND	ND	ND	0.125	ND	ND	ND	0.48	ND	ND
Benzo(a)pyrene	ND	ND	ND	0.129	0.088	ND	ND	0.173	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	0.23	0.111	ND	ND	0.7	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	0.14	0.106	ND	ND	0.37	ND	ND
Chrysene	ND	ND	ND	0.215	0.113	ND	ND	0.78	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	0.18	ND	ND
Fluoranthene	ND	ND	ND	0.22	ND	ND	ND	0.51	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	0.18	0.106	ND	ND	0.73	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	0.248	0.113	ND	ND	0.63	ND	ND
Total PAH	0.00	0.00	0.00	1.63	0.64	0.00	0.00	4.86	0.00	0.00

Laboratory Sample ID: Field Sample ID: Parameter	BB68658 Francis 030A mg/kg	BB68659 Francis 060A mg/kg	BB68660 MLK 000A mg/kg	BB68661 MLK 000B mg/kg	BB68662 MLK 025A mg/kg	BB68663 MLK 025B mg/kg	BB68664 MLK 075A mg/kg	BB68665 MLK 075B mg/kg	BB68666 MLK 175A mg/kg	BB68726 BG-7 Eastside Florence mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	0.421	ND	ND	ND	ND	ND	ND	0.113	ND	ND
Anthracene	0.645	ND	ND	ND	0.176	ND	ND	0.206	ND	ND
Benzo(a)anthracene	1.52	ND	ND	ND	0.205	ND	ND	0.18	ND	ND
Benzo(a)pyrene	0.876	ND	0.073	0.164	0.116	ND	0.087	0.21	ND	ND
Benzo(b)fluoranthene	1.49	ND	ND	0.231	0.171	ND	0.116	0.299	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	1.04	ND	ND	ND	0.145	ND	ND	0.173	ND	ND
Chrysene	1.95	ND	0.115	0.234	0.227	0.094	0.104	0.281	ND	ND
Dibenzo(a,h)anthracene	0.314	ND	ND	ND	0.059	ND	ND	0.083	ND	ND
Fluoranthene	2.26	ND	ND	ND	0.125	ND	0.115	0.197	ND	ND
Fluorene	0.063	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	1.21	ND	0.111	0.255	0.188	ND	0.115	0.323	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	0.226	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	2.59	ND	0.109	0.206	0.131	ND	0.13	0.244	ND	ND
Total PAH	14.61	0.00	0.41	1.09	1.54	0.09	0.67	2.31	0.00	0.00

Laboratory Sample ID:	BB68727	BB68728	BB68729	BB68730	BB68731	BB68732	BB68733	BB68734	BB68735	BB68736
Field Sample ID:	BG-7 Eastside Railroad	Grid A	Grid B	Grid C	Grid D	Grid E	Grid F	Grid G	Grid H	Grid I
Parameter	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	0.076	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PAH	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Laboratory Sample ID:	BB 68737	BB68738	BB68739	BB68740	BB68741	BB68742	BB68743	BB68744	BB68745	BB68746
Field Sample ID:	Grid J	Grid K	Grid L	Charles 000A	Charles 000B	Charles 025A	Charles 025B	Charles 075A	Charles 075B	FSAPTS000A
Parameter	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	0.091	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.099	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	0.129	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	0.095	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.172	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PAH	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Laboratory Sample ID:	BB68747	BB68748	BB68749	BB68750	BB68751	BB68752	BB68753	BB68754	BB68755	BB68756
Field Sample ID:	FSAPTS000B	FSAPTS025A	FSAPTS025B	FSAPTS075A	FSAPTS075B	FSAPTS175A	FSAPTS175B	FSAPTS275A	FSAPTS275B	BG-1 8 (E of MLK)
Parameter	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	0.162	ND	0.086	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	0.1	0.236	ND	0.141	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	0.142	0.194	ND	0.126	ND	ND	0.221	ND	ND
Benzo(b)fluoranthene	ND	0.227	0.241	ND	0.149	ND	ND	0.281	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	0.121	0.2	ND	0.118	ND	ND	0.134	ND	ND
Chrysene	ND	0.167	0.317	ND	0.194	ND	ND	0.216	ND	ND
Dibenzo(a,h)anthracene	ND	ND	0.075	ND	ND	ND	ND	0.104	ND	ND
Fluoranthene	ND	ND	0.475	ND	0.172	ND	ND	ND	ND	ND
Fluorene	ND	ND	0.082	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	0.211	0.321	ND	0.174	ND	ND	0.401	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	0.299	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	0.147	0.421	ND	0.21	ND	ND	0.128	ND	ND
Total PAH	0.00	1.12	3.02	0.00	1.37	0.00	0.00	1.49	0.00	0.00

Laboratory Sample ID: Field Sample ID: Parameter	BB68757 BG-2 8 (E of MLK) mg/kg	BB68758 BG-3 8 (S of Francis) mg/kg	BB68759 BG-4 8 (S of Francis) mg/kg	BB68760 BG-5 8 (E of Bertha) mg/kg	BB68761 BG-6 8 (W of Florence) mg/kg
Acenaphthene	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND
Total PAH	0.00	0.00	0.00	0.00	0.00

Attachment 2.

Qualifications of Author

ALLEN D. UHLER, Ph.D.

Senior Consultant

Environmental Forensics Practice

EXPERIENCE

Dr. Uhler has over 20 years experience in the field of environmental chemistry, with a specialization in environmental forensics – the integration of advanced chemical analyses, petroleum and hydrocarbon product source identification techniques, and understanding of operational practices – to determine the nature, sources, and fate of hydrocarbons and other industrial chemicals in the environment. Dr. Uhler has developed analytical methods for the measurement of petroleum-, coal-derived, and anthropogenic hydrocarbons in the environment, and has led numerous investigations of the occurrence and fate of hydrocarbons in the environment, and has led numerous investigations of the occurrence and fate of hydrocarbons in the aquatic and terrestrial environment. His particular expertise is the analysis of petroleum-, coal-derived and anthropogenic hydrocarbons and other man-made organic compounds in waters, soils, and sediments, the use of numerical chemometric techniques to reveal relationships among samples and suspected sources, differentiation of hydrocarbons in complex source settings, evaluating weathering characteristics of hydrocarbons, and tracking the fate of these chemicals in complex, contaminated environments. He has conducted numerous assessments of the occurrence, sources, and fate of fugitive petroleum at refineries, offshore oil and gas production platforms, bulk petroleum storage facilities, along petroleum pipelines, and in sedimentary environments. He has studied the occurrence, behavior, and fate of coal-derived wastes at former manufactured gas plants, wood-treating facilities, and in sedimentary environments. Prior to joining NewFields Dr. Uhler was a Senior Consultant for Battelle Memorial Institute.

REGISTRATIONS AND PROFESSIONAL AFFILIATIONS

Editorial Board, *Journal of Environmental Forensics.* Amherst Press. 1999 – present.

Invited Speaker, International Society of Environmental Forensics. Santa Fe, NM. September, 2002.

Invited chairperson, International Business Communication's 3rd Executive Forum on Environmental Forensics. Washington, D.C. June, 2000

Invited chairperson, International Business Communication's 2nd Executive Forum on Environmental Forensics. Washington, D.C. June, 1999.

Founding Co- Editor-in-Chief, *International Journal of Environmental Forensics.* Amherst Press. 1998-1999.

Feature Editor, "Environmental Forensics", in *Soil, Sediment, Groundwater.* 1998-present.

Invited speaker, National Environmental Forensics Conference: Chlorinated Solvents and Petroleum Hydrocarbons. August 27-28, 1998, Tucson, AZ.

Editorial Advisory Board, *Soil, Sediment, Groundwater.* 1997-present.

Technical Advisory Committee, *Association for Environmental Health and Sciences,* 1996-present.

Moderator, *Chemical Analysis,* 12th Annual Conference on Contaminated Soils, Amherst, MA.

Staff Fellow, US Food and Drug Administration, Division of Environmental and Elemental Contaminants.

Branch, Methods Development Group, Washington, DC. 1985-1987.

Associate Referee, Association of Official Analytical Chemists, (AOAC) 1985-present.

Faculty Research Associate, University of Maryland, 1983-1985.

EDUCATION AND TRAINING

Ph.D. Chemistry, University of Maryland – 1983
M.S. Chemistry, University of Maryland – 1981
B.A. Chemistry, SUNY, Plattsburgh – 1978

PUBLICATIONS

Environmental Forensic Publication Series –*Contaminated Soil, Sediment & Water, AEHS*:

Stout, S.A., Uhler, A.D., Emsbo-Mattingly, S.J. 2003. Characterization of "urban background" PAH in sediments. Sept. Issue, pp. 16-18.

Stout, S.A., Uhler, A.D., Uhler, R.M., Healey, E.M., McCarthy, K.J. 2003. Detailed chemical fingerprinting of gasoline for environmental forensic investigations. Part 3: Application to gasoline source studies. Mar/April Issue, pp. 16-18.

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HAZARD RANKING SYSTEM SCORING PACKAGE

FOR

SITE NAME	**:**	**GULF STATE CREOSOTE**
EPA ID #	**:**	**MSD985967199**
CITY	**:**	**HATTIESBURG**
COUNTY	**:**	**FORREST**
STATE	**:**	**MISSISSIPPI**
SCORED BY	**:**	**MICHAEL T. SLACK**
REVIEWED BY	**:**	**JIM HARDAGE**
		MS OPC, CERCLA DIV.
DATE SCORED	**:**	**January 7, 1991**

GROUND WATER MIGRATION PATHWAY SCORESHEET

AQUIFER SCORED: MIOCENE AQUIFER SYSTEM

Factor Categories and Factors

	Factor	Max. Value	Value Assigned	
	Likelihood of Release to an Aquifer			
1.	Observed Release	550	0	
2.	Potential to Release			
	2a. Containment	10	10	
	2b. Net Precipitation	10	6	
	2c. Depth to Aquifer	5	5	
	2d. Travel Time	35	15	
	2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	260	
3.	Likelihood of Release (higher of lines 1 and 2e)	550		260
	Waste Characteristics			
4.	Toxicity/Mobility	a	2	
5.	Hazardous Waste Quantity	a	100	
6.	Waste Characteristics	100		3
	Targets			
7.	Nearest Well	50	5	
8.	Population			
	8a. Level I Concentrations	b	0	
	8b. Level II Concentrations	b	0	
	8c. Potential Contamination	b	492	
	8d. Population (lines 8a + 8b + 8c)	b	492	
9.	Resources	5	5	
10.	Wellhead Protection Area	20	0	
11.	Targets (lines 7 + 8d + 9 + 10)	b		502
	Ground Water Migration Score for an Aquifer			
12.	Aquifer Score [(lines 3 x 6 x 11)/82,500)][c]	100		4.75

GROUND WATER MIGRATION PATHWAY SCORESHEET

AQUIFER SCORED: N/A
(proceed to next page if only one aquifer is evaluated)

Factor Categories and Factors

	Likelihood of Release to an Aquifer	**Max. Value**	**Value Assigned**
1.	Observed Release	550	____
2.	Potential to Release		
	2a. Containment	10	____
	2b. Net Precipitation	10	____
	2c. Depth to Aquifer	5	____
	2d. Travel Time	35	____
	2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	____
3.	Likelihood of Release (higher of lines 1 and 2e)	550	____
	Waste Characteristics		
4.	Toxicity/Mobility	a	____
5.	Hazardous Waste Quantity	a	____
6.	Waste Characteristics	100	____
	Targets		
7.	Nearest Well	50	____
8.	Population		
	8a. Level I Concentrations	b	____
	8b. Level II Concentrations	b	____
	8c. Potential Contamination	b	____
	8d. Population (lines 8a + 8b + 8c)	b	____
9.	Resources	5	____
10.	Wellhead Protection Area	20	____
11.	Targets (lines 7 + 8d + 9 + 10)	b	____
	Ground Water Migration Score for an Aquifer		
12.	Aquifer Score [(lines 3 x 6 x 11)/82,500][c]	100	____

Ground Water Migration Score for an Aquifer (concluded):

Ground Water Migration Pathway Score	**Max. Value**	**Value Assigned**
13. Pathway Score (S_{gw}), (highest value from line 12, on previous page(s), for all aquifers evaluated)[c]	100	4.75

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[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

NOTES:

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors	Max. Value	Value Assigned
DRINKING WATER THREAT		
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	___
2b. Runoff	25	___
2c. Distance to Surface Water	25	___
2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	___
3. Potential to Release by Flood		
3a. Containment (Flood)	10	___
3b. Flood Frequency	50	___
3c. Potential to Release by Flood (lines 3a x 3b)	500	___
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	___
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	a	10,000
7. Hazardous Waste Quantity	a	100
8. Waste Characteristics	100	32
Targets		
9. Nearest Intake	50	0
10. Population		
10a. Level I Concentrations	b	0
10b. Level II Concentrations	b	0
10c. Potential Contamination	b	0
10d. Population (lines 10a + 10b + 10c)	b	0
11. Resources	5	5

DRINKING WATER THREAT (concluded):		Max. Value	Value Assigned
	Targets (concluded):		
12.	Targets (lines 9 + 10d + 11)	b	5
	Drinking Water Threat Score		
13.	Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	1.07

HUMAN FOOD CHAIN THREAT		Max. Value	Value Assigned
	Likelihood of Release		
14.	Likelihood of Release (same value as line 5)	550	550
	Waste Characteristics		
15.	Toxicity/Persistence/Bioaccumulation	a	$5X10^8$
16.	Hazardous Waste Quantity	a	100
17.	Waste Characteristics	1,000	320
	Targets		
18.	Food Chain Individual	50	20
19.	Population		
	19a. Level I Concentrations	b	0
	19b. Level II Concentrations	b	0
	19c. Potential Human Food Chain Contamination	b	0.0031
	19d. Population (lines 19a + 19b + 19c)	b	0.0031
20.	Targets (lines 18 + 19d)	b	20.0031
	Human Food Chain Treat Score		
21.	Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	42.67

ENVIRONMENTAL THREAT		Max. Value	Value Assigned
	Likelihood of Release		
22.	Likelihood of Release (same value as line 5)	550	550
	Waste Characteristics		
23.	Ecosystem Toxicity/Persistence/ Bioaccumulation	a	$5X10^8$
24.	Hazardous Waste Quantity	a	100
25.	Waste Characteristics	1,000	320
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	0
	26b. Level II Concentrations	b	0
	26c. Potential Contamination	b	0
	26d. Sensitive Environments (lines 26a + 26b + 26c)	b	0
27.	Targets (value from line 26d)	b	0
	Environmental Threat Score		
28.	Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	0

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED

		Max. Value	Value Assigned
29.	Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100)	100	43.74

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE (concluded):

30.	Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	43.74

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[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

NOTES:

SOIL EXPOSURE PATHWAY SCORESHEET

Factor Categories and Factors		Max. Value	Value Assigned	
RESIDENT POPULATION THREAT				
	Likelihood of Exposure			
1.	Likelihood of Exposure	550		____
	Waste Characteristics			
2.	Toxicity	a	____	
3.	Hazardous Waste Quantity	a	____	
4.	Waste Characteristics	100		____
	Targets			
5.	Resident Individual	50	____	
6.	Resident Population			
	6a. Level I Concentrations	b	____	
	6b. Level II Concentrations	b	____	
	6c. Resident Population (lines 6a + 6b)	b	____	
7.	Workers	15	____	
8.	Resources	5	____	
9.	Terrestrial Sensitive Environments	c	____	
10.	Targets (lines 5 + 6c + 7 + 8 + 9)	b		____
	Resident Population Threat Score			
11.	Resident Population Threat Score (lines 1 x 4 x 10)	b		0
NEARBY POPULATION THREAT				
	Likelihood of Exposure			
12.	Attractiveness/Accessibility	100	10	
13.	Area of Contamination	100	20	
14.	Likelihood of Exposure	500		5
	Waste Characteristics			
15.	Toxicity	a	10,000	
16.	Hazardous Waste Quantity	a	2.206	
17.	Waste Characteristics	100		10

NEARBY POPULATION THREAT (concluded:)	**Max. Value**	**Value Assigned**
Targets		
18. Nearby Individual	1	1
19. Population within 1 mile	b	4.4
20. Targets (lines 18 + 19)	b	5.4
Nearby Population Threat Score		
21. Nearby Population Threat (lines 14 x 17 x 20)	b	270

SOIL EXPOSURE PATHWAY SCORE

22. Soil Exposure Pathway Score[d] (S_s), (lines [11 + 21] / 82,500, subject to a maximum of 100)	100	0.0033

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[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.
[d]Do not round to nearest integer.

Notes:

AIR MIGRATION PATHWAY SCORESHEET

	Factor Categories and Factors	Max. Value	Value Assigned
	Likelihood of Exposure		
1.	Observed Release	550	____
2.	Potential to Release		
	2a. Gas Potential to Release	500	____
	2b. Particulate Potential to Release	500	____
	2c. Potential to Release (higher of lines 2a and 2b)	500	____
3.	Likelihood of Release (higher of lines 1 and 2c)	550	____
	Waste Characteristics		
4.	Toxicity/Mobility	a	____
5.	Hazardous Waste Quantity	a	____
6.	Waste Characteristics	100	____
	Targets		
7.	Nearest Individual	50	____
8.	Population		
	8a. Level I Concentrations	b	____
	8b. Level II Concentrations	b	____
	8c. Potential Contamination	b	____
	8d. Population (lines 8a + 8b + 8c)	b	____
9.	Resources	5	____
10.	Sensitive Environments		
	10a. Actual Contamination	c	____
	10b. Potential Contamination	c	____
	10c. Sensitive Environments (lines 10a + 10b)	c	____
11.	Targets (lines 7 + 8d + 9 + 10c)	b	____
	Air Migration Pathway Score		
12.	Pathway Score (S_a) [(lines 3 x 6 x 11)/82,500][d]	100	____

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60.
[d] Do not round to nearest integer.

Notes:

- Air Migration Pathway was not scored

CALCULATION OF HRS SITE SCORE

$$S = \text{square root of } [(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2)/4]$$

$$S_{score} = \text{square root of } [((4.75)^2 + (43.74)^2 + (0.0033)^2 + (0)^2)/4]$$

$$S_{score} = 22.0$$

CONCLUSION/RECOMMENDATION

HAZARD RANKING SYSTEM SCORING PACKAGE

FOR

SITE NAME	**:**	**GULF STATE CREOSOTE**
EPA ID #	**:**	**MSD985967199**
CITY	**:**	**HATTIESBURG**
COUNTY	**:**	**FORREST**
STATE	**:**	**MISSISSIPPI**
SCORED BY	**:**	**MICHAEL T. SLACK**
REVIEWED BY	**:**	**JIM HARDAGE**
		MS OPC, CERCLA DIV.
DATE SCORED	**:**	**January 7, 1991**

GROUND WATER MIGRATION PATHWAY SCORESHEET

AQUIFER SCORED: MIOCENE AQUIFER SYSTEM

Factor Categories and Factors

	Likelihood of Release to an Aquifer	Max. Value	Value Assigned	
1.	Observed Release	550	0	
2.	Potential to Release			
	2a. Containment	10	10	
	2b. Net Precipitation	10	6	
	2c. Depth to Aquifer	5	5	
	2d. Travel Time	35	15	
	2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	260	
3.	Likelihood of Release (higher of lines 1 and 2e)	550		260
	Waste Characteristics			
4.	Toxicity/Mobility	a	2	
5.	Hazardous Waste Quantity	a	100	
6.	Waste Characteristics	100		3
	Targets			
7.	Nearest Well	50	5	
8.	Population			
	8a. Level I Concentrations	b	0	
	8b. Level II Concentrations	b	0	
	8c. Potential Contamination	b	492	
	8d. Population (lines 8a + 8b + 8c)	b	492	
9.	Resources	5	5	
10.	Wellhead Protection Area	20	0	
11.	Targets (lines 7 + 8d + 9 + 10)	b		502
	Ground Water Migration Score for an Aquifer			
12.	Aquifer Score [(lines 3 x 6 x 11)/82,500)][c]	100		4.75

GROUND WATER MIGRATION PATHWAY SCORESHEET

AQUIFER SCORED: N/A
(proceed to next page if only one aquifer is evaluated)

Factor Categories and Factors

	Factor	Max. Value	Value Assigned	
	Likelihood of Release to an Aquifer			
1.	Observed Release	550	____	
2.	Potential to Release			
	2a. Containment	10	____	
	2b. Net Precipitation	10	____	
	2c. Depth to Aquifer	5	____	
	2d. Travel Time	35	____	
	2e. Potential to Release [lines 2a x (2b + 2c + 2d)]	500	____	
3.	Likelihood of Release (higher of lines 1 and 2e)	550		____
	Waste Characteristics			
4.	Toxicity/Mobility	a	____	
5.	Hazardous Waste Quantity	a	____	
6.	Waste Characteristics	100		____
	Targets			
7.	Nearest Well	50	____	
8.	Population			
	8a. Level I Concentrations	b	____	
	8b. Level II Concentrations	b	____	
	8c. Potential Contamination	b	____	
	8d. Population (lines 8a + 8b + 8c)	b	____	
9.	Resources	5	____	
10.	Wellhead Protection Area	20	____	
11.	Targets (lines 7 + 8d + 9 + 10)	b		____
	Ground Water Migration Score for an Aquifer			
12.	Aquifer Score [(lines 3 x 6 x 11)/82,500)][c]	100		____

Ground Water Migration Score for an Aquifer (concluded):

	Ground Water Migration Pathway Score	**Max. Value**	**Value Assigned**
13.	Pathway Score (S_{gw}), (highest value from line 12, on previous page(s), for all aquifers evaluated)[c]	100	4.75

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

NOTES:

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor Categories and Factors	Max. Value	Value Assigned
DRINKING WATER THREAT		
Likelihood of Release		
1. Observed Release	550	550
2. Potential to Release by Overland Flow		
2a. Containment	10	___
2b. Runoff	25	___
2c. Distance to Surface Water	25	___
2d. Potential to Release by Overland Flow (lines 2a x [2b + 2c])	500	___
3. Potential to Release by Flood		
3a. Containment (Flood)	10	___
3b. Flood Frequency	50	___
3c. Potential to Release by Flood (lines 3a x 3b)	500	___
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	___
5. Likelihood of Release (higher of lines 1 and 4)	550	550
Waste Characteristics		
6. Toxicity/Persistence	a	10,000
7. Hazardous Waste Quantity	a	100
8. Waste Characteristics	100	32
Targets		
9. Nearest Intake	50	0
10. Population		
10a. Level I Concentrations	b	0
10b. Level II Concentrations	b	0
10c. Potential Contamination	b	0
10d. Population (lines 10a + 10b + 10c)	b	0
11. Resources	5	5

DRINKING WATER THREAT (concluded):	Max. Value	Value Assigned
Targets (concluded):		
12. Targets (lines 9 + 10d + 11)	b	5
Drinking Water Threat Score		
13. Drinking Water Threat Score ([lines 5 x 8 x 12]/82,500, subject to a maximum of 100)	100	1.07
HUMAN FOOD CHAIN THREAT		
Likelihood of Release		
14. Likelihood of Release (same value as line 5)	550	550
Waste Characteristics		
15. Toxicity/Persistence/Bioaccumulation	a	$5X10^8$
16. Hazardous Waste Quantity	a	100
17. Waste Characteristics	1,000	320
Targets		
18. Food Chain Individual	50	20
19. Population		
19a. Level I Concentrations	b	0
19b. Level II Concentrations	b	0
19c. Potential Human Food Chain Contamination	b	0.0031
19d. Population (lines 19a + 19b + 19c)	b	0.0031
20. Targets (lines 18 + 19d)	b	20.0031
Human Food Chain Treat Score		
21. Human Food Chain Threat Score ([lines 14 x 17 x 20]/82,500, subject to a maximum of 100)	100	42.67

ENVIRONMENTAL THREAT		Max. Value	Value Assigned
	Likelihood of Release		
22.	Likelihood of Release (same value as line 5)	550	550
	Waste Characteristics		
23.	Ecosystem Toxicity/Persistence/ Bioaccumulation	a	$5X10^8$
24.	Hazardous Waste Quantity	a	100
25.	Waste Characteristics	1,000	320
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	0
	26b. Level II Concentrations	b	0
	26c. Potential Contamination	b	0
	26d. Sensitive Environments (lines 26a + 26b + 26c)	b	0
27.	Targets (value from line 26d)	b	0
	Environmental Threat Score		
28.	Environmental Threat Score ([lines 22 x 25 x 27]/82,500, subject to a maximum of 60)	60	0

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE FOR A WATERSHED

29.	Watershed Score[c] (lines 13 + 21 + 28, subject to a maximum of 100)	100	43.74

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE (concluded):

30.	Component Score (S_{of})[c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	43.74

---

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]Do not round to nearest integer.

NOTES:

SOIL EXPOSURE PATHWAY SCORESHEET

	Factor Categories and Factors	Max. Value	Value Assigned	
	RESIDENT POPULATION THREAT			
	Likelihood of Exposure			
1.	Likelihood of Exposure	550		____
	Waste Characteristics			
2.	Toxicity	a	____	
3.	Hazardous Waste Quantity	a	____	
4.	Waste Characteristics	100		____
	Targets			
5.	Resident Individual	50	____	
6.	Resident Population			
	6a. Level I Concentrations	b	____	
	6b. Level II Concentrations	b	____	
	6c. Resident Population (lines 6a + 6b)	b	____	
7.	Workers	15	____	
8.	Resources	5	____	
9.	Terrestrial Sensitive Environments	c	____	
10.	Targets (lines 5 + 6c + 7 + 8 + 9)	b		____
	Resident Population Threat Score			
11.	Resident Population Threat Score (lines 1 x 4 x 10)	b		0
	NEARBY POPULATION THREAT			
	Likelihood of Exposure			
12.	Attractiveness/Accessibility	100	10	
13.	Area of Contamination	100	20	
14.	Likelihood of Exposure	500		5
	Waste Characteristics			
15.	Toxicity	a	10,000	
16.	Hazardous Waste Quantity	a	2.206	
17.	Waste Characteristics	100		10

NEARBY POPULATION THREAT (concluded:)		Max. Value	Value Assigned
	Targets		
18.	Nearby Individual	1	1
19.	Population within 1 mile	b	4.4
20.	Targets (lines 18 + 19)	b	5.4
	Nearby Population Threat Score		
21.	Nearby Population Threat (lines 14 x 17 x 20)	b	270

SOIL EXPOSURE PATHWAY SCORE

22.	Soil Exposure Pathway Score[d] (S_s), (lines [11 + 21] / 82,500, subject to a maximum of 100)	100	0.0033

---

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60.
[d]Do not round to nearest integer.

Notes:

AIR MIGRATION PATHWAY SCORESHEET

	Factor Categories and Factors	Max. Value	Value Assigned
	Likelihood of Exposure		
1.	Observed Release	550	
2.	Potential to Release		
	2a. Gas Potential to Release	500	
	2b. Particulate Potential to Release	500	
	2c. Potential to Release (higher of lines 2a and 2b)	500	
3.	Likelihood of Release (higher of lines 1 and 2c)	550	
	Waste Characteristics		
4.	Toxicity/Mobility	a	
5.	Hazardous Waste Quantity	a	
6.	Waste Characteristics	100	
	Targets		
7.	Nearest Individual	50	
8.	Population		
	8a. Level I Concentrations	b	
	8b. Level II Concentrations	b	
	8c. Potential Contamination	b	
	8d. Population (lines 8a + 8b + 8c)	b	
9.	Resources	5	
10.	Sensitive Environments		
	10a. Actual Contamination	c	
	10b. Potential Contamination	c	
	10c. Sensitive Environments (lines 10a + 10b)	c	
11.	Targets (lines 7 + 8d + 9 + 10c)	b	
	Air Migration Pathway Score		
12.	Pathway Score (S_a) [(lines 3 x 6 x 11)/82,500][d]	100	

[a]Maximum value applies to waste characteristics category.
[b]Maximum value not applicable.
[c]No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60.
[d]Do not round to nearest integer.

Notes:

- Air Migration Pathway was not scored

CALCULATION OF HRS SITE SCORE

$$S = \text{square root of } [(S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2)/4]$$

$$S_{score} = \text{square root of } [((4.75)^2 + (43.74)^2 + (0.0033)^2 + (0)^2)/4]$$

$$S_{score} = 22.0$$

CONCLUSION/RECOMMENDATION

MTS:CREO-HRS

REFERENCES

1. SITE INSPECTION, PHASE II REPORT, GULF STATE CREOSOTE SITE, HATTIESBURG, MISSISSIPPI, JANUARY, 1992.

2. PRELIMINARY ASSESSMENT REPORT, GULF STATE CREOSOTE SITE, HATTIESBURG, MS, MARCH 1990

3. ESTIMATES OF HOUSEHOLDS, FOR COUNTIES (MISSISSIPPI), TABLE 1, JULY 1, 1985.

4. FEDERAL REGISTER, VOL. 55, NO. 241, BOOK 2, 40 CFR PART 300, HAZARD RANKING SYSTEM, FINAL RULE, DECEMBER 14, 1990.

AIR MIGRATION PATHWAY

- AIR MIGRATION PATHWAY WAS NOT SCORED

CALCULATION OF HRS SITE SCORE

$$S = \sqrt{\frac{S_{GW}^2 + S_{SW}^2 + S_S^2 + S_A^2}{4}}$$

$$S = \sqrt{\frac{(4.75)^2 + (43.74)^2 + (0.0033)^2 + (0)^2}{4}}$$

$$\boxed{S = 22.0}$$

(REFERENCES 1, 2, 3, AND 4)

TARGETS | VALUE ASSIGNED

18. NEARBY INDIVIDUAL — 1
TABLE 5-9 - ASSIGNED
VALUE = 1

19. POPULATION WITHIN 1 MILE
- TABLE 5-10

- TRAVEL DISTANCE CATEGORY	ESTIMATED # OF PEOPLE	DISTANCE WEIGHTED VALUES
• GREATER THAN 0 TO 1/4	58 RESIDENCES ⊗ 2.66 PEOPLE PER RESIDENCE = 154 (ROUNDED)	4 VALUES
• > 1/4 TO 1/2	180 RESIDENCES ⊗ 2.66 = 479 (ROUNDED)	7
• > 1/2 TO 1	2,175 RESIDENCES ⊗ 2.66 = 5,786 (ROUNDED)	33

- VALUE FOR THE POPULATION WITHIN 1 MILE FACTOR (PN)

$$PN = \frac{1}{10}(4+7+33) = 4.4$$ 4.4

20. TARGETS (LINES 18 + 19)

(1 + 4.4) = 5.4 — 5.4

NEARBY POPULATION THREAT SCORE

21. NEARBY POPULATION THREAT
(LINES 14 x 17 x 20) =
(5 x 10 x 5.4) = 270 — 270

SOIL EXPOSURE PATHWAY SCORE

22. SOIL EXPOSURE PATHWAY SCORE
(LINES 11 + 21) / 82,500
(0 + 270) / 82,500 = 0.0033 — 0.0033

SOIL EXPOSURE PATHWAY

	VALUE ASSIGNED
RESIDENT POPULATION THREAT	
RESIDENT POPULATION THREAT SCORE	
11. RESIDENT POPULATION THREAT SCORE (LINES 1 x 4 x 10) - EVALUATION DID NOT MEET RESIDENT POPULATION CRITERIA (SECTION 5.1), PROCEEDED TO NEARBY POPULATION THREAT (SECTION 5.2)	0
NEARBY POPULATION THREAT	
LIKELIHOOD OF EXPOSURE	
12. ATTRACTIVENESS / ACCESSIBILITY (TABLE 5-6)	10
13. AREA OF CONTAMINATION TABLE 5-7	20
14. LIKELIHOOD OF EXPOSURE TABLE 5-8	5
WASTE CHARACTERISTICS	
15. TOXICITY - BENZO(a) PYRENE - HIGHEST TOXICITY FACTOR VALUE	10,000
16. HAZARDOUS WASTE QUANTITY TABLE 5-2 - $(75,000\ ft^2)/34,000$	2.206
17. WASTE CHARACTERISTICS (TOXICITY VALUE) ⊗ (HAZARDOUS WASTE QUANTITY VALUE) = 10,000 ⊗ 2.206 = 22,060 TABLE 2-7 - WASTE CHARACTERISTICS FACTOR CATEGORY VALUE = 10	10

VALUE ASSIGNED

24. HAZARDOUS WASTE QUANTITY
(SAME AS LINE 16) — 100

25. WASTE CHARACTERISTICS
- (ECOSYSTEM TOXICITY/PERSISTENCE VALUE)
⊗ (HAZARDOUS WASTE QUANTITY VALUE)
$= (10{,}000) \otimes (100) = 1 \times 10^6$
- $1 \times 10^6 \otimes 50{,}000$ (BIOACCUMULATION, ECOSYSTEM, VALUE)
$= 5 \times 10^{10}$
- WASTE CHARACTERISTICS FACTOR VALUE - TABLE 2-7
= 320 — 320

TARGETS

26. SENSITIVE ENVIRONMENTS
26. a. LEVEL I CONCENTRATIONS — 0
26. b. LEVEL II CONCENTRATIONS — 0
26. c. POTENTIAL CONTAMINATION — 0
26. d. SENSITIVE ENVIRONMENT
(LINES 26a + 26b + 26c) — 0

27. TARGETS
(VALUE FROM LINE 26d) — 0

ENVIRONMENTAL THREAT SCORE

28. ENVIRONMENTAL THREAT SCORE
([LINES 22 × 25 × 27]/82,500,
SUBJECT TO A MAXIMUM OF 60)
([550 × 320 × 0]) = 0 — 0

SURFACE WATER OVERLAND/FLOOD MIGRATION
COMPONENT SCORE FOR A WATERSHED

29. WATERSHED SCORE
(LINES 13 + 21 + 28, SUBJECT
TO A MAX. OF 100) =
(1.07 + 42.67 + 0) = 43.74 — 43.74

ENVIRONMENTAL THREAT

LIKELIHOOD OF RELEASE — VALUE ASSIGNED

22. LIKELIHOOD OF RELEASE (SAME VALUE AS LINE 5) — 550

WASTE CHARACTERISTICS

23. ECOSYSTEM TOXICITY/PERSISTENCE/ BIOACCUMULATION

NAPHTHALENE -
ECOSYSTEM TOXICITY VALUE = 1000
PERSISTENCE VALUE = 0.4
ECOSYSTEM TOXICITY/PERSISTENCE VALUE (TABLE 4-20) = 400
ECOSYSTEM BIOACCUMULATION VALUE = 500
ECO. TOX./PERSIST./ECO. BIO. VALUE (TABLE 4-21) = 2×10^5

ACENAPHTHENE
ECOSYSTEM TOXICITY VALUE = 10,000
PERSISTENCE VALUE = 0.4
ECOSYSTEM TOXICITY/PERSISTENCE VALUE = 4,000
ECOSYSTEM BIOACCUMULATION VALUE = 500
ECO. TOX./PERSIST./ECO. BIO. VALUE = 2×10^6

BENZO(a) ANTHRACENE
ECOSYSTEM TOXICITY VALUE = 10,000
PERSISTENCE VALUE = 1.0
ECOSYSTEM TOXICITY / PERSISTENCE VALUE = 10,000
ECOSYSTEM BIOACCUMULATION VALUE = 50,000
ECO. TOX./PERSIST./ECO. BIO. VALUE = 5×10^8

CHRYSENE
ECO. TOX./PERSIST./ECO. BIO. VALUE = 0

BENZO(a) PYRENE
ECOSYSTEM TOXICITY VALUE = 10,000
PERSISTENCE VALUE = 1.0
ECOSYSTEM TOXICITY/PERSISTENCE VALUE = 10,000
ECOSYSTEM BIOACCUMULATION VALUE = 50,000
ECO. TOX./PERSISTENCE/ECO. BIO. VALUE = 5×10^8

BENZO(a) ANTHRACENE & BENZO(a) PYRENE -
HIGHEST ECOSYSTEM TOXICITY/PERSISTENCE/ ECOSYSTEM BIOACCUMULATION VALUE = 5×10^8 — 5×10^8

VALUE ASSIGNED

16. HAZARDOUS WASTE QUANTITY (SAME AS LINE 7 - DRINKING WATER THREAT) — 100

17. WASTE CHARACTERISTICS
- TOXICITY/PERSISTENCE VALUE ⊗ HAZARDOUS WASTE QUANTITY VALUE
  (10,000 × 100 = 1×10^6)
- 1×10^6 ⊗ 50,000 (BIOACCUMULATION VALUE) = 5×10^{10}
- WASTE CHARACTERISTICS SCORE VALUE (TABLE 2-7) = 320 — 320

TARGETS

18. FOOD CHAIN INDIVIDUAL (SECTION 4.1.3.3.1) — 20

19. POPULATION
19.a. LEVEL I CONCENTRATIONS — 0
19.b. LEVEL II CONCENTRATIONS — 0
19.c. POTENTIAL HUMAN FOOD
- CHAIN CONTAMINATION

FISHERY - LEAF RIVER

$$(\text{RIVER LENGTH IN MILES}) \times \left(\frac{5280 \text{ FEET}}{1 \text{ MILE}}\right) \times (\text{CANAL WIDTH IN FEET}) \times \left(\frac{1 \text{ ACRE}}{43{,}560 \text{ ft}^2}\right) \times \left(\frac{50 \text{ POUNDS}}{\text{ACRE} \cdot \text{YEAR}} \text{ ESTIMATED PRODUCTION}\right) = (10.5 \text{ MILES}) \times \left(\frac{5280}{1}\right)(300 \text{ FEET})\left(\frac{1}{43{,}560}\right)(50)$$

= 19,091 POUNDS OF PRODUCTION PER YEAR (ROUNDED)

- TABLE 4-18 ⇒ P = HUMAN FOOD CHAIN POPULATION VALUE = 31
- POTENTIAL HUMAN FOOD CHAIN CONTAMINATION FACTOR

$$(PF) = \frac{1}{10}(31)(D)$$

D = DILUTION WEIGHT FROM TABLE 4-13 FOR FISHERY (LEAF RIVER) = 0.001

$$PF = \frac{1}{10}(31)(0.001) = 0.0031$$ — 0.0031

19d. POPULATION
(LINES 19a + 19b + 19c) =
(0 + 0 + 0.0031) = 0.0031 — 0.0031

20. TARGETS
(LINES 18 + 19d) = (20 + 0.0031) = 20.0031 — 20.0031

HUMAN FOOD CHAIN THREAT SCORE

21. HUMAN FOOD CHAIN THREAT SCORE
([LINES 14 × 17 × 20] / 82,500)
SUBJECT TO A MAX. OF 100
([550 × 320 × 20.0031]) / 82,500 = 42.67 — 42.67

TARGETS — VALUE ASSIGNED

9. NEAREST INTAKE — 0

10. POPULATION

10a. LEVEL I CONCENTRATIONS — 0

10b. LEVEL II CONCENTRATIONS — 0

10c. POTENTIAL CONTAMINATION — 0

10d. POPULATION (LINES 10a+10b+10c) — 0

11. RESOURCES — 5

12. TARGETS (LINES 9+10d+11) — 5
(0+0+5)=5

DRINKING WATER THREAT SCORE

13. DRINKING WATER THREAT SCORE
([LINES 5x8x12)]/82,500)
([550 x 32x 5]/82,500) = — 1.07

HUMAN FOOD CHAIN THREAT

LIKELIHOOD OF RELEASE

14. LIKELIHOOD OF RELEASE (SAME AS LINE 5) — 550

WASTE CHARACTERISTICS

15. TOXICITY/PERSISTENCE/BIOACCUMULATION

NAPHTHALENE - TOXICITY/PERSISTENCE, VALUE: 400
BIOACCUMULATION VALUE = 500
TOXICITY/PERSISTENCE/BIOACCUMULATION VALUE (TABLE 4-16) = 2×10^5

ACENAPHTHENE - TOXICITY/PERSISTENCE VALUE = 4
BIOACCUMULATION VALUE = 500
TOX./PERSIST./BIO. VALUE = 2,000

BENZO(a)ANTHRACENE - TOXICITY/PERSISTENCE VALUE = 1,000
BIOACCUMULATION VALUE = 50,000
TOX./PERSIST./BIO. VALUE = 5×10^7

CHRYSENE - TOXICITY/PERSISTENCE/BIOACCUMULATION VALUE = 0

BENZO(a)PYRENE - TOXICITY/PERSISTENCE VALUE = 10,000
BIOACCUMULATION VALUE = 50,000
TOX./PERSIST./BIO. VALUE = 5×10^8

BENZO(a)PYRENE - HIGHEST TOXICITY/PERSISTENCE/BIOACCUMULATION VALUE — 5×10^8

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

DRINKING WATER THREAT

LIKELIHOOD OF RELEASE

VALUE ASSIGNED

1. OBSERVED RELEASE — 550

5. LIKLIHOOD OF RELEASE — 550

WASTE CHARACTERISTICS

6. TOXICITY/PERSISTENCE

NAPHTHALENE – TOXICITY VALUE = 1,000
PERSISTENCE VALUE = 0.4
TOXICITY/PERSISTENCE VALUE (TABLE 4-12) = 400

ACENAPHTHENE – TOXICITY VALUE = 10
PERSISTENCE VALUE = 0.4
TOXICITY/PERSISTENCE VALUE = 4

BENZO(a)ANTHRACENE – TOXICITY VALUE = 1,000
PERSISTENCE VALUE = 1.0
TOXICITY/PERSISTENCE VALUE = 1,000

CHRYSENE – TOXICITY/PERSISTENCE VALUE = 0

BENZO(a) PYRENE – TOXICITY VALUE = 10,000
PERSISTENCE VALUE = 1.0
TOXICITY/PERSISTENCE VALUE = 10,000

BENZO(a) PYRENE – HIGHEST TOXICITY/PERSISTENCE VALUE — 10,000

7. HAZARDOUS WASTE QUANTITY (SAME AS LINE 5 OF GROUNDWATER MIGRATION PATHWAY SCORESHEET) — 100

8. WASTE CHARACTERISTICS
   - (TOXICITY/PERSISTENCE VALUE) ⊗ (HAZARDOUS WASTE QUANTITY VALUE) = WASTE CHARACTERISTICS PRODUCT
     (10,000) ⊗ (100) = 1×10^6
   - FROM TABLE 2-7 - WASTE CHARACTERISTICS FACTOR CATEGORY VALUE (ASSIGNED VALUE) = 32 — 32

Value Assigned

- 2 Palmers Crossing Water Association Public Wells within the four-mile radius from the site - mixed into one distribution system - 470 connections total ⇒

$$\frac{(470 \text{ connections})(2.66 \text{ residents per connection})}{(2 \text{ wells})}$$

= 625.10 people served per well

- 3 Lamar Park Water Association Public Wells with the four-mile radius from the site - mixed into one - distribution system - 1,100 connections total ⇒

$$\frac{(1{,}100 \text{ connections}) \otimes (2.66 \text{ residents per connection})}{(3 \text{ wells})}$$

= 975.33 people served per well

$$- \quad PC = \frac{1}{10} \sum_{i=1}^{3} W_i$$

$$= \frac{1}{10} (2{,}939 + 678 + 1{,}306)$$

$$= 492$$ 492

8d. Population (lines 8a + 8b + 8c) 492

9. Resources (Section 3.3.3) 5
Numerous wells supplying water to commercial food crops and/or commercial forage crops

10. Wellhead Protection Area 0

11. Targets (lines 7 + 8d + 9 + 10) 502
(5 + 492 + 5 + 0)

Ground Water Migration Score for an Aquifer

12. Aquifer Score
[(lines 3 x 6 x 11) / 82,500)]

[(260 x 3 x 502) / 82,500)] = 4.75

TARGETS | VALUE ASSIGNED

7. NEAREST WELL (SECTION 3.3.1) — 5

8. POPULATION

8a. LEVEL I CONCENTRATIONS — 0

8b. LEVEL II CONCENTRATIONS — 0

8c. POTENTIAL CONTAMINATION (SECTION 3.3.2 POPULATION)

DISTANCE CATEGORY (MILES)	WELLS/POPULATION SERVED	POPULATION VALUE
0 TO 1/4	0	0
>1/4 TO 1/2	0	0
>1/2 TO 1	0	0
>1 TO 2	• 5 PRIVATE WELLS ⊗ 2.66 PEOPLE PER HOUSEHOLD - 1980 CENSUS = 13.30 & 4 CITY OF HATTIESBURG WELLS ⊗ 3,506.36 PEOPLE PER WELL = 14,025.44 • 13.30 + 14,025.44 = 14,038.74 PEOPLE TOTAL	(2,939)
>2 TO 3	• 3 LAMAR WATER ASSOCIATION WELLS, 2 CENTRAL WATER ASSOCIATION WELLS, 2 PALMERS CROSSING WELLS 3 ⊗ (975.33 PEOPLE) + 2 (432.25 PEOPLE) + 2 (625.10 PEOPLE) = 5,040.69 PEOPLE & 19 PRIVATE WELLS ⊗ 2.66 = 50.54 PEOPLE • 5,040.69 PEOPLE + 50.54 PEOPLE = 5091.23 PEOPLE SERVED TOTAL	(678)
>3 TO 4	• 38 PRIVATE WELLS ⊗ 2.66 = 101.08 PEOPLE & 7 HATTIESBURG WELLS ⊗ 3506.36 = 24,544.52 • 101.08 PEOPLE + 24,544.52 PEOPLE = 24,645.6 TOTAL PEOPLE SERVED	(1,306)

CALCULATIONS:

- 11 CITY OF HATTIESBURG PUBLIC WELLS WITHIN THE FOUR-MILE RADIUS FROM THE SITE - MIXED INTO ONE DISTRIBUTION SYSTEM - 14,500 CONNECTIONS TOTAL ⇒ (14,500 CONNECTIONS)(2.66 PEOPLE PER HOUSEHOLD) / (11 WELLS)

  = 3,506.36 PEOPLE SERVED PER WELL

- 2 CENTRAL WATER ASSOCIATION PUBLIC WELLS WITHIN THE FOUR-MILE RADIUS FROM THE SITE - MIXED INTO ONE DISTRIBUTION SYSTEM - 325 CONNECTIONS TOTAL ⇒ (325 CONNECTIONS)(2.66 RESIDENTS PER CONNECTION) / (2 WELLS)

  = 625.10 PEOPLE SERVED PER WELL

WASTE CHARACTERISTICS

4. TOXICITY / MOBILITY

NAPHTHALENE - TOXICITY VALUE = 1,000
- WATER SOLUBILITY = 31 mg/l
- DISTRIBUTION COEFFICIENT = 372.5496
- MOBILITY VALUE (TABLE 3-8) = 0.002
- TOXICITY / MOBILITY VALUE (TABLE 3-9) = 2

ACENAPHTHENE - TOXICITY VALUE = 10
- WATER SOLUBILITY = 3.9 mg/l
- DISTRIBUTION COEF. = 314
- MOBILITY VALUE = 0.002
- TOXICITY / MOBILITY VALUE = 0.02

BENZO(a)ANTHRACENE - TOXICITY VALUE = 1,000
- WATER SOLUBILITY = 0.0094 mg/l
- DISTRIBUTION COEFFICIENT = 210,000
- MOBILITY VALUE = 2×10^{-9}
- TOXICITY / MOBILITY VALUE = 2×10^{-6}

CHRYSENE - TOXICITY / MOBILITY VALUE = 0

BENZO(a) PYRENE - TOXICITY VALUE = 10,000
- WATER SOLUBILITY = 0.00162 mg/l
- DISTRIBUTION COEF. = 771,000
- MOBILITY VALUE = 2×10^{-9}
- TOXICITY / MOBILITY VALUE = 2×10^{-5}

NAPHTHALENE - HIGHEST TOXICITY/MOBILITY FACTOR VALUE — 2

5. HAZARDOUS WASTE QUANTITY

ESTIMATED VOLUME OF WASTE -

$75,000 \text{ ft}^2 \times 10 \text{ ft}$ (APPROX. DEPTH) = $750,000 \text{ ft}^3$

$750,000 \text{ ft}^3 \div 2,500$ (TABLE 2-5, TIER C) = 300

HAZARDOUS WASTE QUANTITY VALUE (TABLE 2-6) = 100 — 100

(ESTIMATED VOLUME OF WASTE WAS DETERMINED FROM PRIOR SAMPLING INVESTIGATIONS - SEE APPENDIX A OF SSI-II REPORT)

6. WASTE CHARACTERISTICS

- (TOXICITY / MOBILITY VALUE) x (HAZARDOUS WASTE QUANTITY VALUE) = WASTE CHARACTERISTICS PRODUCT

(2) x (100) = 200

- FROM TABLE 2-7 - WASTE CHARACTERISTICS FACTOR CATEGORY VALUE = 3 — 3

SITE INSPECTION, PHASE II
REPORT
GULF STATE CREOSOTE SITE
HATTIESBURG, MISSISSIPPI

GROUNDWATER MIGRATION PATHWAY SCORESHEET

AQUIFER SCORED: MIOCENE AQUIFER SYSTEM

LIKELIHOOD OF RELEASE TO AN AQUIFER	VALUE ASSIGNED
1. OBSERVED RELEASE	0
2. POTENTIAL TO RELEASE	
2a. CONTAINMENT (SECTION 3.1.2.1 CONTAINMENT (FEDERAL REGISTER) ALL SOURCES SECTION, TABLE 3-2	10
2b. NET PRECIPITATION (SECTION 3.1.2.2 NET PRECIPITATION) -FIGURE 3-2	6
2c. DEPTH TO AQUIFER (SECTION 3.1.2.3 DEPTH TO AQUIFER -TABLE 3-5)	5
2d. TRAVEL TIME (SECTION 3.1.2.4 TRAVEL TIME -TABLES 3-6 & 3-7)	15
e. POTENTIAL TO RELEASE [a x (b+c+d)] [10 x (6+5+15)] = 260	260
3. LIKLIHOOD OF RELEASE (HIGHER OF LINES 1 AND 2e)	260

HAZARD RANKING SYSTEM SCORING SUMMARY

FOR

GULF STATES CREOSOTE
EPA SITE NUMBER MSD985967199
HATTIESBURG
FORREST COUNTY, MS
EPA REGION: 4

SCORE STATUS: IN PREPARATION

SCORED BY MICHAEL T SLACK
OF MS BPC
ON 03/06/90

DATE OF THIS REPORT: 03/07/90
DATE OF LAST MODIFICATION: 03/07/90

GROUND WATER ROUTE SCORE	:	63.55
SURFACE WATER ROUTE SCORE	:	16.08
AIR ROUTE SCORE	:	0.00
MIGRATION SCORE	:	37.89

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

HRS GROUND WATER ROUTE SCORE

CATEGORY/FACTOR		RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE		NO	0	0
2. ROUTE CHARACTERISTICS				
DEPTH TO WATER TABLE		15 FEET		
DEPTH TO BOTTOM OF WASTE		6 FEET		
DEPTH TO AQUIFER OF CONCERN		9 FEET	3	6
PRECIPITATION		60.0 INCHES		
EVAPORATION		46.0 INCHES		
NET PRECIPITATION		14.0 INCHES	2	2
PERMEABILITY		1.0X10-5 CM/SEC	1	1
PHYSICAL STATE			3	3
TOTAL ROUTE CHARACTERISTICS SCORE:				12
3. CONTAINMENT			3	3
4. WASTE CHARACTERISTICS				
TOXICITY/PERSISTENCE:CREOSOTE				15
WASTE QUANTITY	CUBIC YDS	2501		
	DRUMS	0		
	GALLONS	0		
	TONS	0		
	TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:				23
5. TARGETS				
GROUND WATER USE			3	9
DISTANCE TO NEAREST WELL		3400 FEET		
AND		MATRIX VALUE	35	35
TOTAL POPULATION SERVED		58121 PERSONS		
NUMBER OF HOUSES		0		
NUMBER OF PERSONS		0		
NUMBER OF CONNECTIONS		15295		
NUMBER OF IRRIGATED ACRES		0		
TOTAL TARGETS SCORE:				44

GROUND WATER ROUTE SCORE (Sgw) = 63.55

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SITE: GULF STATES CREOSOTE

HRS SURFACE WATER ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0
2. ROUTE CHARACTERISTICS			
SITE LOCATED IN SURFACE WATER	YES		
SITE WITHIN CLOSED BASIN	NO		
FACILITY SLOPE	0.0 %		
INTERVENING SLOPE	0.0 %	3	3
24-HOUR RAINFALL	4.0 INCHES	3	3
DISTANCE TO DOWN-SLOPE WATER	0 FEET	3	6
PHYSICAL STATE		3	3
TOTAL ROUTE CHARACTERISTICS SCORE:			15
3. CONTAINMENT		3	3
4. WASTE CHARACTERISTICS			
TOXICITY/PERSISTENCE:CREOSOTE			15
WASTE QUANTITY CUBIC YDS	2501		
DRUMS	0		
GALLONS	0		
TONS	0		
TOTAL	2501 CU. YDS	8	8
TOTAL WASTE CHARACTERISTICS SCORE:			23
5. TARGETS			
SURFACE WATER USE		2	6
DISTANCE TO SENSITIVE ENVIRONMENTS		0	0
COASTAL WETLANDS	NONE		
FRESH-WATER WETLANDS	NONE		
CRITICAL HABITAT	NONE		
DISTANCE TO STATIC WATER	> 3 MILES		
DISTANCE TO WATER SUPPLY INTAKE	12000 FEET		
AND	MATRIX VALUE	4	4
TOTAL POPULATION SERVED	4		
NUMBER OF HOUSES	1		
NUMBER OF PERSONS	0		
NUMBER OF CONNECTIONS	0		
NUMBER OF IRRIGATED ACRES	0		
TOTAL TARGETS SCORE:			10

SURFACE WATER ROUTE SCORE (Ssw) = 16.08

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HRS AIR ROUTE SCORE

CATEGORY/FACTOR	RAW DATA	ASN. VALUE	SCORE
1. OBSERVED RELEASE	NO	0	0

2. WASTE CHARACTERISTICS

REACTIVITY: MATRIX VALUE

INCOMPATIBILITY

TOXICITY

WASTE QUANTITY CUBIC YARDS
DRUMS
GALLONS
TONS

TOTAL

TOTAL WASTE CHARACTERISTICS SCORE: N/A

3. TARGETS

POPULATION WITHIN 4-MILE RADIUS
0 to 0.25 mile
0 to 0.50 mile
0 to 1.0 mile
0 to 4.0 miles

DISTANCE TO SENSITIVE ENVIRONMENTS
COASTAL WETLANDS
FRESH-WATER WETLANDS
CRITICAL HABITAT

DISTANCE TO LAND USES
COMMERCIAL/INDUSTRIAL
PARK/FOREST/RESIDENTIAL
AGRICULTURAL LAND
PRIME FARMLAND
HISTORIC SITE WITHIN VIEW?

TOTAL TARGETS SCORE: N/A

AIR ROUTE SCORE (Sa) = 0.00

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
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HAZARD RANKING SYSTEM SCORING CALCULATIONS
FOR
SITE: GULF STATES CREOSOTE
AS OF 03/07/90

GROUND WATER ROUTE SCORE

ROUTE CHARACTERISTICS		12
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	23
TARGETS	X	44

= 36432 /57,330 X 100 = 63.55 = S_{gw}

SURFACE WATER ROUTE SCORE

ROUTE CHARACTERISTICS		15
CONTAINMENT	X	3
WASTE CHARACTERISTICS	X	23
TARGETS	X	10

= 10350 /64,350 X 100 = 16.08 = S_{sw}

AIR ROUTE SCORE

OBSERVED RELEASE 0 /35,100 X 100 = 0.00 = S_{air}

SUMMARY OF MIGRATION SCORE CALCULATIONS

	S	S^2
GROUND WATER ROUTE SCORE (S_{gw})	63.55	4038.60
SURFACE WATER ROUTE SCORE (S_{sw})	16.08	258.57
AIR ROUTE SCORE (S_{air})	0.00	0.00
$S^2_{gw} + S^2_{sw} + S^2_{air}$		4297.17
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}$		65.55
$S_M = \sqrt{(S^2_{gw} + S^2_{sw} + S^2_{air})}/1.73$		37.89

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P. O. Box 10385
Jackson, Mississippi 39209
(601) 961-5171

FILE COPY

CHRONOLOGY

AMERICAN CREOSOTING COMPANY

↓

Operated creosoting plants at various locations

↓

Gulf States Creosoting - a subsidiary of Am.Creosoting Company
Operated the H'Burg plant and others

1956

Union Bag & Paper Corp (predecessor to U.Camp)
Agreement w/Am.Cresoting Co. to purchase certain assets

↙ U. Camp Purchased stock in Georgia Forest, a subsidiary of AmCre Co.

↘ American Creosoting Corporation was formed and it purchased other assets of Am.Cre.Co - including the H.'Burg plant, the Connecticut plant & others

↓

1958 G. States was liquidated and
its assets & liabilities were transferred
to AmCreCorp.

1960

Am.Cres. Corp. transferred its lease on
the H'Burg site to Industrial Park, Inc.

1964

U. Camp/K.McGee Purchase Agreement - U. Camp agrees
to sell all stock in AmCre.Corp to K.McGee

1965

AmCreCorp merges w/its subsidiary, T. J. Moss, Inc.

Name changed to Moss American, Inc.

Moss American became a subsidiary of K.M. Chemical

(1974)

Moss American, Inc. merged into K.M. Chemical & K.M. Chemical assumed all of Moss American's liabilities, which included all of AmCr.Corp's past liabilities

FAX TRANSMITTAL SHEET

TO: Reed Allison
DGNB, Hattiesburg

PH#: 545-4322 FAX#: 545-4391

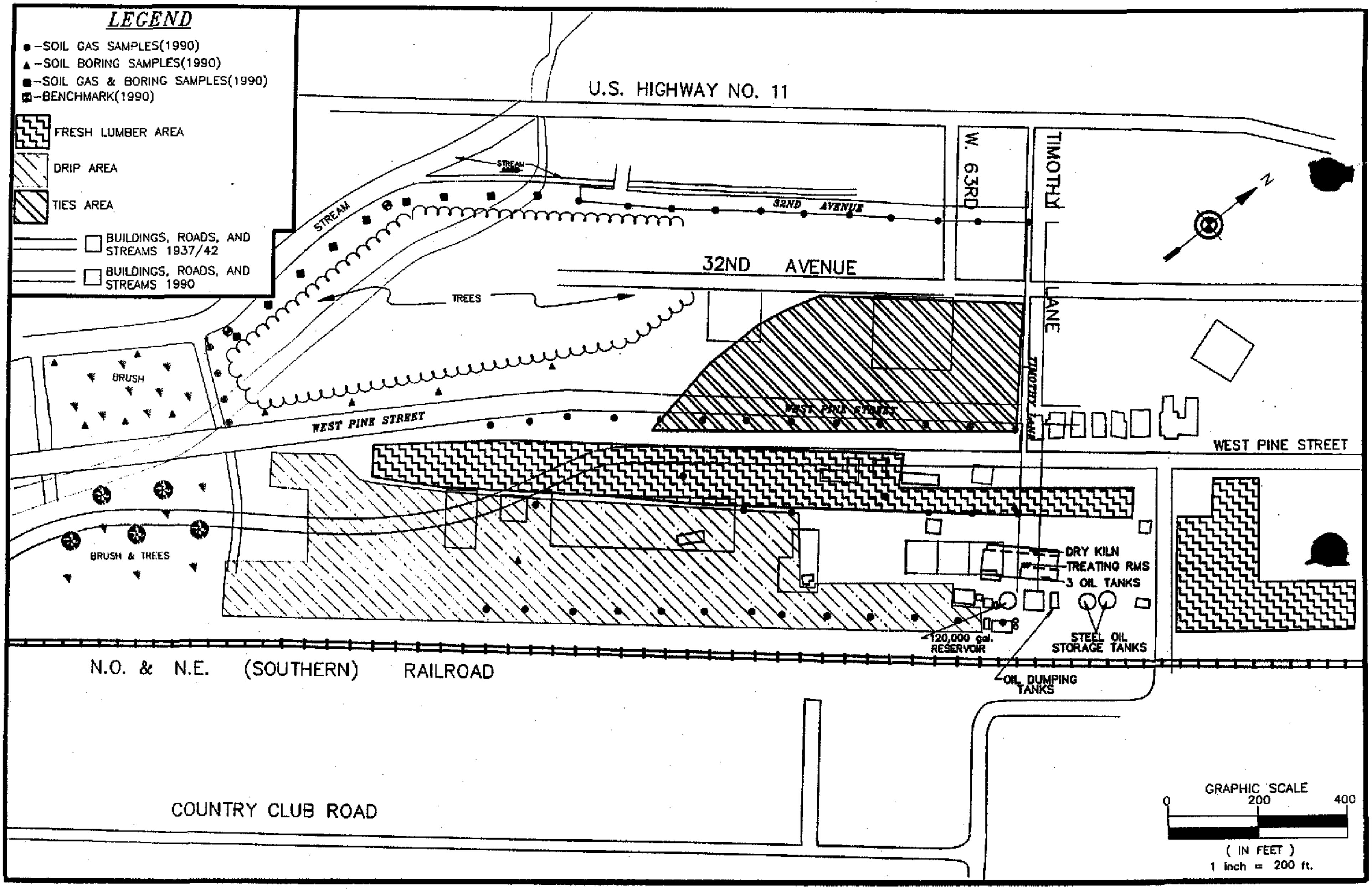
FROM: Jerry Banks
DEPART. OF ENVIRONMENTAL QUALITY
OFFICE OF POLLUTION CONTROL
HAZARDOUS WASTE DIVISION
P. O. BOX 10385
JACKSON, MS 39289-0385
FAX#601/961-5741 PH#: 601/961-5221

DATE: Oct. 23, 1992

[ ] ROUTINE [X] PRIORITY

Please deliver the following 2 pages including transmittal sheet to the above addressee. If there are any problems with this FAX, PLEASE CALL 601/961/5171 or the telephone number as shown above.

Message: Bob Rogers Emergency Response (961-5079)


LEGEND
-SOIL GAS SAMPLES(1990)
-SOIL BORING SAMPLES(1990)
-SOIL GAS & BORING SAMPLES(1990)
-BENCHMARK(1990)
FRESH LUMBER AREA
DRIP AREA
TIES AREA
BUILDINGS, ROADS, AND STREAMS 1937/42
BUILDINGS, ROADS, AND STREAMS 1990
U.S. HIGHWAY NO. 11
W. 63RD
TIMOTHY
LANE
TIMOTHY LANE
32ND AVENUE
32ND AVENUE
STREAM
STREAM
TREES
WEST PINE STREET
WEST PINE STREET
WEST PINE STREET
BRUSH
BRUSH & TREES
N
DRY KILN
TREATING RMS
3 OIL TANKS
STEEL OIL STORAGE TANKS
120,000 gal. RESERVOIR
OIL DUMPING TANKS
N.O. & N.E. (SOUTHERN) RAILROAD
COUNTRY CLUB ROAD
GRAPHIC SCALE
0
200
400
(IN FEET)
1 inch = 200 ft.

MEMORANDUM

TO: Bob Rogers

FROM: Richard Ball

RE: Hattiesburg - American Creosote Site

DATE: January 4, 1990

8-7-89 Jim Vance, Mobile District Corps., reported to this agency creosote in borings along Gordon Creek.

8-31-89 I investigated site and discovered creosote seeping into Gordon Creek. Title search of county records revealed a creosote operation was in operation along Gordon Creek from around 1900 to 1960. The last operator of record was American Creosote. The site is located on 16th sections land, with the Hattiesburg School District as trustee.

9-5-89 Don Rigger, EPA and myself investigated the site. Creosote was found seeping into creek. Water samples from creek taken.

9-12-89 Contacted Hattiesburg School District Superintendent about our discovery on Gordon Creek and implication.

10-10-89 Meet with Mayor of Hattiesburg and discussed what this agency had found.

12-12-89 Contacted Mobile District of Corps., and told them of the problem we found in Gordon Creek.

1-2-90 Don Rigger, Greg Powell, EPA, Jim Vance, Ken Guidry, Corps of Engineers, Joe Meador, City of Hattiesburg, Burce Reid, Pat Harrison, Waterway District, and myself met and discussed the problem along Gordon Creek as it relates to Hattiesburg flood control project.

1-22-90 EPA plans to sample area. At present, we do not know how large and extensive an area is contaminated. The old site was around 84 acres along the railroad, about 1/2 mile long by 1/4 mile wide. Today this area is covered by car dealers, and other small businesses. Plan to contact local authorities and affected lease holders when identified prior to the 22d and inform them of our investigation.

RB-4:lr

Memorandum

To: Bob Rogers
From: Richard Ball

Subject: Gulf State Creosote - Hattiesburg
Sec 16, T4N R13W Forest County, Ms.

Date Aug. 13, 1990

8-7-90 Mobile District Corp. and Pat Harrison Water Way District, reported to this Agency creosote in borings along Gordon Creek.

8-31-89 This Agency investigated ~~[illegible]~~ and discovered creosote seeping into Gordon Creek. Title search of county records revealed a creosote ~~[illegible]~~ mill was in operation ~~along Gordon Creek~~ from around 1900 to 1960. The last operator of record was American Creosote. This ~~[illegible]~~ mill was located on 16th section land, with the Hattiesburg School District as trustee.

9-5-89 E.P.A and this Agency investigated site. Water samples ~~from Gordon Creek~~ were taken. Creosote was found ~~[illegible]~~ seeping into ~~Creek~~ Gordon creek.

9-12-89 Contacted City of Hattiesburg and Hattiesburg School District about our discovery and implications.

1-2-90 Don Rigger, Greg Powell, E.P.A, Jim Vance Ken Guidry, Corp of Engineers, Joe Meador, City of Hattiesburg, Bruce Reid, Pat Harrison Waterway District, and myself met and discussed the problem along Gordon Creek as it relates to Hattiesburg flood control project.

1-22-90 E.P.A plans to sample area. At present, we do not know how large and extensive an area is contaminated. The old site was around 84 acres, along the railroad. Today this area is covered by car dealers, and other small businesses.

5-1-90 Soil sample sent to E.P.A, Edison, N.J. as to Bio remediation

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
Bureau of Pollution Control
P.O. Box 10385
Jackson, Mississippi 39289-0385
(601) 961-5171

October 6, 1989

Mr. Don Rigger
EPA Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Don:

Re: American Creosoting Corporation
Hattiesburg, Mississippi

This site is located on 16th section land. A legal description can be found in the attached copy of an instrument recorded in DB 44, page 295. In Mississippi, 16th section land is school trust land, with title held by the State, and the local school board as trustee. I have contacted the Hattiesburg Public School District about this problem, and their reply is enclosed.

I researched the county land records along with old records at the University of Southern Mississippi. The first records of a creosoting operation was 1920. I also found some pictures, along with a 1930 fire insurance survey. The following is a list of instruments on record showing who leased or operated a creosoting operation.

1. July 30, 1920 - Agreement to install railroad tracks from NO and NE Railroad Company to Hattiesburg Creosoting Company and recorded in DB 20 page 402.

2. January 3, 1929 - Right of way easement from Gulf States Creosoting Company to the City of Hattiesburg, and recorded in DB 35 page 517.

3. May 26, 1930 - Lease transfer from C.B. McLeod to Gulf States Creosoting Company and recorded in DB 38 page 555.

4. March 20, 1933 - Lease transfer from the Gulf States Liquidating Company (aka Hattiesburg Creosoting Company) to Gulf States Creosoting Company, and record in DB 44 page 295. A copy of this instrument is attached for a legal description of the property.

5. July 7, 1947 - Release of property from the Board of Supervisors of Forest County to Gulf States Creosoting Company, and recorded in MB 22 page 465. Before 1978, the trustee was the County Board of Supervisors.

6. July 18, 1960 - Transfer of unexpired lease from American Creosoting Corporation to Industrial Park, Inc. and recorded in DB 224 page 254.

American Creosoting was the last operator on this property. From 1960 to today this area has changed from industrial to commercial - residential.

I am enclosing pictures of Gordon`s Creek taken when you were here. This creek flows through the heart of Hattiesburg`s residential area, taking in Kempor Park Zoo, Jaycee Park, and Hattiesburg High School.

The geology for this area is Miocene with the site being Pleistocene high terraces. In 1988, this formation was designated sole source aquifer, west of the Pearl River. There are 9 public water wells within two miles.

This site needs immediate action taken. If I can be of any further assistance, or if you have any questions, please do not hesitate to contact me.

Sincerely,

Richard Ball

Richard Ball
ES&T Branch

RB-1:lr
Enclosure

Established 1885
GORDON WALKER, ED. D.
SUPERINTENDENT

Hattiesburg Public School District
POST OFFICE BOX 1569 • 301 MAMIE STREET
HATTIESBURG, MISSISSIPPI 39403-1569

TELEPHONE
(601) 584-6283

September 14, 1989

RECEIVED
SEP 15 1989
Dept. of Natural Resources
Bureau of Pollution Control

Mr. Richard Ball
Bureau of Pollution Control
Post Office Box 10385
Jackson, MS 39289-0385

Dear Mr. Ball:

The purpose of this letter is to confirm our conversations of yesterday and today regarding pollution on sixteenth section land.

Please be advised that the Hattiesburg School District will cooperate fully in this investigation and seeks a speedy resolution to the matter. However, please also know that the district does not assume responsibility for such pollution nor does the district have funds for remediation of the problem.

Please advise me as soon as possible in regard to specific actions to be taken by the Bureau of Pollution Control or the Environmental Protection Agency along with a request for specific information needed from our district.

Thank you very much for your cooperation in this matter.

Sincerely,

Gordon Walker

Gordon Walker
Superintendent

GW:lc

pc Mr. Johnny DuPree

- Gordons Creek site, Hattiesburg

Water Sample collected: 1400 31 Aug 89

Naphthalene	57.42 ug/ml (ppm)
Acenaphthylene	1.57
Acenaphthene	23.91
Fluorene	26.74
Phenanthrene	43.27
Anthracene	11.64
Fluoranthene	40.62
Pyrene	31.53
Benzo(a)Anthracene	9.80
Chrysene	8.36
Benzo(b)fluoranthene	3.88
Benzo(k)fluoranthene	5.58
Benzo(a)pyrene	4.66
Indeno(1,2,3-c,d)Pyrene	1.20
Dibenzo(a,h) Anthracene	0.201
Benzo(ghi)Perylene	0.706

Total PNA's: 271.0 ug/ml (ppm

MDL 1.0 ug/ml (ppm)

Analyst: David McDonald
Bonner Analytical Testing Co.

Jordans Creek Site, Hattiesburg

Soil Sample collected: 1400 31 Aug 89

Naphthalene	2,830 ug/g (ppm)
Acenaphthylene	43.75
Acenaphthene	783.6
Fluorene	919.3
Phenanthrene	2,021
Anthracene	355.3
Fluoranthene	1,037
Pyrene	861.1
Benzo(a)Anthracene	215.0
Chrysene	217.4
Benzo(b)fluoranthene	73.46
Benzo(k)fluoranthene	142.9
Benzo(a)pyrene	109.1
Indeno(1,2,3-c,d)Pyrene	9.04
Dibenzo(a,h) Anthracene	ND
Benzo(ghi)Perylene	3.37

Total PNA's 9,620 ug/g (ppm)

MDL 5.0 ug/g (ppm)

Analyst: David McDonald

Bonner Analytical Testing Co.

Bonner Analytical Testing Company

Rt. 14, Box 509
Hattiesburg MS 39402

Telefax Communication

To: Richard Ball
Bureau of Pollution Control

\# of Pages 3 (including cover)

Date/Time 1 Sep 89 1825

If you have any problems with this transmittal, call (601) 264-2854.
Our fax # is (601) 268-7084.

EXPRESS

STATE OF MISSISSIPPI

DEPARTMENT OF ENVIRONMENTAL QUALITY

RAY MABUS
GOVERNOR

March 8, 1990

FILE COPY

Mr. Brian Farrier
Site Investigation and Support
Branch
Waste Management Division
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Farrier:

Re: Gulf State Creosote
MSD985967199
Hattiesburg, MS

Enclosed is a preliminary assessment for the above referenced site. A site discovery form for this site was sent to you on February 14, 1990. On the discovery form, the site was identified as American Creosote. We later realized that the site had already been entered into CERCLIS under the name of Gulf State Creosote, so please disregard the February 14, 1990, notification.

According to our emergency response staff, EPA Region IV is planning a removal action at this site. With your concurrence, the Bureau could perform an SSI at the site later this year or in calendar year 1991.

Please contact Michael Slack or me if you have any questions or comments.

Sincerely,

Jim Hardage
Hazardous Waste Division

JH-5:lr
Enclosure

BUREAU OF POLLUTION CONTROL, P.O. BOX 10385, JACKSON, MS 39289-0385, (601) 961-5171

A
PRELIMINARY ASSESSMENT (PA)
REPORT FOR
GULF STATE CREOSOTE
HATTIESBURG, MISSISSIPPI
MSD985967199

PREPARED FOR:

Brian Farrier
Site Investigation and Support Branch
Waste Management Division - Region IV
Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, GA 30365

PREPARED BY:

Michael Slack
Hazardous Waste Division
Mississippi Bureau of Pollution Control (BPC)
P.O. Box 10385
Jackson, Mississippi 39289-0385

REVIEWED AND EDITED BY:

Jim Hardage (BPC)

March 6, 1990

This Preliminary Assessment (PA) Report includes:

1. Introduction
2. Background
3. Site Description
4. Sampling History
5. Waste Description/Containment
6. Geology/Hydrology
7. The Aquifer of Concern
8. Precipitation
9. Surface Water
10. Sensitive Environments
11. Conclusions and Recommendations
12. Appendix
    (a) HRS II Checklist
    (b) References (1 to 16)

Introduction

The following report is a preliminary assessment (PA) of the Gulf State Creosote site in Hattiesburg, Mississippi.

County Code: 035

Congressional District: 05

Coordinates: Latitude 31° 18' 50"
Longitude 89° 18' 50"

Location: NW 1/4 SW 1/4 S16 T4N R13W

Directions to Site: The Gulf State Creosote site may be reached by traveling south on Highway 49 through the City of Hattiesburg. Take the Highway 11 exit and travel east to northeast for approximately 0.6 to one mile. Turn right onto Timothy Lane and continue for two blocks. Turn right onto Pine Street. The Gulf State Creosote site is adjacent to the road on the right and left sides.

Background

In August of 1989, Richard Ball of the Mississippi Bureau of Pollution Control (BPC) investigated the site due to reports from the Corps of Engineers, Mobile District, indicating creosote in borings along Gordans Creek. A title search of county records revealed a creosote plant was in operation along Gordans Creek from around 1900 to 1960. The Gulf States Creosoting Company operated on the site from the mid 1930's to the late 1950's. The last operator of record was American Creosote (Reference 4).

Site Description

The Gulf State Creosote site is approximately 84 acres in size, about 1/2 of a mile long and 1/4 of a mile wide. The site is located along Gordans Creek, which flows through the site in a north northeasterly direction. A railroad borders the site to the southeast.

The site at one time, during the creosote operating years, consisted of buildings, structures, tanks, boilers, machinery, and equipment. Today the site consists of vacant lots, automobile dealers, and other small businesses (References 4 and 5).

The site is located on the south side of the City of Hattiesburg and is surrounded by residential areas, schools, and small businesses. The site is located on 16th section land with the Hattiesburg School District as trustee (References 4 and 5).

Sampling History

Currently, EPA emergency response personnel and the BPC are conducting a sampling investigation of the site.

Waste Description/Containment

According to site visits in 1989 by the BPC and EPA emergency response personnel, creosote was discovered leeching into Gordans Creek. The waste was observed to be unconsolidated with no diversion or containment system present.

The hazardous substance of concern is creosote which is moderately toxic and highly persistent. The areal extent of contamination is not known at this time; therefore, a maximum waste quantity is assumed. The physical state of the hazardous substance at the time of disposal was a liquid and/or sludge.

Geology/Hydrology

The stratigraphic units below the site in descending order are as follows: Hattiesburg Formation and the Catahoula Sandstone, Vicksburg Group (Undifferentiated) and the Yazoo Clay (Reference 2).

Fresh-water aquifers in the study are mostly beds of sand or zones of sandy beds. The beds dip gently to the southwest and contain fresh water as much as 40 miles from the outcrops (Reference 2).

Prediction of aquifer thickness and lithology is difficult because of the lenticular bedding of most units. Lithologic changes occur in short distances and individual sands, which are, regular and thicken or thin in short distances, are difficult to trace, especially along the dip of the beds (Reference 2).

At Hattiesburg, the Hattiesburg Formation consists of thick beds of massive clays - 150 or 200 feet thick - which contain some lime but very little sand. Geophysical logs of nearby wells to the east of the site indicate a clay layer that occurs approximately 30 feet above sea level. The clay layer ranges from 110 to 180 feet in thickness and is overlain by and grades upward into alternating fine-grained silty sands and clays. The clay layer is underlain by interbedded sands and clays. The sands increase in prominence and become gravelly toward the base. A geohydrologic section to the west of the site (within the three-mile radius) indicates numerous silty sands and clay lenses underlying the land surface with sands increasing in prominence approximately 100 feet below sea level. There is no uniform clay layer present, i.e., the clay layer mentioned above is not continuous over the three-mile radius

(References 2, 6, and 8). Four Forrest County aquifer tests of the Hattiesburg Formation show hydraulic conductivities ranging from 96 to 180 ft/d (Reference 11).

Separating the Hattiesburg from the underlying Catahoula is extremely difficult. To avoid confusion both of these units are referred as the Miocene Aquifer System. The aquifer system is composed of numerous interbedded layers of sand and clay (sand beds in the Miocene are characteristically lens-shaped or wedge-shaped). Because of the interbedded nature, the formations cannot be reliably separated and correlated either on the surface or in the subsurface.

Recharge to the Miocene Aquifer is from rainfall directly on the outcrop and leakage between aquifer units of the Miocene Aquifer System. Ten Forrest County aquifer tests of the Catahoula Sandstone, which is the lower unit of the Miocene Aquifer System, show hydraulic conductivities ranging from 18 to 170 ft/d. Hydraulic condutivities average 95 ft/d for the Miocene Aquifer System. Lithologic data indicates that the Miocene Aquifer System extends to a depth in excess of 1000 feet below sea level with the base of fresh water occurring approximately 800 feet below sea level (References 3, 10, and 11).

Underlying the Miocene Aquifer is the Vicksburg Group (Undifferentiated) which is generally composed of limestone beds alternating with thin beds of limy sand and clay. The clay formations effectively isolate the overlying Miocene Aquifer System (References 2 and 10).

The Aquifer of Concern

The Hattiesburg Formation and the Catahoula Sandstone are considered as a single hyraulic unit, referred to as the Miocene Aquifer System. These aquifers constitute the aquifer of concern (AOC).

The first water bearing unit of the AOC occurs in the surficial aquifer (Hattiesburg Formation) at a depth of approximately 15 feet below the land surface. The unsaturated zone consists primarily of silty sands and silty clays and has an average hydraulic conductivity of approximately 1×10^{-5} cm/s (References 1, 6, 7, and 13).

U.S.G.S. identifies the following public water supply wells in the AOC within the three-mile radius of the site:

> Four (4) wells for the City of Hattiesburg identified as #D004, #D005, #D006, and #D007 on the U.S.G.S. water wells printout. There are seven (7) additional City of Hattiesburg wells which are located between the three and four-mile radius from the site. According to the Mississippi State Department of Health, Division of Water Supply, the water from all the City of Hattiesburg wells (11) is mixed into one distribution system.

Two (2) wells for the Central Water Association identified as #D045 and #D046 on the U.S.G.S. water wells printout.

Two (2) wells for the Palmers Crossing Water Association identified as #D042 and #D044 on the U.S.G.S. water wells printout.

The City of Hattiesburg wells, the Central Water Association wells, and the Palmers Crossing Water Association wells supply an estimated population of approximately 58,121 (References 7 and 14). These wells are screened from approximately 330 feet below the land surface to a maximum depth of approximately 650 feet.

There are also numerous domestic private wells occurring in both units of the AOC within the three-mile radius. No other drinking water source is presently available (References 7 and 14).

The nearest well in the AOC is a private well located approximately 3400 feet southeast of the site. The well is located and identified as U.S.G.S. #D106 on the topographic map and the water wells printout. The well is screened at a depth of approximately 667 feet below the land surface (Reference 7).

Precipitation

The climate of southeastern Mississippi is humid and semitropical. Average annual rainfall is approximately 60 inches. Average annual runoff from the numerous streams in the area is approximately 20 inches. The remainder of the precipitation seeps into the ground or is dissipated by evapotransportation (Reference 2).

The mean annual lake evaporation for the area is approximately 46 inches. The net annual precipitation of the area is about 14 inches. The one-year, twenty-four-hour rainfall is approximately 4 inches (References 1 and 2).

Surface Water

The Gulf State Creosote site is located adjacent to Gordons Creek which is the nearest perennial downslope surface water (i.e., the site is in surface water). Gordons Creek flows in a north northeasterly direction before entering the Leaf River approximately 4.5 stream miles from the site. The three-mile migration pathway begins and ends in Gordons Creek (Reference 5).

The site and surrounding area is relatively flat with a slight gradient to the west southwest. The surface elevation of the sight is approximately 180 feet above mean sea level (Reference 5).

According to the Mississippi Bureau of Land and Water Resources, there is one surface water intake located along the three-mile migration pathway. The water is used for domestic purposes with the intake located approximately 2.25 stream miles from the site. Gordons Creek is generally used for recreational purposes such as fishing and swimming (References 5 and 12).

Environmental Concerns

There are no critical habitats of federal endangered species or national wildlife refuges within one mile of the site along the surface water migration pathway (Reference 15).

Topographic maps of the Gulf State Creosote site and the surrounding area indicate no wetlands along the migration pathway (Reference 5).

Conclusions and Recommendations

According to our emergency response staff, EPA Region IV is planning a removal action at this site. With your concurrence, the Bureau could perform an SSI at the site later this year or in the calendar year 1991.

REFERENCES

1. EPA HRS Guidance Manual.

2. Water for Industrial Development in Forrest, Greene, Jones, Perry, and Wayne Counties, Mississippi, Water Resources Division, U.S. Geological Survey, 1966, pp. 2,3, 38-43.

3. A Preliminary Assessment Reassessment (PAR) Report for Hercules, Incorporated, Hattiesburg, Mississippi, prepared by Michael T. Slack, Mississippi BPC, December 15, 1989.

4. Information on Gulf State Creosote Site, from Mississippi BPC, Hazardous Waste Division (HWD) Files.

5. Topographic Maps of the Gulf State Creosote Site: Hattiesburg SW, Mississippi Quadrangle 7.5 Minute Series; Hattiesburg, Mississippi Quadrangle 7.5 Minute Series; Carterville, Mississippi Quadrangle 7.5 Minute Series.

6. Forrest County Mineral Resources, Mississippi State Geological Survey, Bulletin 44, Mississippi University, 1941, p. 24.

7. Printout from U.S. Geological Survey Data Base of all Water Wells within a Three-mile Radius and Four-mile Radius of the Gulf State Creosote Site, Hattiesburg, Mississippi.

8. Geophysical Logs of Water Wells Near the Gulf State Creosote Site, Hattiesburg, Mississippi, from the Mississippi Bureau of Geology, #D-1, #D-4, #D-7, #D-12.

9. Shows, Thad N., Water Resources of Mississippi, Bulletin 113, Mississippi Geological, Economic, and Topographic Survey, Jackson, Mississippi, 1970, pp. 107, 114, and 115.

10. Gandl, L.A., Characterization of Aquifers Designated as Potential Drinking - Water Sources in Mississippi, U.S. Geological Survey, Water Resources Investigations, Open-File Report 81-550, Jackson, Mississippi, 1982, pp. 15, 17-20.

11. Results of Aquifer Tests in Mississippi, U.S. Geological Survey - Water Resources Division, Bulletin 71-2, 1971, pp. 10 and 22.

12. Information on Surface Water Use from the Mississippi Bureau of Land and Water Resources, Jackson, Mississippi.

13. Field Log of Borings, Gordons Creek, Hattiesburg, Mississippi, July 27, 1989.

14. Information on Public Water Supply Wells in Hattiesburg, Mississippi, from Water Supply Division, Mississippi State Department of Health.

15. U.S. Fish and Wildlife Service, Vicksburg Office, Species List, and U.S. Fish and Wildlife Service, Jackson Office, Topographic Maps Indicating Sensitive Environments.

16. Integrated Risk Information System (IRIS).

PA-1:lr

DB 34/248 American Creosote Works, Inc.
New Orleans Mobile & Chicago RR Co.

R-of-way being in SE¼ SE¼ 33 SW¼ SW¼ Sec 34 15N R 12 E.

for [illegible] by S. W. Labiot, Pres.

Aug. 5. 1915

DB 34/329 Town of Louisville
WD American Creosote Work, Inc. a La. corp.
5-22-1913 if plant operated for less than 10 yrs., [illegible] back to city.
N½ SE¼ SE¼ Sec 33 T15 R12E 20 Ac m/l
Also 1320 ft off of the South End of Block 7 of [illegible]

35/111 W. W. Estes
WD American Cresote Works
Beg at NW Corner Sec 3 14 12 run South on Sec Line
23 chains 32 links, then E 3 chain 68 links, & R/W G M and RR
then N 20 chain 25 links cont. 5.72 acre
Also NE¼ NE¼ Sec 4 14 R12E less 55/100 acre in NE
SE¼ NE¼ West of [illegible] Louisville & Philadelphia public Rd. 76 Acres

Dec. 31, 1918

DB 38/218 Charley Laufley & Mary
WD American Creosote Works.
Beg NW Corner Sec 3 T14 12E ... 45/100 acres
Also Beg at NE corn Sec 4 55/100 acr.

Jan. 23, 1923

Sec 33 T1S R12E

Sec 4, T14 R12E

DB 174/422

~~165/100~~

~~165~~/513

~~146~~/100

~~145~~/189

134/584

~~70~~/230

~~68~~/88

68/93-107 (Box 12)

~~41/589~~

~~49/136 OCD~~

~~45~~/624

3/451

MTG. 335/551

~~34/329~~

~~34/248~~

~~38/218~~

~~35/117~~

DB 68/93 American Creosote Works of Louisiana, Inc.
WD to American Creosote Works, Inc. by Harry H. White
Aug. 1, 1950

DB 145/189 American Creosote Works, Inc.
to American Creosote Works, Ms. Inc.
WD

Dec. 12, 1979

~~DB [illegible]~~ American Creosote Works, Inc.
DT. 385/675 to The Miss. Bank MTG. $650,000.
MTG. ~~MTG~~

Oct. 30, 1979

~~[illegible]~~ MTG. DT 385/675 Assig. from Ms. Bank to Savage
BB 146/800 Life Insurance Company,
March 26, 1980

~~DB 145/689~~

DB 165/500
Lease Agreement
with Opt. to Purchase

American Creosote Works Mississippi, Inc. Lessor
American Wood Treatment, Inc. Lessee

Feb. 1, 1984

DB 165/513
Lease Agreement
with Opt. to Purchase

American Creosote Works Mississippi Inc
American Wood Treatment, Inc,

~~March 22~~, Feb. 1, 1984

DB 174/202
Lease Agreement
with Opt. to Purchase

American Creosote Works ~~Co~~. Miss. Inc.
Superior Wood Products, Inc.

Dec. 3, 1986

45/624 American Creoste Works, Inc.
WD to Earl Barmare

[illegible] Jan. 3, 1930

City of Hattiesburg   Hattiesburg [illegible]

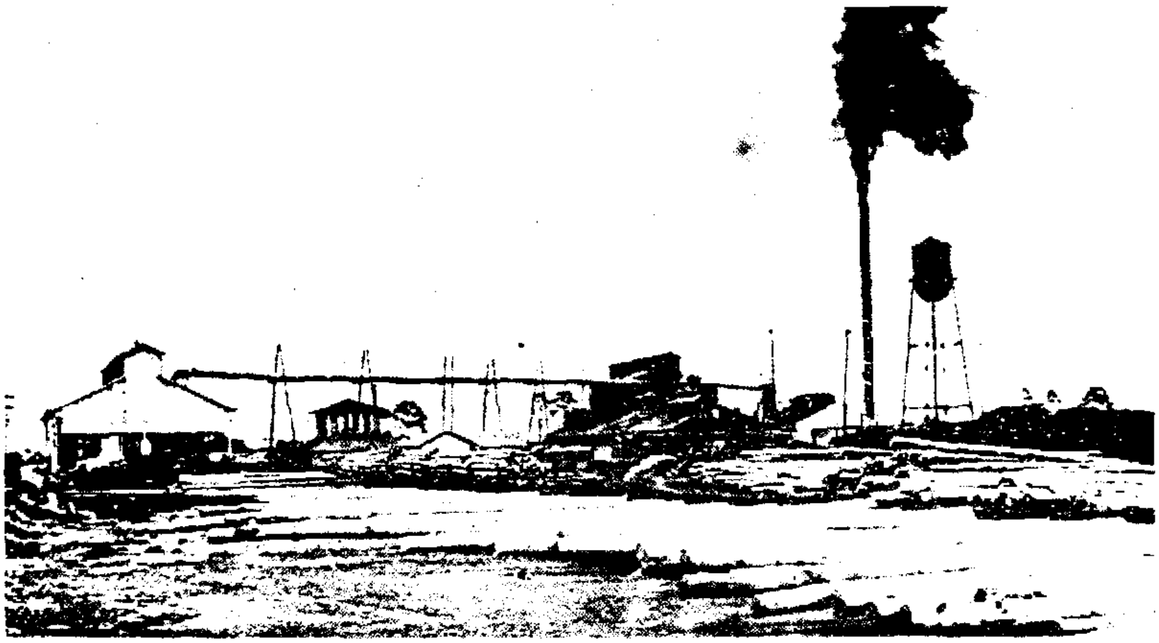
Dr. Gordon Walker. Super.

584-6283

City of Hattiesburg School District   584-6283

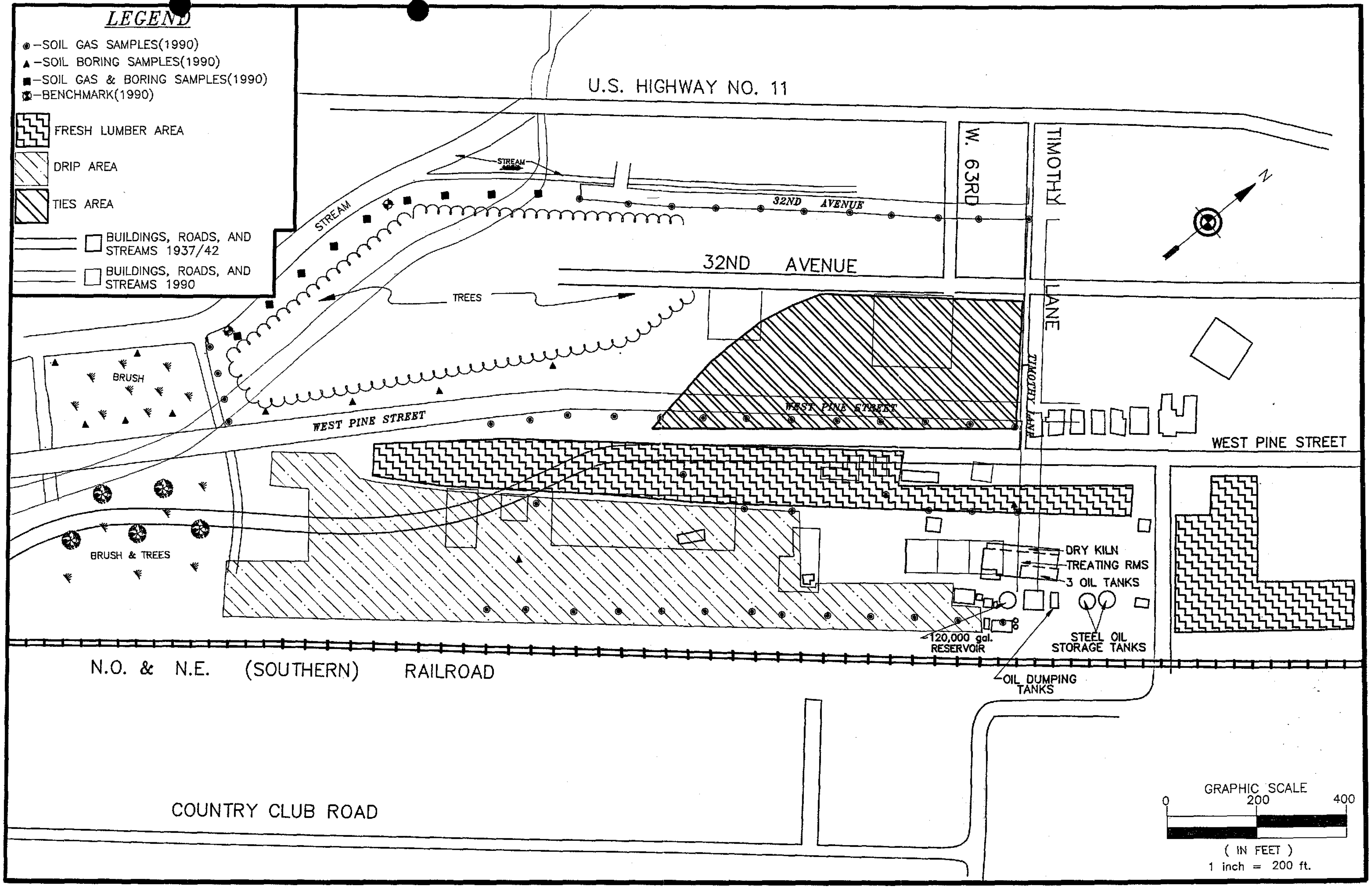
846 Main St.

Hattiesburg Ms. 39403

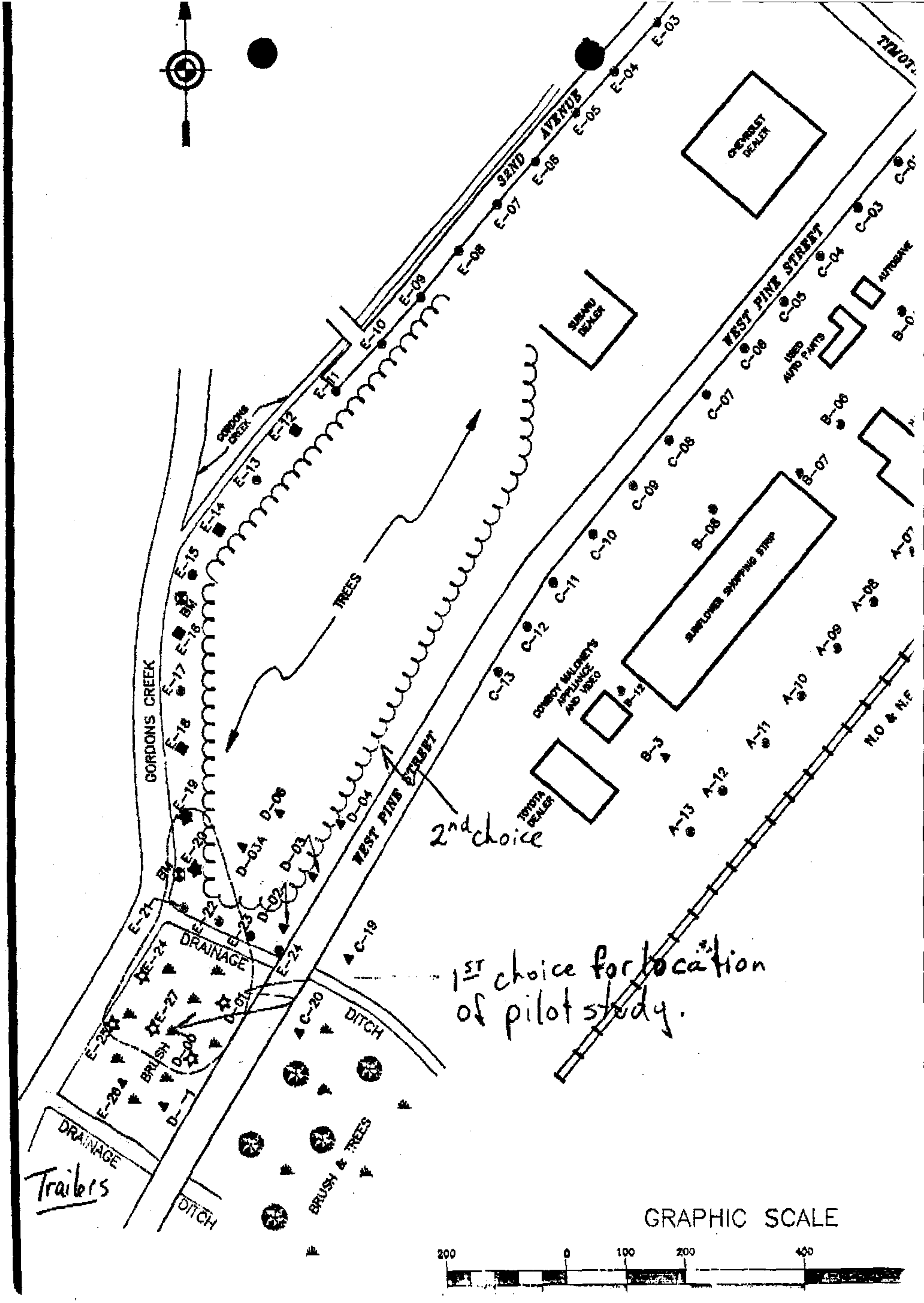


PLANT OF GULF STATES CREOSOTING CO.

PLANT OF HERCULES POWDER COMPANY



LEGEND
–SOIL GAS SAMPLES(1990)
–SOIL BORING SAMPLES(1990)
–SOIL GAS & BORING SAMPLES(1990)
–BENCHMARK(1990)
FRESH LUMBER AREA
DRIP AREA
TIES AREA
BUILDINGS, ROADS, AND STREAMS 1937/42
BUILDINGS, ROADS, AND STREAMS 1990
U.S. HIGHWAY NO. 11
W. 63RD
TIMOTHY LANE
STREAM
32ND AVENUE
32ND AVENUE
TREES
BRUSH
WEST PINE STREET
WEST PINE STREET
TIMOTHY LANE
WEST PINE STREET
BRUSH & TREES
DRY KILN
TREATING RMS
3 OIL TANKS
120,000 gal. RESERVOIR
STEEL OIL STORAGE TANKS
OIL DUMPING TANKS
N.O. & N.E. (SOUTHERN) RAILROAD
COUNTRY CLUB ROAD
N
GRAPHIC SCALE
0
200
400
(IN FEET)
1 inch = 200 ft.



SEND AVENUE
WEST PINE STREET
CHEVROLET DEALER
SUBARU DEALER
AUTOSAVE
USED AUTO PARTS
SUNFLOWER SHOPPING STRIP
COWBOY MALONEY'S APPLIANCE AND VIDEO
TOYOTA DEALER
GORDONS CREEK
TREES
DRAINAGE
BRUSH
DITCH
BRUSH & TREES
N.O & N.E
2nd choice
1st choice for location of pilot study.
Trailers
GRAPHIC SCALE
200
0
100
200
400

Property Description

SE¼ of SE¼ ... on 33, Township 15, Range 12 East l... the land described as: beginning at a point on the North line of said quarter section 573 feet west of the main line of N.O.M. and C.R.R. (now Gulf, Mobile and Ohio), thence due west 425 feet to a point, thence south 22 degrees west 390 feet to a point, thence south 67 degrees 45 minutes east 545 feet to a point, thence north 50 degrees east 540 feet to a point, thence due north 170 feet to a point, thence due west 354 feet to a point, thence north 22 degrees east 60 feet to point of beginning, containing 8 acres more or less, and also less the land described as: beginning at the northwest corner of SE¼ of SE¼ run east 250 feet, thence south 250 feet, thence in a southwestwardly direction to a point 550 feet south of beginning point, thence 550 feet north to a point of beginning; and,

Free and undisputed water rights in and to such an amount of water necessary to operate creosote plant in pond located on and also possibility of reverter conditioned upon failure of grantee to maintain pond or to allow creosote plant to use water from pond located on property described as, beginning at a point on the north line of SE¼ of SE¼ Section 33, Township 15, Range 12 East 573 feet west of the main line of N.O.M. and C.R.R. (now Gulf Mobile and Ohio Railroad), thence due west 425 feet to a point, thence south 22 degrees west 390 feet to a point, thence south 67 degrees 45 minutes east 545 feet to a point, thence north 50 degrees east 540 feet to a point, thence due north 170 feet to a point, thence due west 354 feet to a point, thence north 22 degrees east 60 feet to point of beginning, containing 8 acres, more or less; and,

The south 1320 feet of Block 7 of the Louisville Improvement Company Addition to the City of Louisville, Mississippi, according to the map of said addition on file in the Chancery Clerk's Office, Winston County, Mississippi, said tract being on the west side of the SW¼ of SW¼ Section 34, Township 15, Range 12 East; and,

Beginning at the southeast corner of the SW¼ ofSE¼ Section 33, Township 15, Range 12 East and run west 90 feet, thence north 590 feet, thence east 90 feet, thence south to point of beginning 590 feet, being in the SW¼ of SE¼ Section 33, Township 15, Range 12 East; and,

Beginning at the northeast corner of the NW¼ of the NE¼ Section 4, Township 14, Range 12 East and run west 200 feet, thence south 1056 feet, thence east 200 feet, thence north 1056 feet to point of beginning, all being in the NW¼ of the NE¼ Section 4, Township 14, Range 12 East and

East ½ of NE¼ lying west of the old Philadelphia and Louisville Road less the south 1/8 Section 4, Township 14, Range 12 East; and,

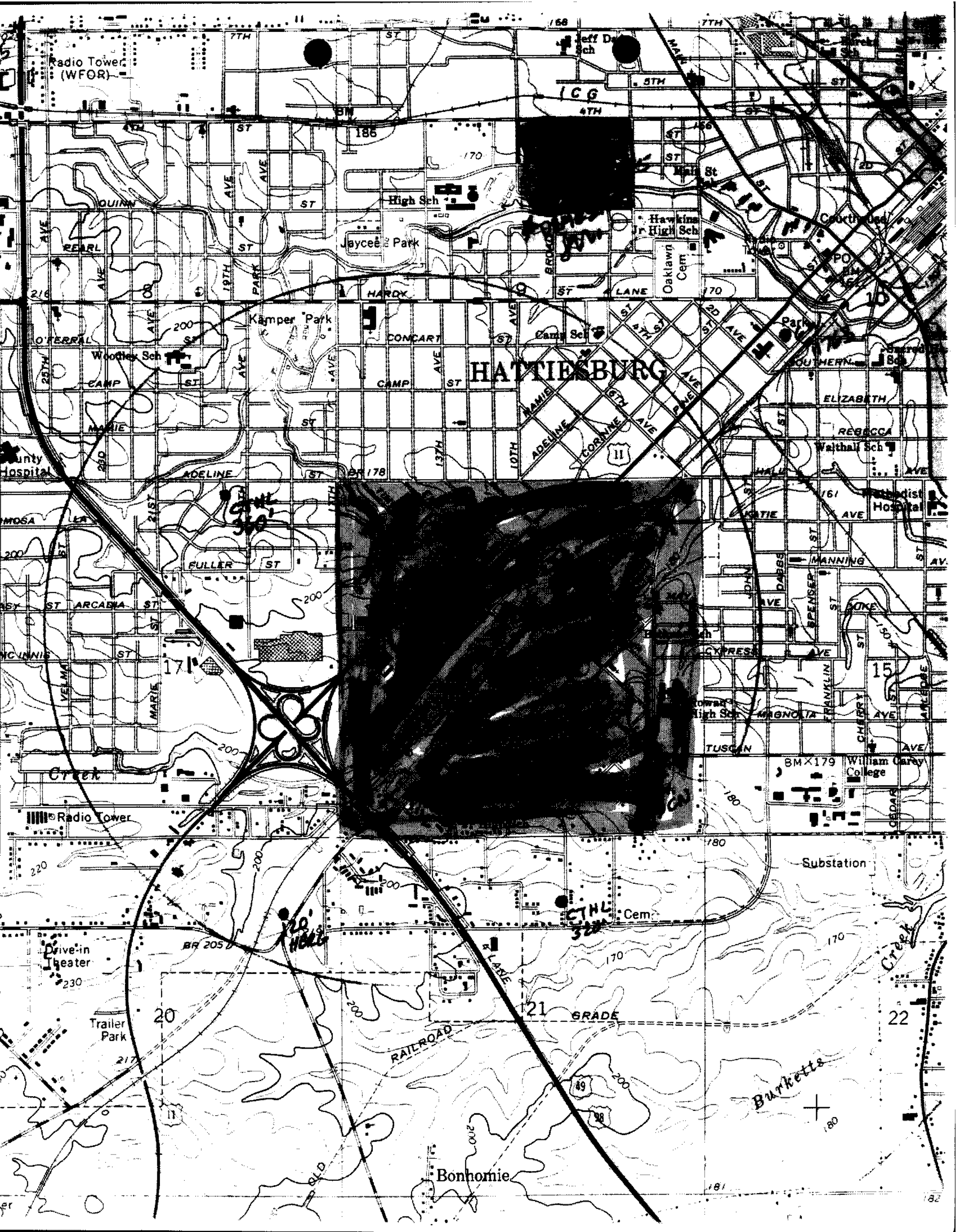
A strip of land on the west side of NW¼ of Section 3, Township 14, Range 12 East, described as beginning at the northwest corner of the NW¼ of Section 3, Township 14, Range 12 East and run south on the section line 23 chains and 32 links, thence east 3 chains and 68 links to right-of-way of the Gulf, Mobile and Northern Railroad (now Gulf, Mobile and Ohio Railroad), thence north along said right-of-way 23 chains and 32 links more or less to the north section line, thence west of section line to point of beginning.

..the above described r perty subject to the following:

Railroad right-of-way granted to New Orlenass, Mobile and Chicago Railroad two strips of land totaling 8646 feet in length and 20 feet wide, except where tracks pass building, being 10 feet on each side of center line of tracks of the American Creosote Works plant in the SE¼ of SE¼ of Section 33 and SW¼ of SW¼ Section 34, Township 15, Range 12 East. Tracks are set aside for the sole use of the American Creosote Works, Inc. in the operation of their creosoting plant, tracks not to be removed unless plant is removed, in event of removal land reverts to owner. Land Deed Book 41, Page 569.

Right of way granted to Mississippi Power Company a strip of land 100 feet in width for the purpose of erecting and maintaining electric, telephone, transmission lines over NW¼ of NE¼ less 8 acres on south side thereof Section 4, Township 14, Range 12 East; and 8 acres in northeast corner of the NE¼ of NW¼ Section 4, Township 14, Range 12; described as, 50 feet on each side of a line and the continuation thereof commencing at a point on the north boundary of said Section 4, this point being west 2637.2 feet from the northeast corner of said Section 4, this is the beginning point, thence south 20 degrees and 10 minutes east 1190 feet more or less to the south boundary line of said NW¼ of NE¼ less 8 acres off the south side of Section 4, Township 14, Range 12 East, Land Deed Book 41, Page 569.

together with all buildings, structures, and appurtenances thereto.



HATTIESBURG
Radio Tower (WFOR)
High Sch
Jaycee Park
Hawkins Jr High Sch
Oaklawn Cem
Kamper Park
Woodley Sch
Camp Sch
Walthall Sch
Methodist Hospital
William Carey College
Substation
Cem
Drive-in Theater
Trailer Park
Radio Tower
Bonhomie
Burketts Creek
Creek
7TH
5TH
4TH
QUINN
PEARL
HARDY
CONCART
O'TERRAL
CAMP
MARIE
ADELINE
CORINNE
MAMIE
ELIZABETH
REBECCA
KATIE
MANNING
CYPRESS
MAGNOLIA
TUSCAN
FULLER
ARCADIA
VELMA
FRANKLIN
CHERRY
SPENSER
DABBS
JOHN
CEDAR
GRADE
RAILROAD
OLD
LANE
BR 205
BR 178
BM×179
20
21
22
15
17

being duly sworn, says that the notice, a true copy of which is hereto annexed, appeared in the issues of said newspaper as follows:

Date 3-10, 1933

Number words 1000
Published 1 Times

Printer's Fee	$20.00
Making Proof	.50
Total	$20.50

(Signed) Thos. St. John, Publisher.

Sworn to and subscribed before me this 10 day of March 1933.

F. Delsing,
Notary Public.
My Commission Expires April 12, 1934.

(Seal)

Recording fee $6.20

&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&

THE GULF STATES LIQUIDATING COMPANY
TO ( ) DEED
THE GULF STATES CREOSOTING COMPANY

Filed for record 9 o'clock A.M. March 24, 1933,
Recorded March 24, 1933,
Ethel Baylis, Clerk.

STATE OF MISSISSIPPI: :
COUNTY OF FORREST : :

For and in consideration of the sum of -----FORTY THOUSAND & NO/100 ($40,000.00) DOLLARS ----- cash in hand paid, the receipt of which is hereby acknowledged, the undersigned THE GULF STATES LIQUIDATING COMPANY, a Mississippi corporation, does hereby grant, bargain, sell, convey and warrant unto the GULF STATES CREOSOTING COMPANY, a Delaware corporation, the following described property lying and being situated in the City of Hattiesburg, Forrest County, Mississippi, to-wit:

All of Block 75 of the D. D. McInnis Third Survey of the City of Hattiesburg, excepting, however, the following described parcels of land:

Except that parcel of land described as beginning at the Northwest corner of said Block 75 and run Eastward along the Southern boundary line of Florence Street a distance of 200 feet, thence at right angles to last named course Southward a distance of 150 feet, thence at right angles to the last named course Westward a distance of 200 feet to Thirty Second Avenue; thence Northward along the East boundary line of Thirty Second Avenue a distance of 150 feet to the point of beginning; and

Except also that part of land described as beginning at the Northeast corner of said Block 75 and run Southward along the West boundary line of West Pine Street 75 feet; thence at right angles to the last named course Westward 180 feet; thence at right angles to the last named course Northward 75 feet to Florence Street; thence at right angles to the last named course Eastward 180 feet to point of beginning; and

Except that parcel of land described as a part of said Block 75 beginning at the point of intersection of the Northwest line of Pine Street with the Southwest line of Florence Street and run thence Southwest along the Northwest line of Pine Street 75 feet to the point of beginning, and thence run Southwest along the North-west line of Pine Street, 75 feet, thence run Northwest at right angles to Pine Street 180 feet, thence run Northeast parallel with Pine Street 75 feet and thence run Southeast 180 feet to the point of beginning; and

All of Lot 1 of Block 74 of the D. D. McInnis Third Addition to the City of Hattiesburg, and

All of Lot 2 of the Davis & Johnson Subdivision of Block 74 of the D. D. McInnis Third Addition to the City of Hattiesburg; and

Beginning [illegible] Northerly corner of Block 72 of the original D. D. McInnis Third Survey o[illegible] Hattiesburg, the same being the point of intersection of the Southeaste[illegible] line of Thirty Second Avenue with the Southwesterly boundary line of the un[illegible] lying between Blocks 72 and 74 of the said D. D. McInnis Third Survey, [illegible] point of beginning, and run thence in a Southwesterly direction along the [illegible] boundary line of Thirty Second Avenue 550 feet, more or less, to the East prong [illegible] Creek, thence in a Southerly direction along and following the meanderings [illegible] Gordon's Creek 450 feet, more or less, thence run East 380 feet, more or less, t[illegible] boundary line of Lewin Avenue or Pine Street, thence run in a Northeast[illegible] along the Western boundary line of Lewin Avenue or Pine Street 710 fee[illegible] Easterly corner of said Block 72 of said D. D. McInnis Third Survey, [illegible] run Northwest along the Northeast boundary line of said Block 72 to the point [illegible]; the same containing 10 acres of land, more or less.

All of Bl[illegible], 12 and 13 of the Hicks Subdivision of the D. D. McInnis Survey of Secti[illegible] Township 4 North, Range 13 West, and

All of Bl[illegible] 4, 5, 6, 7, 8 and 14 of the Hicks Subdivision of the D. D. McInnis Survey [illegible] 16, Township 4 North, Range 13 West.

All of the [illegible] described land located in and being a part of Section 16, Township 4 North, Range [illegible] the City of Hattiesburg, Forrest County, Mississippi, and lying West of t[illegible] E. R.R. right of way through said section.

Said prope[illegible] described as:

Beginning [illegible] section of the Western boundary of Florence Street with the Southern bounda[illegible] Second Avenue, run thence South 44 degrees and 53 minutes West along the [illegible] boundary of Thirty Second Avenue a distance of 150 feet to a concrete monume[illegible] the point of beginning.

Thence ru[illegible] degrees and 53 minutes West which is along the southerly boundary of Th[illegible] Avenue for a distance of 2897.2 feet to a concrete monument, thence continu[illegible] above mentioned course a distance of 14 feet to the center of Gordon's Cr[illegible] South 84 degrees and 36 minutes East along center of Gordon's Creek a distan[illegible]; thence South 56 degrees and 22 minutes East along center of Gordon's Cre[illegible] of 15.81 feet; thence South 4 degrees and 15 minutes East along the cente[illegible] Creek a distance of 18.02 feet, thence South 14 degrees and 56 minutes West [illegible] center of Gordon's Creek a distance of 41.04 feet; thence South 4 degrees [illegible] East along the center of Gordon's Creek a distance of 18.02 feet; the[illegible] degrees and 30 minutes East along the center of Gordon's Creek a distan[illegible], thence South 76 degrees and 32 minutes East along the center of Gordo[illegible] distance of 69.02 feet, thence South 59 degrees and 44 minutes East al[illegible] of Gordon's Creek a distance of 17.46 feet; thence South 7 degrees and [illegible] along the center of Gordon's Creek a distance of 16.49 feet; thence South 0 [illegible] 58 minutes East along the center of Gordon's Creek a distance of 30.24 feet; [illegible] degrees and 18 minutes East along the center of Gordon's Creek a distan[illegible]; thence South 19 degrees and 41 minutes East along the center of Gordo[illegible] distance of 12.94 feet; thence West 38 feet to a concrete monument; thence co[illegible] a distance of 809.83 feet to a concrete monument located on the West bo[illegible] tion 16, Township 4 North, Range 13 West, thence South 1773.09 feet to a conc[illegible] which is the intersection of the West boundary line of Section 16 wit[illegible] sterly right of way line of the New Orleans and Northeastern Railroad; then[illegible] degrees and 53 minutes East along the Northwesterly right of way line of the New Orleans & Northeastern Railroad a distance of 4219.45 feet to a concrete monument, thence North 45 degrees and 07 minutes West a distance of 483 feet to a concrete monument which is on the Northwesterly boundary of West Pine Street; thence North 44 degrees and 53 minutes East along the Northwesterly boundary of West Pine Street a distance of 611.21 feet to a concrete monument, thence North 45 degrees and 07 minutes West a distance of 400 feet to point of beginning.

All of said property being located in Section 16, Township 4 North, Range 13 West, in Forrest County, State of Mississippi, and containing 84.43 acres, more or less.

The interest hereby conveyed is the unexpired portion of a lease on said land for 99 years made on July 3, 1854.

There is located on the above described property a creosoting plant consisting of buildings, structures, tanks, boilers, machinery and equipment, and this conveyance embraces and includes not only the above described lands, but any and all buildings, improvements, tanks, machinery and equipment going to and making up the said creosoting plant.

The grantor herein warrants the payment of all taxes on the above described land up to and including the year 1932. The grantee herein assumes and agrees to pay the taxes for the year 1933.

The Gulf States Liquidating Company is a corporation created and existing under and by virtue of the Laws of the State of Mississippi and was originally incorporated under the name of the Hattiesburg Creosoting Company, which name by proper Amendment to its Charter of Incorporation was changed to the Gulf States Creosoting Company, and which name has been recently changed by proper Amendment to its Charter of Incorporation to The Gulf States Liquidating Company.

Witness the signature and corporate seal of The Gulf States Liquidating Company hereunto affixed by its duly constituted and authorized officers on this the 20th day of March, A. D., 1933.

THE GULF STATES LIQUIDATING COMPANY,

(SEAL)

By H. S. Hagerty
Vice President

ATTEST:

T. C. Hannah
Secretary

WITNESSES:

A. D. Katz

Hazel C. Kraus

STATE OF MISSISSIPPI,

COUNTY OF FORREST,

CITY OF HATTIESBURG,

Personally came and appeared before me, the undersigned authority in and for said state, county and city, H. S. Hagerty, Vice President, and T. C. Hannah, Secretary, of The Gulf States Liquidating Company, a Mississippi corporation, who acknowledged that they signed, sealed, executed and delivered the foregoing and attached conveyance on the day and year therein mentioned for and on behalf of, and as the voluntary act and deed of, said Corporation.

Given under my hand and seal of office on this the 20 day of March, 1933.

Mrs. Ila Rester
Notary Public

(SEAL)

My Commission Expires May 6, 1936

"WHEREAS, The stockholders of this Corporation in their annual meeting assembled on the 15th day of February, 1933, at which time the corporate name of this Company was the GULF STATES CREOSOTING COMPANY, by proper resolution approved the sale of the creosoting plants of this Corporation to the GULF STATES CREOSOTING COMPANY, a Delaware corporation, and authorized and empowered this Board of Directors to provide for the form of transfer for said properties; and

WHEREAS, It now appears that practically all details in the consummation of the said transaction have been worked out to the mutual satisfaction of both parties:

NOW, THEREFORE, BE IT RESOLVED, That H. S. Hagerty, the Vice President, and T. C. Hannah, the Secretary, of this Corporation be, and they are hereby, authorized, empowered and directed to execute the proper and necessary deeds of conveyance, or other papers, for the purpose of conveying to and vesting in the GULF STATES CREOSOTING COMPANY, a Delaware corporation, the creosoting plants and other properties of this Company, and particularly the creosoting plants located at Slidell, Louisiana, Hattiesburg, Meridian and Jackson, Mississippi, Birmingham, Alabama, and Brunswick, Georgia; also the railroad and railroad right of way at Jackson, Mississippi, and the oil storage tank at Chalmette, Louisiana, together with the inventories and any other properties embraced and included in this transaction."

****

I hereby certify that the above and foregoing is a true and exact copy of the resolution passed at a regularly convened and held meeting of the Board of Directors of The Gulf States Liquidating Company on March 13, 1933, at which a quorum and majority of the said Board was present and participating.

This the 18th day of March, 1933.

T. C. Hannah

Secretary

(SEAL)

U.S. REVENUE STAMPS $40.00 ATTACHED AND CANCELLED

Recording fee $4.95

&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&

Mrs. Ed C. Corley — Filed for Record at 2 o'clock P. M. Mar.23,1933

To ( ) Deed — Recorded March 25, 1933.

Mrs. Gertrude C. Smith — Ethel Baylis, Clerk

STATE OF MISSISSIPPI

FORREST COUNTY.

For and in consideration of the sum of $250.00 and other valuable consideration heretofore and now paid and assumed, the receipt of which is hereby acknowledged, I hereby sell, convey and warrant to Mrs. Gertrude C. Smith, the following described lands situated and being in Forrest County, State of Mississippi;

All of Lot 15 - and 20 feet off West side Lot 14 Block 21, according to Hattiesburg Heights second survey, as per plat of said survey of record in office of Chancery Clerk of said County.

This land constitutes no part of my homestead.

Witness my signature this the 24th day of March 1933.

Mrs. Ed C. Corley

STATE OF MISSISSIPPI

FORREST COUNTY.

Personally appeared before me the undersigned authority, in and for said county and State, Mrs. Ed. C. Corley, who acknowledged that she signed and delivered the above and foregoing deed on the day and date therein mentioned as her act and deed and for the

H 0000 1030 - 000 - 001

Parcel 1 6.5 Acres SW of Creek

May 31, Sec 16, T4N R 13W Forrest Co.

Com SW corner NW1/4 N 460 ft E 763.15 ft to
SE line Hy 11 ; SW along SE line Hy 247.4 ft
to the P.O.B. ; SW along SE line H/W 410 ft ;
SE along Hy 50 ft ; SW along SE line Hy 200.9 ft ;
then E 219.2 ft ; then S 245.8 ft to Blk 13 Hick Subd.
then E 393.1 ft to West Bank Gordon Creek.
NE along W Bank Gordon Creek 143.0 ft
NE " " " " " 315.8 ft & NW
365 ft to Pt of Beg. Sec 16, 4 13

Tax Ass. to Sunburst Bank
P.O. Box 16059
H.burg Ms. 39402

Larry E. Morton & Sandra

DB 594 p 120
DB 602 - p. 389
DB 607 - p 409

Blk 13 Hicks Subd. D.D. McInnis 3d. survey
or Add to H.burg.

Parcel 5, 11.8 Acres MAP 31-1030-5

ppty Beg. 500 ft SW, intersection NW/L Pine St & SW/L 62nd Street. SWly Along Pine St. 1293.3 ft; N 50° 0' 8" W 272.4 ft; N 2° 0' 47" E 143 ft; N 4° 0' 7" E 212.3 ft; NEly 1059 ft; SEly 400 ft to P.O.B. Sec 16 T4N R13W

Tax acct RSCO Realty Co.
P.O. Box 1586
H. town

DB 224
p. 254
Deed

American Creosoting Corp, a [illegible] Del. corp
Industrial Park, Inc. a Ms corp.

Remaining unexpired term of a 16 sec lease per
Mr Bk 22 p 467 DB 96 p 470

July 18, 1960

DB 20
P- 402
· Co

N.O. & NE- Railroad Co
Hattiesburg Creosoting Co

7-30-1920

T.C. Hannah sec.
for Hattiesburg Co.

DB 44
P. 295
deed.

The Gulf State Liquidation Company
→ Gulf States Creosoting Company, a Delaware Corp

All DR 75 DB [illegible]

DB 206
p 248

Gulf Development Inc
Roy M. Conn & Lelia Mae R. Conn
pt. Sec 16, T4N R13W.

Jan. 8, 1959

DB 35 p. 517 Gulf States Creosoting Company
to City of Hattiesburg
R/W Right of way for a street across land extending from the Southerly end of 3d Ave at the most Southerly corner of Blk 43, of the D.D. McInnis 3rd survey to the NW side of West Pine St at a pt directly opposite & across from NW end of Lot 11 Blk 5 of Hicks Subd. of DD McInnis 3rd survey 50 ft wide

Jan 7, 1929

by H. S. Hagerty VP T. C. Hannah secretary

Min Book 20 p. 465 Supervisors of Forrest Co
to Gulf States Creosoting Company
re-lease re-lease ... for 99 yrs

July 7, 1947

(1855)

dead C. B. McLeod.

DB 38/555 Gulf States Creosoting Co.

5-26-1930 Blks 9, 10, 11, 12 13 Hoch Subd. sec 16, Book 4 p 16-18

NW 1/4 SW 1/4 16. 4N R13W

unexpir port of unexpir lease

expir 7-3-54

May 26, 1930

54
99

Book #6

DB 35 p 517

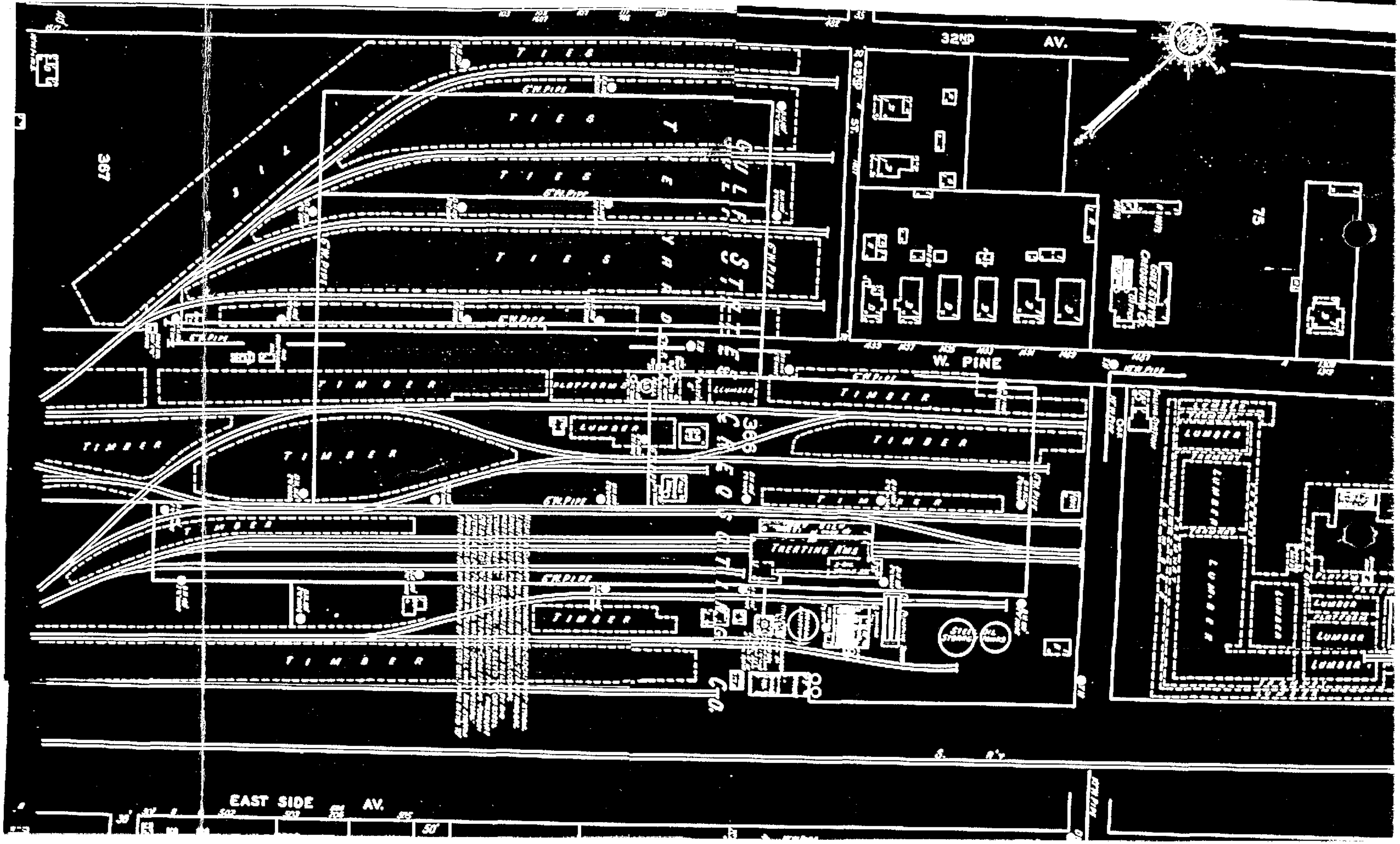
DB 44 p 295

DB 206 p 248

DB 210 p 110

DB 224 p 254

DB 240 p 132


32ND AV.
W. PINE
EAST SIDE AV.
GULF STATES CREOSOTING CO.
TIE YARD
TIES
TIMBER
LUMBER
PLATFORM
TREATING RMS
367
368
75

Beginning at the most Northerly corner of Block 72 of the original D. D. McInnis Third Survey of the City of Hattiesburg, the same being the point of intersection of the Southeasterly boundary line of Thirty Second Avenue with the Southwesterly boundary line of the unnamed street lying between Blocks 72 and 74 of the said D. D. McInnis Third Survey, which is the point of beginning, and run thence in a Southwesterly direction along the Eastern boundary line of Thirty Second Avenue 550 feet, more or less, to the East prong of Gordon's Creek, thence in a Southerly direction along and following the meanderings of said Gordon's Creek 450 feet, more or less, thence run East 380 feet, more or less, to the Western boundary line of Lewin Avenue or Pine Street, thence run in a Northeasterly direction along the Western boundary line of Lewin Avenue or Pine Street 710 feet to the most Easterly corner of said Block 72 of said D. D. McInnis Third Survey, and thence run Northwest along the Northeast boundary line of said Block 72 to the point of beginning; the same containing 10 acres of land, more or less.

All of Blocks 9, 10, 11, 12 and 13 of the Hicks Subdivision of the D. D. McInnis Survey of Section 16, Township 4 North, Range 13 West, and

All of Blocks 1, 2, 3, 4, 5, 6, 7, 8 and 14 of the Hicks Subdivision of the D. D. McInnis Survey of Section 16, Township 4 North, Range 13 West.

All of the above described land located in and being a part of Section 16, Township 4 North, Range 13 West, in the City of Hattiesburg, Forrest County, Mississippi, and lying West of the N.O. & N.E. R.R. right of way through said section.

Said property also being described as:

Beginning at the intersection of the Western boundary of Florence Street with the Southern boundary of Thirty Second Avenue, run thence South 44 degrees and 53 minutes West along the Southern boundary of Thirty Second Avenue a distance of 150 feet to a concrete monument which is the point of beginning.

Thence run South 44 degrees and 53 minutes West which is along the southerly boundary of Thirty Second Avenue for a distance of 2897.2 feet to a concrete monument, thence continuing along the above mentioned course a distance of 14 feet to the center of Gordon's Creek; thence South 84 degrees and 36 minutes East along center of Gordon's Creek a distance of [illegible] feet; thence South 56 degrees and 22 minutes East along center of Gordon's Creek a distance of 15.81 feet; thence South 4 degrees and 15 minutes East along the center of Gordon's Creek a distance of 18.02 feet, thence South 14 degrees and 56 minutes West along the center of Gordon's Creek a distance of 41.04 feet; thence South 4 degrees and [illegible] minutes East along the center of Gordon's Creek a distance of 18.02 feet; thence South [illegible] degrees and 30 minutes East along the center of Gordon's Creek a distance of [illegible] feet, thence South 76 degrees and 32 minutes East along the center of Gordon's Creek a distance of 69.02 feet, thence South 59 degrees and 44 minutes East along the center of Gordon's Creek a distance of 17.46 feet; thence South 7 degrees and [illegible] minutes East along the center of Gordon's Creek a distance of 16.49 feet; thence South 0 degrees and 58 minutes East along the center of Gordon's Creek a distance of 30.24 feet; thence South [illegible] degrees and 18 minutes East along the center of Gordon's Creek a distance of [illegible] feet; thence South 19 degrees and 41 minutes East along the center of Gordon's Creek a distance of 12.94 feet; thence West 38 feet to a concrete monument; thence continuing West a distance of 809.83 feet to a concrete monument located on the West boundary of Section 16, Township 4 North, Range 13 West, thence South 1773.09 feet to a concrete monument which is the intersection of the West boundary line of Section 16 with the Northwesterly right of way line of the New Orleans and Northeastern Railroad; thence [illegible] degrees and 53 minutes East along the Northwesterly right of

Beginning [illegible] most Northerly corner of Block 72 of the original D. D. McInnis Third Survey of the City of Hattiesburg, the same being the point of intersection of the Southeastern boundary line of Thirty Second Avenue with the Southwesterly boundary line of the un[illegible] lying between Blocks 72 and 74 of the said D. D. McInnis Third Survey, [illegible] point of beginning, and run thence in a Southwesterly direction along the Eastern boundary line of Thirty Second Avenue 550 feet, more or less, to the East prong of Gordon's Creek, thence in a Southerly direction along and following the meanderings of said Gordon's Creek 450 feet, more or less, thence run East 380 feet, more or less, to the Western boundary line of Lewin Avenue or Pine Street, thence run in a Northeasterly direction along the Western boundary line of Lewin Avenue or Pine Street 710 feet to the most Easterly corner of said Block 72 of said D. D. McInnis Third Survey, [illegible] run Northwest along the Northeast boundary line of said Block 72 to the point [illegible]; the same containing 10 acres of land, more or less.

All of Blo[illegible] 11, 12 and 13 of the Hicks Subdivision of the D. D. McInnis Survey of Secti[illegible]ship 4 North, Range 13 West, and

All of Blo[illegible] 4, 5, 6, 7, 8 and 14 of the Hicks Subdivision of the D. D. McInnis Survey [illegible] 16, Township 4 North, Range 13 West.

All of the [illegible]ibed land located in and being a part of Section 16, Township 4 North, Range [illegible] the City of Hattiesburg, Forrest County, Mississippi, and lying West of [illegible].E. R.R. right of way through said section.

Said prope[illegible] described as:

Beginning [illegible]rsection of the Western boundary of Florence Street with the Southern bounda[illegible] Second Avenue, run thence South 44 degrees and 53 minutes West along the [illegible]boundary of Thirty Second Avenue a distance of 150 feet to a concrete monume[illegible] the point of beginning.

Thence ru[illegible]egrees and 53 minutes West which is along the southerly boundary of Thi[illegible]enue for a distance of 2697.2 feet to a concrete monument, thence continui[illegible] above mentioned course a distance of 14 feet to the center of Gordon's Cre[illegible] South 84 degrees and 36 minutes East along center of Gordon's Creek a distanc[illegible]et; thence South 56 degrees and 22 minutes East along center of Gordon's Cre[illegible]ce of 15.81 feet; thence South 4 degrees and 15 minutes East along the cente[illegible]'s Creek a distance of 18.02 feet, thence South 14 degrees and 56 minutes West [illegible]enter of Gordon's Creek a distance of 41.04 feet; thence South 4 degrees [illegible]es East along the center of Gordon's Creek a distance of 18.02 feet; the[illegible] degrees and 30 minutes East along the center of Gordon's Creek a distanc[illegible], thence South 76 degrees and 32 minutes East along the center of Gordo[illegible] distance of 69.02 feet, thence South 59 degrees and 44 minutes East al[illegible]ter of Gordon's Creek a distance of 17.46 feet; thence South 7 degrees and [illegible] along the center of Gordon's Creek a distance of 16.49 feet; thence South 0[illegible] 58 minutes East along the center of Gordon's Creek a distance of 30.24 feet; [illegible] degrees and 18 minutes East along the center of Gordon's Creek a distanc[illegible], thence South 19 degrees and 41 minutes East along the center of Gordo[illegible] distance of 12.94 feet; thence West 38 feet to a concrete monument; thence co[illegible] a distance of 809.83 feet to a concrete monument located on the West bou[illegible]tion 16, Township 4 North, Range 13 West, thence South 1773.09 feet to a conc[illegible] which is the intersection of the West boundary line of Section 16 with[illegible]sterly right of way line of the New Orleans and Northeastern Railroad; thenc[illegible]egrees and 53 minutes East along the Northwesterly right of

DR 44 Pg 295

being duly sworn [illegible]ys that the notice, a true copy o[illegible]hich is hereto annexed, appeared in the issues of said newspaper as follows:

Date 3-10, 1933

Number words 1000
Published 1 Times

Printer's Fee	$20.00
Making Proof	.50
Total	$20.50

(Signed) Thos. St. John, Publisher.

Sworn to and subscribed before me this 10 day of March 1933.

F. Delsing,
Notary Public.
My Commission Expires April 12, 1934.

(Seal)

Recording fee $6.20

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THE GULF STATES LIQUIDATING COMPANY
TO ( ) DEED
THE GULF STATES CREOSOTING COMPANY

Filed for record 9 o'clock A.M. March 24, 1933,
Recorded March 24, 1933,
Ethel Baylis, Clerk.

STATE OF MISSISSIPPI: :
COUNTY OF FORREST : :

For and in consideration of the sum of -----FORTY THOUSAND & NO/100 ($40,000.00) DOLLARS ----- cash in hand paid, the receipt of which is hereby acknowledged, the undersigned THE GULF STATES LIQUIDATING COMPANY, a Mississippi corporation, does hereby grant, bargain, sell, convey and warrant unto the GULF STATES CREOSOTING COMPANY, a Delaware corporation, the following described property lying and being situated in the City of Hattiesburg, Forrest County, Mississippi, to-wit:

All of Block 75 of the D. D. McInnis Third Survey of the City of Hattiesburg, excepting, however, the following described parcels of land:

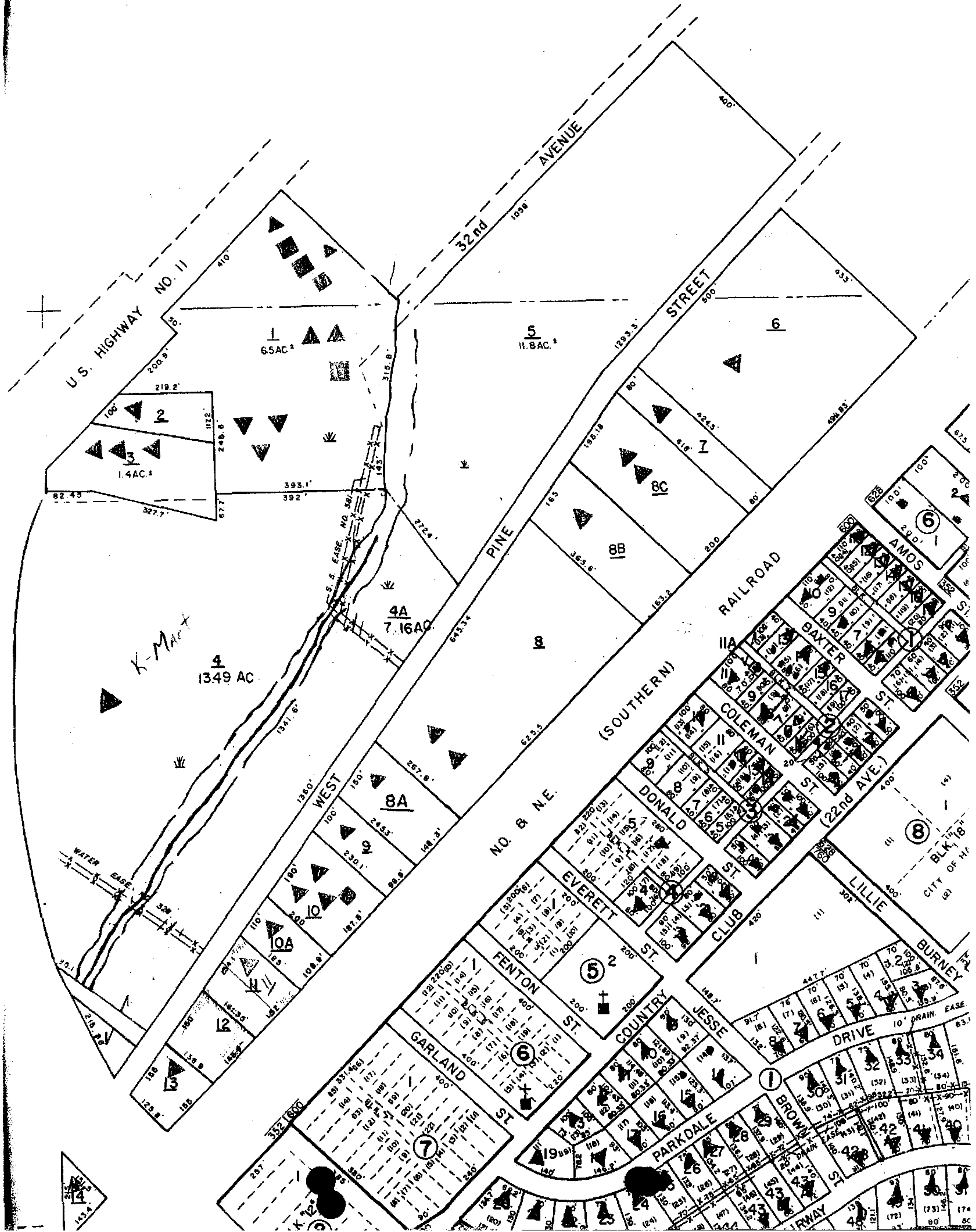
Except that parcel of land described as beginning at the Northwest corner of said Block 75 and run Eastward along the Southern boundary line of Florence Street a distance of 200 feet, thence at right angles to last named course Southward a distance of 150 feet, thence at right angles to the last named course Westward a distance of 200 feet to Thirty Second Avenue; thence Northward along the East boundary line of Thirty Second Avenue a distance of 150 feet to the point of beginning; and

Except also that part of land described as beginning at the Northeast corner of said Block 75 and run Southward along the West boundary line of West Pine Street 75 feet; thence at right angles to the last named course Westward 180 feet; thence at right angles to the last named course Northward 75 feet to Florence Street; thence at right angles to the last named course Eastward 180 feet to point of beginning; and

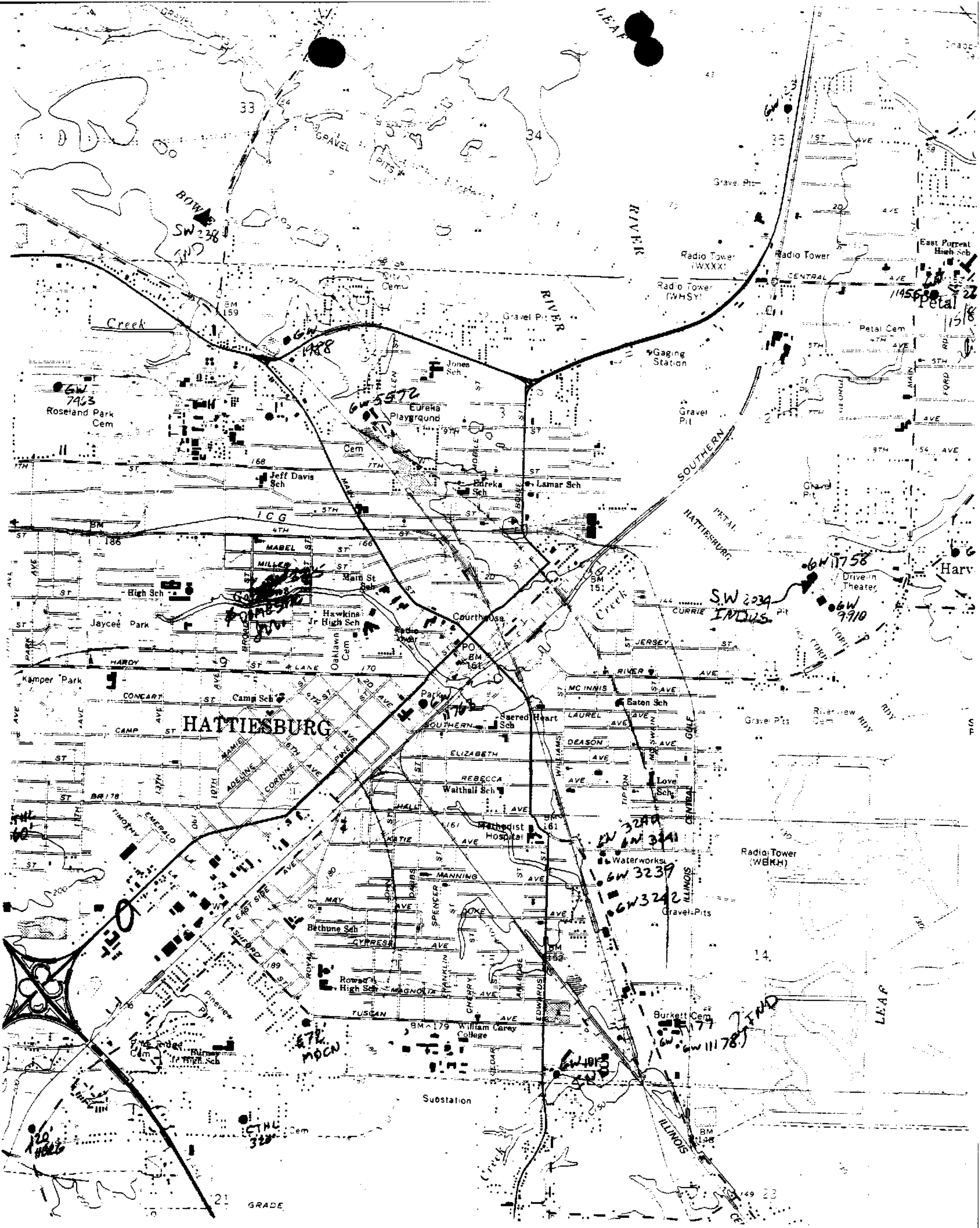
Except that parcel of land described as a part of said Block 75 beginning at the point of intersection of the Northwest line of Pine Street with the Southwest line of Florence Street and run thence Southwest along the Northwest line of Pine Street 75 feet to the point of beginning, and thence run Southwest along the North-west line of Pine Street, 75 feet, thence run Northwest at right angles to Pine Street 180 feet, thence run Northeast parallel with Pine Street 75 feet and thence run Southeast 180 feet to the point of beginning; and

All of Lot 1 of Block 74 of the D. D. McInnis Third Addition to the City of Hattiesburg, and

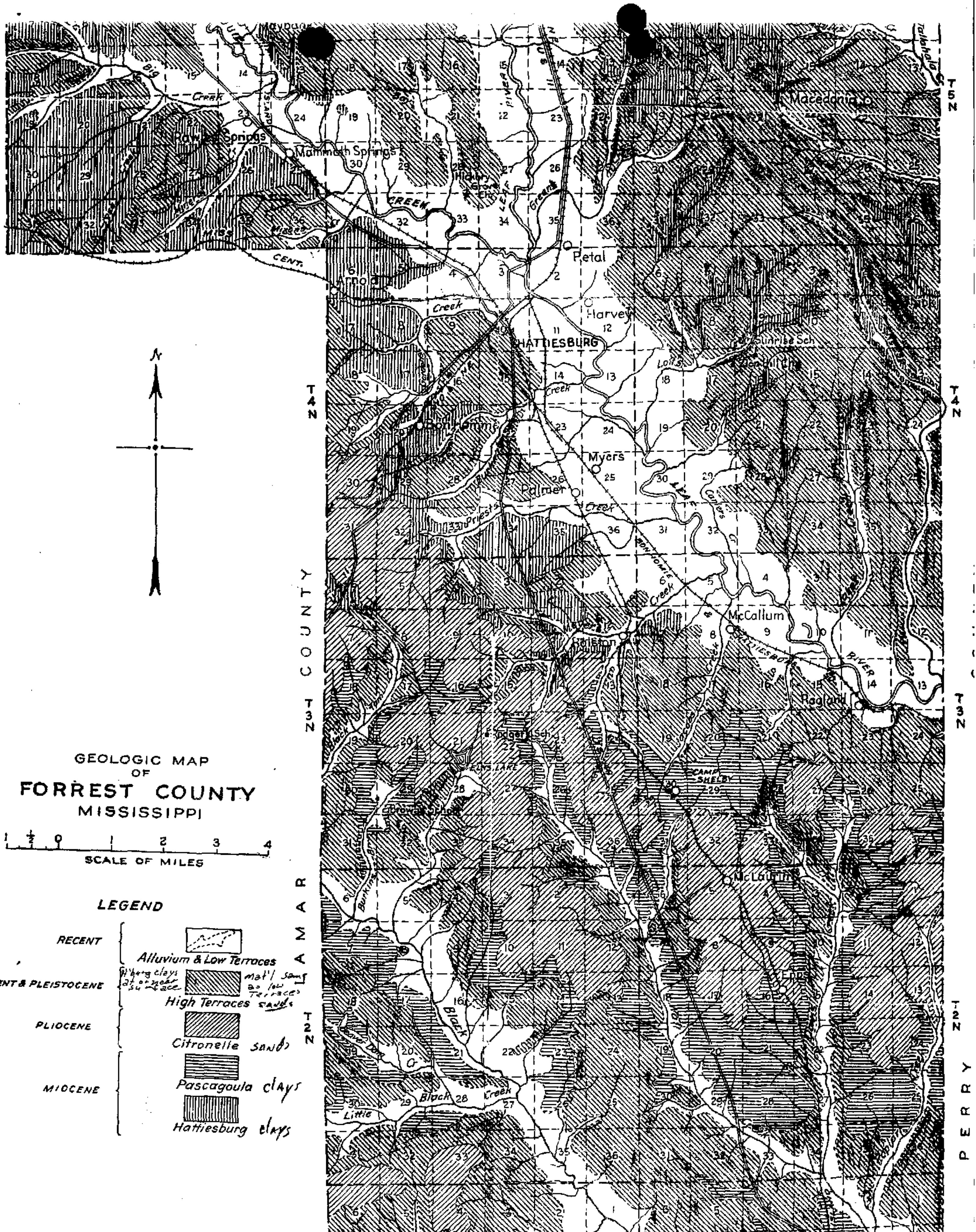
All of Lot 2 of the Davis & Johnson Subdivision of Block 74 of the D. D. McInnis Third Addition to the City of Hattiesburg; and



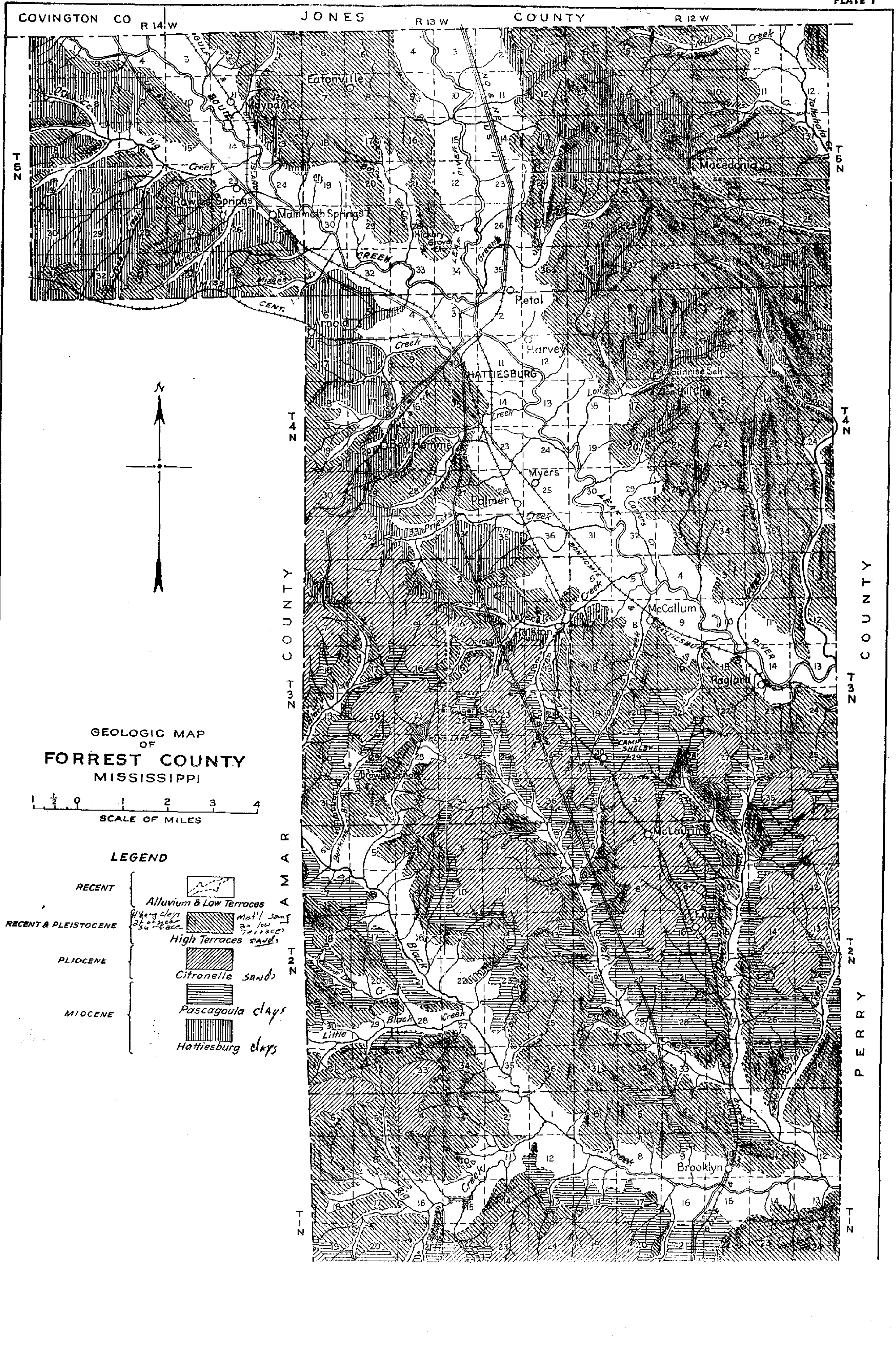
U.S. HIGHWAY NO. 11
32nd AVENUE
PINE STREET
WEST
RAILROAD
NO. 8 N.E. (SOUTHERN)
K-Mart
4
13.49 AC
4A
7.16 AC
1
6.5 AC±
5
11.8 AC±
3
1.4 AC±
S.S. EASE. NO. 381
WATER EASE.
COLEMAN
DONALD
EVERETT ST.
FENTON ST.
GARLAND ST.
COUNTRY CLUB
JESSE
PARKDALE
BROWN ST.
DRIVE
10' DRAIN. EASE
BAXTER ST.
AMOS
LILLIE
BURNEY
(22nd AVE.)
BLK 18
CITY OF H



HATTIESBURG
Petal
RIVER
LEAF
SOUTHERN
ILLINOIS
CENTRAL
Creek
Radio Tower (WXXX)
Radio Tower (WHSY)
Radio Tower
Radio Tower (WBKH)
East Purvis High Sch
Petal Cem
Gaging Station
Gravel Pit
Gravel Pits
Jones Sch
Eureka Playground
Roseland Park Cem
Jeff Davis Sch
Eureka Sch
Lamar Sch
High Sch
Jaycee Park
Main St Sch
Hawkins Jr High Sch
Courthouse
Oaklawn Cem
Kamper Park
Camp Sch
Sacred Heart Sch
Eaton Sch
Love Sch
Walthall Sch
Methodist Hospital
Waterworks
Bethune Sch
Rowan High Sch
Burkett Cem
William Carey College
Substation
Drive-in Theater
Riverview Cem
Pineview Park
GW 7963
GW 1988
GW 5572
SW 238 IND
SW 2034 INDUS
GW 11758
GW 9910
GW 3240
GW 3241
GW 3239
GW 3242
GW 11178



GEOLOGIC MAP
OF
FORREST COUNTY
MISSISSIPPI
SCALE OF MILES
1 ½ 0 1 2 3 4
LEGEND
RECENT
Alluvium & Low Terraces
RECENT & PLEISTOCENE
High Terraces
PLIOCENE
Citronelle
MIOCENE
Pascagoula
Hattiesburg
N
LAMAR COUNTY
PERRY COUNTY
T 5 N
T 4 N
T 3 N
T 2 N
T 1 N
Macedonia
Mammoth Springs
Petal
Harvey
HATTIESBURG
Arnold
Myers
Palmer
McCallum
Rogland
McLaurin
Brooklyn
CAMP SHELBY
Sunrise Sch.


GEOLOGIC MAP
OF
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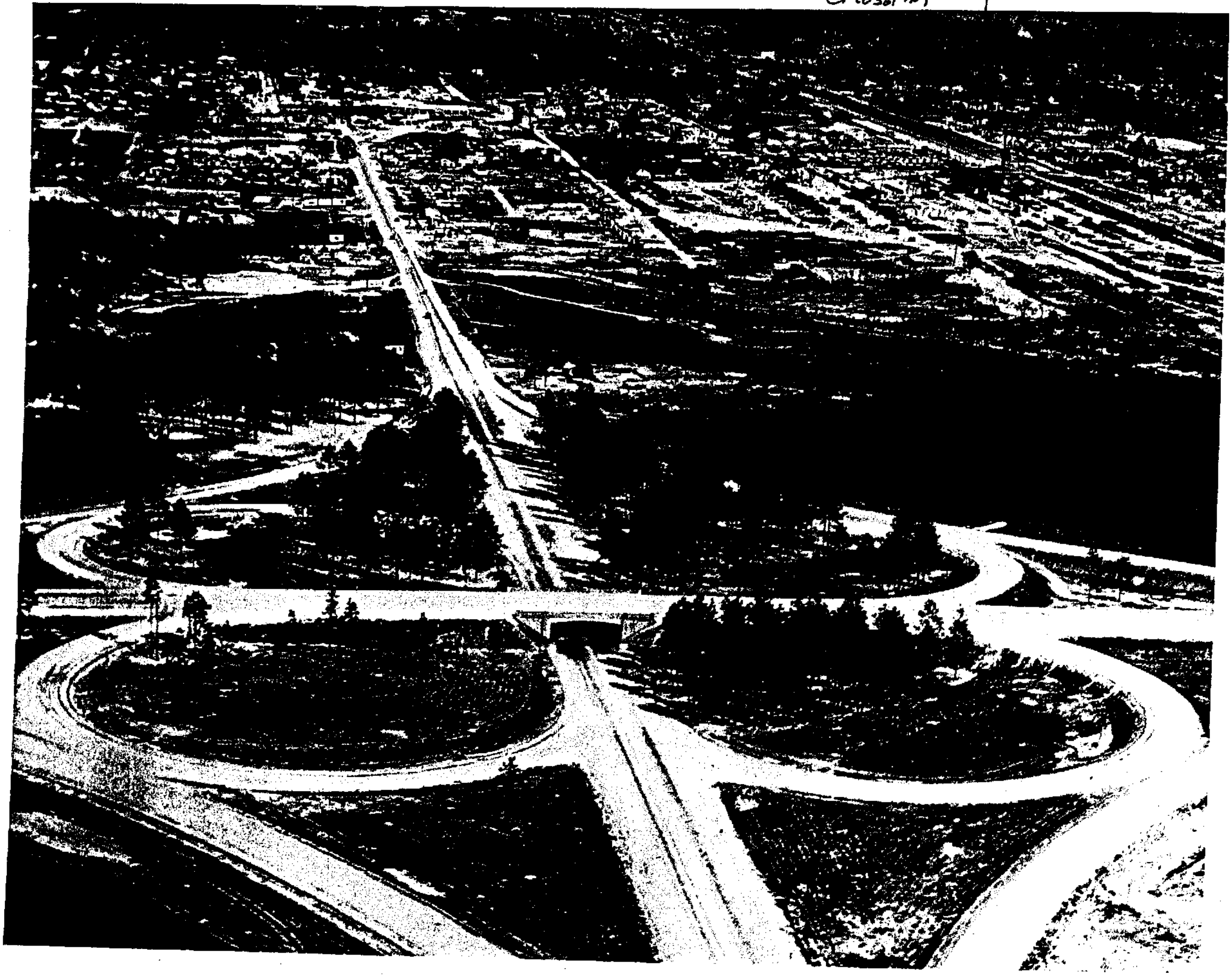
High Terraces
PLIOCENE
Citronelle
MIOCENE
Pascagoula
Hattiesburg
COVINGTON CO
JONES COUNTY
R 14 W
R 13 W
R 12 W
T 5 N
T 4 N
T 3 N
T 2 N
T 1 N
LAMAR COUNTY
PERRY COUNTY
Eatonville
Maybank
Rawls Springs
Mammoth Springs
Macedonia
Petal
Arnold
Harvey
HATTIESBURG
Bon Homme
Myers
Palmer
McCallum
Ralston
Ragland
CAMP SHELBY
McLaurin
Epps
Brooklyn
LEAF RIVER
Big Creek
Black Creek

Gulf States Creosoting Site



PRESS RETURN FOR MENU OR ENTER PRIMOS COMMAND? ED GAIL
P99
.NULL.
^001^001
1DATE: 08/09/89 WATER WELLS ON RECORD WITHIN 1 MILE RADIUS OF GORDON CREEK PAGE 1

LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D036 REV BERRY BELL	311802	891813	01-01-51	H	320	122CTHL
D069 J D LEWIS	311901	891910	--	S	360	122CTHL
D063 GEO VARNADO	311800	891900	01-01-62	H	120	122HBRG
D106 CIVIL DEFENSE	311823	891758	04-11-83	H	672	122MOCN

BOTTOM

P999
.NULL.
^001^001
1DATE: 08/08/89 WATER WELLS ON RECORD WITHIN 4 MILE RADIUS OF GORDON CREEK *Site* PAGE 1

D12
MID EAST S/6 T4N R13W
31°18'30"
89°18'40"
31°18'42"
89°18'40"

LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
E068 C L DEWS	311623	892103	01-01-56	H	--	--
E135 LAMAR PARK W A	311834	892218	01-01-71	Z	42.0	--
B184 HATTIESBURG	312110	0891945	07-19-85	U	--	--
B101 AMERICAN SAND	312130	891910	01-01-75	H	96.0	--
D022 MISS POWER CO.	312002	891546	01-01-44	U	108	--
D033 JOS DELIA	311653	891748	01-01-57	H	55.0	--
D040 WOMACK ICE CO	312021	891710	01-01-65	U	18.0	--
D061 MURRAY ENVELOPE	312029	891811	01-01-67	U	105	--
D029 E FORREST UTIL	312002	0891544	--	-	134	110ALVM
B076 HAPPY ACRES	312104	891645	01-01-70	U	100	110ALVM
1 D110 PETAL	312044	0891542	08-15-88	P	128	110ALVM
D091 BEESON ACDY	311629	891727	01-01-71	H	52.0	112LTRC
D092 RICHARD PARKER	312038	891720	01-01-71	H	80.0	112LTRC
E035 JOE F WHITE	311940	891730	01-01-62	H	26.0	112LTRC
E018 A D SAUCIER	311909	0892202	01-01-47	H	97.0	112TRCS
D021 MISS POWER CO	312002	891545	01-01-63	E	112	112TRCS
2 D028 PETAL	312037	891548	01-01-55	P	124	112TRCS
3 D029 PETAL	312002	891544	01-01-62	P	134	112TRCS
D028 PETAL	312047	0891543	---	-	120	112TRCS
D020 MISS POWER	311935	0891613	01-01-48	E	110	112TRCS
E085 DAVID COX	311547	892103	01-01-68	H	50.0	121CRNL
E019 J Z WARD	312020	892133	01-01-56	H	40.0	121CRNL
E030 MARGRET LAIRD	311900	892211	01-01-51	H	40.0	121CRNL
E044 HERBERT DRAIN	311653	892141	--	H	100	121CRNL
E045 D S STEWART	311709	892106	01-01-18	H	30.0	121CRNL
E091 PHILIP PHUGH	311723	892148	01-01-68	H	55.0	121CRNL
E092 W G MCDONALD	311730	892205	01-01-68	H	50.0	121CRNL
E107 B F COURTNEY	311700	892130	01-01-69	H	122	121CRNL
E108 S WALKER	311936	892224	01-01-69	H	155	121CRNL
E109 LEON BRYANT	311700	892136	01-01-70	H	67.0	121CRNL
E110 PHILIP PUGH	311733	892154	01-01-70	H	57.0	121CRNL
E111 RICHBURG GROCRY	311642	892100	01-01-70	H	80.0	121CRNL
E112 BENTON LOTT	311715	892148	01-01-70	H	57.0	121CRNL
E138 BILLY HAMBRY	311745	892131	01-01-71	H	39.0	121CRNL
E145 BILLIE HARBERRY	311800	892101	01-01-71	H	38.0	121CRNL
B126 AM SAND & GRAVEL	312120	891827	07-14-84	H	110	121CRNL
D076 BOB CHAIN	311713	892029	01-01-69	H	50.0	121CRNL
D094 TJ MILLER	311655	892037	01-01-72	H	72.0	121CRNL
F038 M D CONN	311518	891817	01-01-73	H	115	121CRNL
F042 ADAM WALLS JR	311510	891810	01-01-75	H	60.0	121CRNL

1DATE: 08/08/89 WATER WELLS ON RECORD WITHIN 4 MILE RADIUS OF GORDON CREEK PAGE 2

LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE

E002 H CRANFORD	312007	892202	01-01-52	H	150	121PLCN
E010 J Q HUGH	311916	892149	--	H	110	121PLCN
E215 HATTIESBURG	311938	0892111	09-17-85	U	660	122CTHL
E214 HATTIESBURG	311938	0892111	09-17-85	-	680	122CTHL
4 E141 LAMAR PARK W A	311912	892128	01-01-71	P	714	122CTHL
5 E189 LAMAR PARK W A	311901	892122	01-01-73	P	714	122CTHL
6 E210 LAMAR PARK W A	312046	0892119	06-29-79	P	740	122CTHL
E222 HATTIESBURG	311725	0892101	06-30-89	U	720	122CTHL
E220 HATTIESBURG	311725	0892101	05-25-89	U	1000	122CTHL
D108 HATTIESBURG	311958	0891958	08-30-85	U	640	122CTHL
D008 HATTIESBURG	311834	891701	01-01-57	U	710	122CTHL
B006 HATTIESBURG	312115	0891936	01-01-34	U	444	122CTHL
D084 MARSHALL DURBIN	311942	891524	01-01-70	N	684	122CTHL
7 B002 HATTIESBURG	312109	0891942	01-01-30	P	622	122CTHL
B004 HATTIESBURG	312105	0891949	01-01-30	U	450	122CTHL
8 D046 CENTRAL W A	311736	0891658	01-01-65	P	672	122CTHL
D109 HERCULES	312024	0891846	01-15-88	N	641	122CTHL
9 D005 HATTIESBURG	311847	0891702	01-01-60	P	678	122CTHL
10 B003 HATTIESBURG	312105	0891949	01-01-30	P	610	122CTHL
11 D042 PALMERS XING W A	311656	0891702	01-01-65	P	642	122CTHL
12 D045 CENTRAL W A	311735	0891650	01-01-65	P	694	122CTHL
13 D007 HATTIESBURG	311803	0891644	01-01-60	P	688	122CTHL
14 D004 HATTIESBURG	311836	0891701	01-01-60	P	485	122CTHL
15 D006 HATTIESBURG	311847	0891702	01-01-60	P	673	122CTHL
D107 HATTIESBURG	311958	0891950	08-30-85	U	690	122CTHL
D038 HERCULES POWDER	312015	0891842	01-01-65	N	687	122CTHL
16 B001 HATTIESBURG	312109	0892009	01-01-41	P	419	122CTHL
17 B005 HATTIESBURG	312115	0891923	01-01-31	P	621	122CTHL
18 B007 HATTIESBURG	312115	0891923	01-01-52	P	635	122CTHL
19 B017 HATTIESBURG	312107	0892006	01-01-64	P	607	122CTHL
20 B023 HATTIESBURG	312106	891951	01-01-66	P	607	122CTHL
D009 MARSHALL DURBIN	311804	891645	01-01-59	N	678	122CTHL
D010 MARSHALL DURBIN	311804	891647	01-01-63	N	678	122CTHL
D011 DIXIE PINE PROD	311723	891607	01-01-50	N	740	122CTHL
D012 DIXIE PINE PROD	311723	891610	01-01-55	U	727	122CTHL
D013 COASTAL CHEM CO	312019	891745	01-01-47	U	325	122CTHL
D014 DIXIE PINE PROD	312015	891851	01-01-43	U	501	122CTHL
D016 HERCULES PWD CO	312016	891707	01-01-52	U	451	122CTHL
D018 SOUTHERN RR	311953	891653	01-01-39	U	410	122CTHL
D019 CENTRAL PKNG CO	311936	891642	01-01-57	U	420	122CTHL

LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D023 CRYSTAL ICE CO.	311954	891553	--	U	360	122CTHL
D027 CEN FORRESTATCR	311633	891650	01-01-49	H	360	122CTHL
D031 CLINTON LBR CO.	312035	891627	01-01-39	U	390	122CTHL
D035 PEPSI COLA BOT.	312043	891950	01-01-58	U	346	122CTHL
D036 REV BERRY BELL	311802	891813	01-01-51	H	320	122CTHL
D043 PALMERS CROSSUT	311654	891701	01-01-65	U	326	122CTHL
D049 LEON PRINGLE	311948	891842	01-01-54	H	576	122CTHL
D053 VAN HOOK	311942	892011	01-01-57	H	362	122CTHL
D060 HERCULES PWD CO	312029	891810	01-01-67	N	671	122CTHL
D069 J D LEWIS	311901	891910	--	S	360	122CTHL

D072	PINE BURR PK CO	311845	891650	01-01-68	N	662	122CTHL
D085	M BREWER	311930	891812	01-01-70	H	358	122CTHL
D086	BEESON ACADEMY	311651	891727	01-01-70	H	523	122CTHL
D088	BEVERLY DRIVE N	311627	891733	01-01-70	H	340	122CTHL
D130	HATTIESBURG	311930	0891730	01-01-50	U	390	122CTHL
D104	MS TANK	312004	0891957	12-03-80	N	700	122CTHL
E221	HATTIESBURG	311725	0892102	05-29-89	U	960	122CTHL
D025	E TRAVILLION HS	311624	0891545	01-01-57	U	580	122CTHL
E009	DAISY SAUCIER	311923	0892137	01-01-59	H	310	122HBRG
E046	CHESTER MOULDER	311700	892101	01-01-63	D	69.0	122HBRG
D032	BEVERLY DRIVE-IN	311642	0891701	01-01-50	U	50.0	122HBRG
D044	PALMERS XING W A	311640	0891659	01-01-65	P	642	122HBRG
D101	BILLY MOORE	311701	0892041	07-31-80	H	400	122HBRG
A004	WEST HILLS C CL	312040	0892138	01-01-63	U	248	122HBRG
B018	JACK GANDY	312135	891754	01-01-49	H	50.0	122HBRG
B028	H F SUMRALL	312111	892049	01-01-66	H	70.0	122HBRG
B030	CHAS WADE	312127	891820	01-01-66	H	55.0	122HBRG
B031	CHAS. WADE	312127	891820	01-01-66	H	55.0	122HBRG
B035	C J MORGAN	312152	891839	01-01-66	H	75.0	122HBRG
B078	LAUREL HOT MIX	312124	891845	01-01-71	H	97.0	122HBRG
D026	BEV DRIVE IN	311639	891702	01-01-60	H	40.0	122HBRG
D034	JOS DELIA	311653	891748	01-01-59	H	55.0	122HBRG
D040	WOMACK ICE CO.	312021	891711	01-01-65	U	105	122HBRG
D047	H S LITTLE	312031	892035	01-01-65	H	60.0	122HBRG
D048	R O BLACKWELL	312031	892035	01-01-58	H	185	122HBRG
D050	N D CARPENTER	311936	891452	01-01-60	H	35.0	122HBRG
D051	GEORGE DRAUGHIN	311936	891512	01-01-57	H	23.0	122HBRG
D052	GEO DRAUGHIN	311933	891513	01-01-57	H	33.0	122HBRG
D054	D M WARD	311721	891717	01-01-57	H	120	122HBRG
D055	KENNISON	312029	891928	01-01-57	H	138	122HBRG

LOCAL WELL NUMBER		LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D057	W D CARPENTER	311933	891510	01-01-60	H	35.0	122HBRG
D058	C M LINGEL	312008	891622	01-01-60	H	78.0	122HBRG
D059	ERNIE ELKINS	311656	892053	01-01-66	H	60.0	122HBRG
D062	EDD WALTERS	311837	891614	01-01-62	H	48.0	122HBRG
D063	GEO VARNADO	311800	891900	01-01-62	H	120	122HBRG
D064	JAMES WEBB	311656	891658	01-01-61	H	78.0	122HBRG
D065	M RAYBORN	311900	891600	01-01-60	H	935	122HBRG
D065	M RAYBORN	311900	891600	01-01-60	H	100	122HBRG
D066	PAUL RAYBORN	311900	891600	01-01-60	H	94.0	122HBRG
D068	RAY BRELAND	311900	891600	01-01-60	H	106	122HBRG
D070	MURRAY ENVELOPE	312035	891820	01-01-68	N	422	122HBRG
D087	ROY LIVIRETT	312015	891524	01-01-70	H	20.0	122HBRG
D089	MASONITE CORP	311633	891600	01-01-70	H	162	122HBRG
D090	LEE TAYLOR	311645	891515	01-01-62	H	126	122HBRG
D039	COASTAL CHEMICAL	312020	0891737	04-01-65	U	350	122HBRG
D105	MP&L	311927	0891730	07-07-81	A	122	122HBRG
E013	HAL FOX	311854	0892139	01-01-60	H	513	122MOCN
E124	LAMAR PARK SUBDIV	311913	0892127	01-01-68	U	721	122MOCN
E007	EARL NIX	311938	892139	01-01-56	H	342	122MOCN
E008	W L SAUCIER	311933	892158	01-01-49	H	284	122MOCN

E014 HARVEY TAYLOR	311723	892205	01-01-56	H	187	122MOCN
E072 L O ENGLISH	311740	892230	01-01-64	H	168	122MOCN
E074 W RUFF	311629	892129	01-01-68	U	---	122MOCN
E198 BEN COURTNEY	311638	892130	01-01-74	H	108	122MOCN
B069 GLENDALE UTIL DST	312152	0891848	01-01-69	U	654	122MOCN
B057 AMERICAN S&G CO	312121	891814	01-01-69	H	106	122MOCN
B058 MCMAHAN	312109	892025	01-01-69	H	105	122MOCN
B059 B UNDERWOOD	312112	891624	01-01-69	H	75.0	122MOCN
B063 LAUREL HALMIX C	312126	891736	01-01-69	I	106	122MOCN
B068 LAGRACE MOTEL	312115	892030	01-01-70	H	86.0	122MOCN
B070 LAGRACE MOTEL	312115	892030	01-01-70	H	87.0	122MOCN
B084 AMERICAN SAND	312057	892118	01-01-71	H	94.0	122MOCN
B085 RANDY POWELL	312049	891601	01-01-71	H	25.0	122MOCN
B086 RUSSELL	312048	891602	01-01-71	H	25.0	122MOCN
B103 MOBILE OIL CORP	312112	891619	06-08-77	N	254	122MOCN
D030 EAST FOREST UTL	312039	891545	01-01-43	U	390	122MOCN
D056 MISS SOU. UNIV.	311957	892004	---	I	---	122MOCN
D073 L A PRINCE	311957	891612	01-01-70	H	105	122MOCN
D077 WHSY RADIO STAT	312041	891629	01-01-69	H	60.0	122MOCN
D078 ROSS RAYBOURN	311739	891624	01-01-69	H	110	122MOCN

LOCAL WELL NUMBER	LATITUDE (DEGREES)	LONGITUDE (DEGREES)	DATE WELL CONSTRUCTED	PRIMARY USE OF WATER	DEPTH OF WELL (FEET)	AQUIFER CODE
D079 E P FILLENGAME	311645	892024	01-01-69	H	485	122MOCN
D080 CUMMINGS	311657	892038	01-01-70	H	417	122MOCN
D081 STEWART	311733	892018	01-01-70	H	65.0	122MOCN
D082 BONNIE LEIGH	311542	892024	01-01-70	H	430	122MOCN
D083 DAVID COX	311648	892050	01-01-70	H	60.0	122MOCN
D093 ROGER BLACKWELL	311640	892050	01-01-72	H	65.0	122MOCN
D096 JOE TATUM	311758	891707	01-01-72	H	125	122MOCN
D097 RAY LIVERETT	312043	891713	01-01-74	H	65.0	122MOCN
D098 LEE RUSTIN	312030	891730	01-01-74	H	58.0	122MOCN
D100 MS POWER CO	311928	0891737	09-07-79	N	650	122MOCN
D102 MARSHALL DURBIN	311822	891638	09-02-80	N	672	122MOCN
D103 MS POWER CO	311928	891737	09-07-79	N	650	122MOCN
D106 CIVIL DEFENSE	311823	891758	04-11-83	H	672	122MOCN
B054 LOVELL COOLEY	312140	0891750	01-01-68	H	82.0	124HCGB

BOTTOM