FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

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Ty Schreiner, Project Manager
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Dear Mr. Schreiner:

As requested, Friedman & Bruya has reviewed the documents and data files from testing conducted by Analytical Resources in June-August 2002 and February-March 2003; and by North Creek Analytical in November-December 2003, March 2004, March 2005 and February 2006. We have also reviewed the data provided to Kennedy/Jenks by Friedman & Bruya in reports dated July 23, 2002, December 19, 2003, January 29, 2004, May 5, 2004, March 10, 2006, March 16, 2006 and October 4, 2006. In addition, the results for one sample analyzed by Friedman & Bruya in 2005 (B-19-21-22) are incorporated directly into this report. These data were reviewed to determine the source of hydrocarbon material found at the Former Tacoma Metals site located at 1919 Portland Avenue in Tacoma, Washington.

Site History

The Former Tacoma Metals site was used for wood-treating activities in the early 1900s through 1920s and was briefly developed and used as a coke plant in the 1940s. From the early 1950s through 1999, the site was used for metals recycling.

The main wood-treating operations occurred primarily on the western portion of the site near the former retort area (refer to Figure 1). The metals recycling activities occurred across the entire site. Hydrocarbons (detected using standard analytical methods for petroleum hydrocarbons NWTPH-G and NWTPH-Dx) have been found in soil and groundwater in the western portion of the site, but their source has not been determined. (Note: The analytical methods NWTPH-G and NWTPH-Dx are useful for determining the amount of material that boils within certain hydrocarbon ranges such as gasoline- and diesel-range hydrocarbons. However, these analytical methods are not always capable of identifying whether the material present is due to a particular source or commercial product.)

Light non-aqueous phase liquid (LNAPL) has also been detected on the water table at two locations in the western portion of the site. Historically, LNAPL has been present at well MW-12, located near a former hydraulic shear used for the metals recycling operations. LNAPL has also been detected at well MW-8(R), located down gradient (at low tide) of the former retort area. Dense non-aqueous phase liquid (DNAPL) has been detected at off-property well MW-28(R) (refer to Figure 1).

Types of Potential Contaminants

Based on historical information, the chemicals from the wood-treating activities can be distinguished from chemicals attributable to the metal recycling operations. Creosote was likely the primary material used for wood-treating activities at this site. Chlorinated phenols, such as pentachlorophenol, were considered beneficial wood preserving chemicals before 1940; however, they do not appear to have been widely used at the time.[1] Metals (lead) and petroleum hydrocarbons would be expected from the metal recycling operations.

Creosote, a complex mixture of many different compounds, was generally manufactured by heating coal or oil in a retort. This pyrolysis process produced town gas or manufactured gas and a pyrogenic byproduct. Depending on the operating conditions of the retort, the byproduct could be used directly as creosote or subjected to distillation to produce a liquid suitable for use as creosote.

Occasionally, diesel fuel or kerosene manufactured from crude oil (petrogenic materials) were mixed with the pyrogenic material from the retort. Such mixtures effectively lowered the cost of the finished creosote.

The pyrogenic process used to manufacture creosote produces a liquid that consists primarily of aromatic hydrocarbons. In general, the major chemicals comprising pyrogenic materials are polynuclear aromatic hydrocarbons (PAHs).[2] There are two general types of PAHs present, parent PAHs and alkylated PAHs. Parent PAHs are compounds like naphthalene, phenanthrene and pyrene. These parent PAHs consist of carbon atoms arranged in a series of rings, typically with six carbon atoms in each ring. An alkylated PAH has the same ring system as a parent PAH, but the alkylated PAH has an extra CH_2 or methylene group attached to one or more of the rings. Methylnaphthalenes (C1-naphthalenes), dimethylnaphthalenes

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[1] "Oil-Tar Creosote for Wood Preservation", Glenn Voorhies, Bulletin Series No. 13, June 1940, Oregon State College, pages 14 to 16. Refer to Attachment 1.
[2] "Chemical and Physical Characteristics of Tar Samples From Selected Manufactured Gas Plant (MGP) Sites", Electric Power Research Institute TR-102184, Project 2879-12, May 1993. Refer to Attachment 1.

(C2-naphthalenes), and trimethylnaphthalenes (C3-naphthalenes) are examples of alkylated PAHs.

The relative proportion of parent and alkylated PAHs can be used to distinguish pyrogenic (creosote) PAHs from the petrogenic PAHs in petroleum products like diesel fuel, kerosene and fuel oil. For pyrogenic materials like creosote, the amount of the PAHs decreases as the number of extra methylene groups increases. The parent PAH, fluorene, is present in creosote at higher levels than the C1-fluorenes, the C1-fluorenes are present at higher levels than the C2-fluorenes, and so on. This decreasing pattern is in contrast to the pattern for petrogenic materials like kerosene and diesel fuel, where the amount of the alkylated PAHs often exceeds the amount of parent PAHs.[3]

Several explanations are possible for the dominance of parent PAHs in pyrogenic products. Some believe the more facile burning of the alkylated PAHs leaves behind unreacted parent PAHs, while others contend that the parent PAHs are preferential combustion by-products formed by the combination of free radicals created in the burning process. Regardless of the explanation, the relative ratio of parent and alkylated PAHs can be used to distinguish pyrogenic from petrogenic PAHs.

A material's boiling point or boiling range can also be used to identify its source. The boiling point of a compound provides information about its particular physical properties.[4] For example, a gasoline engine is designed for fuel that vaporizes readily and burns quickly. Therefore, gasoline consists primarily of highly volatile, low-boiling compounds that vaporize easily in a gasoline engine. Other products like diesel fuel and motor oil have higher boiling ranges than gasoline. The combustion process in diesel engines is different than in gasoline engines. With diesel engines, compression of the fuel initiates the combustion process. Diesel engines require a slight delay between the beginning of the combustion process and the time when it reaches its maximum efficiency. Consequently, a less volatile, higher-boiling fuel than gasoline is needed for diesel engines.[5] Finally, motor oil must not burn or lose its lubricating properties when used in an engine. Compounds that readily vaporize cause flammability problems and reduce the lubricating properties of the oil. Motor oils, therefore, do not contain the low-boiling compounds that make up gasoline and diesel fuel.

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[3] "Manufactured Gas Plant Process Wastes and By-Products", A.D. Uhler, S.A. Stout and K.J. McCarthy, Soil & Groundwater, December 1999/January 2000. Refer to Attachment 1.
[4] "Hydrocarbon Fingerprinting for Application in Forensic Geology", L.G. Bruce and G.W. Schmidt, AAPG Bulletin, V. 78, No. 11, November 1994, pages 1692-1710. Refer to Attachment 1.
[5] "Petroleum Products Handbook", V.B. Guthrie, McGraw-Hill Book Co., NY, 1960, page 1-19. Refer to Attachment 1.

Because creosote must penetrate several inches into wood in order to be an effective preservative, it must be relatively non-viscous. Industry specifications were developed to dictate the approximate boiling range of creosote, which is very similar to the boiling range of diesel fuel.

A gas chromatograph (GC) can be used to establish a material's boiling range.[6] When a sample or a sample extract is injected into a GC, the compounds travel down a long tube or column whose sides are coated with special chemicals. Different compounds travel down the column at different speeds, depending on their boiling points and other chemical properties. A given compound will travel repeatedly through the column at a characteristic time, which enables the GC to identify compounds based on their elution time.

In any GC analysis, the most volatile compounds (those with the lowest boiling points), typically elute first. As the processing time increases, less volatile compounds (those with higher boiling points) elute from the GC. As the analysis progresses, a GC trace is produced that records the time when various compounds eluted from the GC. The trace appears as a series of peaks along a time axis that represent compounds eluting from the GC at the times indicated on the GC trace. The heights of the peaks represent the quantity of the compound present, and the location of the peaks along the time axis helps to identify the compounds that are present. The time axis can be converted into a thermometer scale by analyzing compounds with differing boiling points.

Thus a GC analysis trace provides information about the types or classes of compounds present in a material. This information can include the identification of normal alkanes, compounds usually found in crude oil or products made from crude. Other types of compounds identified by a GC include aromatic hydrocarbons. Each compound is identified by a particular pattern of peaks on the GC trace.[7]

Presented below are GC traces showing the differences between gasoline, kerosene, diesel fuel and motor oil (Figures 1 through 4, respectively). Because of the high sensitivity of the testing method used, the samples were diluted with a solvent. The solvent appears as a large peak near the 2-minute mark on the x-axis and should not be considered when reviewing GC traces. In general, compounds with progressively higher boiling points (and

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[6] "Interpretation of Gas Chromatographic Data in Subsurface Hydrocarbon Investigations", R.B. Senn and M.S. Johnson, Groundwater Monitoring Review, Winter 1987, pages 58-63. Refer to Attachment 1.
[7] "Forensic Environmental Geochemistry: Differentiation of Fuel-Types, Their Sources and Release Time", I.R. Kaplan, Y. Galperin, S-T. Lu and R-P. Lee, Organic Geochemistry, Vol 27, No. 56, 1997, pages 289-317. Refer to Attachment 1.

therefore longer elution times) appear in order on the right-hand side of the chart.

When comparing GC traces from different laboratories, it is important to understand that the actual trace can vary depending on the operating parameters of the GC that was used. If the operating parameters vary, adjustments must be made to one or more of the traces. The traces provided below can be compared directly because only one set of operating parameters was used.[8]
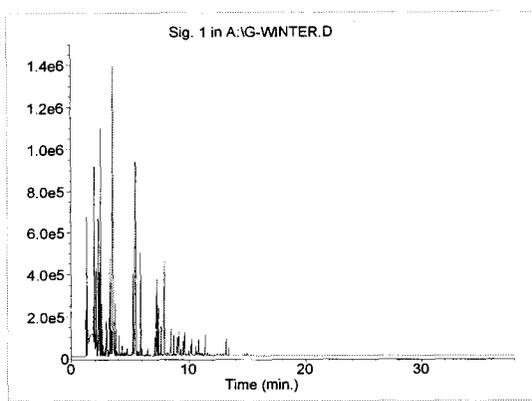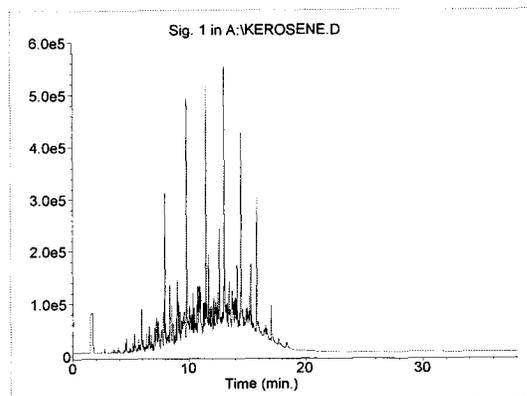
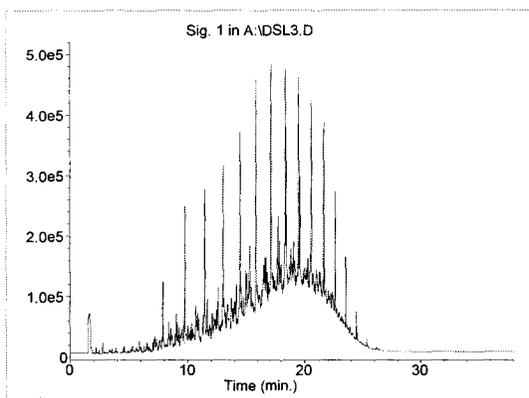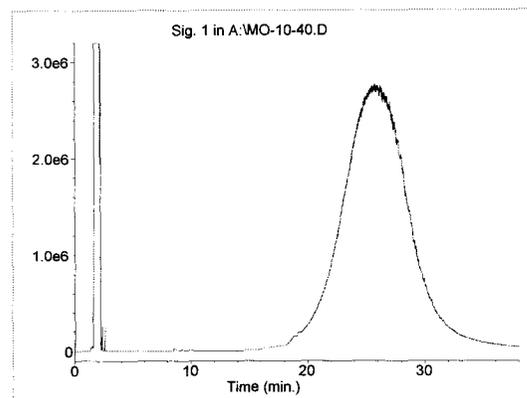Figure 1. Gasoline

Figure 2. Kerosene

Figure 3. Diesel Fuel

Figure 4. Motor Oil

[8] When comparing these GC traces, one should note the presence of a hump in the trace for diesel and motor oil and its absence in the GC trace of gasoline. The absence of a hump in the GC trace of gasoline indicates that it contains a relatively small number of (several hundred) individual compounds. Diesel and motor oil contain tens of thousands of individual compounds. The large number of compounds present in diesel and motor oil overwhelms the capability of the GC to separate the product into individual peaks as it can with gasoline. The inability of the GC to separate or resolve all of the compounds causes the presence of a hump.

Figure 5 shows the GC trace of a creosote. Note that it boils in the same range as diesel fuel. Of particular importance is the absence of a hump of material, indicating that much fewer compounds are present in this material than in either kerosene or diesel fuel.
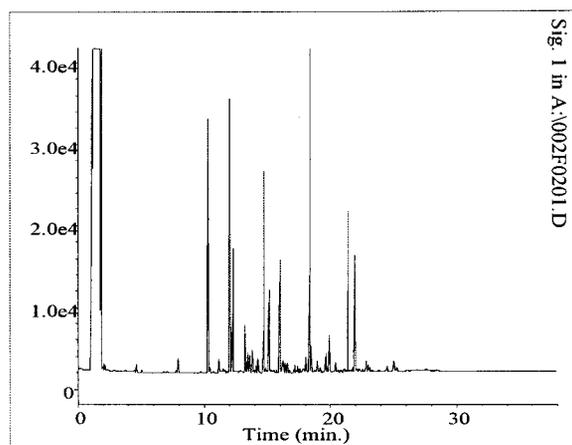

Figure 5. Creosote

The presence or absence of creosote can be readily noted when reviewing the testing data. The fact that creosote consists primarily of the parent PAHs is a reliable way to identify its presence.

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Scope of Our Investigation

Friedman and Bruya, Inc. conducted a forensic evaluation of the hydrocarbon data collected from soil, groundwater, and product (LNAPL and DNAPL) in the western portion of the site, and at off-property locations north and west of the site, and rendered an expert opinion on the nature and source (i.e., pyrogenic or petrogenic) of the hydrocarbons. Our forensic evaluation included the following:

A) Chemical analysis of the following:

- Two deep soil samples collected from boring B1 and B3 located in the former retort area and down gradient (at low tide) of the retort area, respectively

- One deep soil sample collected from boring B13 located along the western property boundary adjacent to well MW-18

- One deep soil sample collected from off-property boring B19

- One deep soil sample collected from off-property boring B32

- Two product samples collected from onsite well MW-8(R) and off-property well MW-28(R)

- Two groundwater samples collected from off-property wells MW-28(R) and MW-31

- Two deep soil samples collected from off-property locations B35-32-33 and B36-31-32.

B) Review of hydrocarbon chromatograms obtained from analysis of the seven deep soil samples, two water samples and two product samples identified above.

C) Review of hydrocarbon chromatograms provided by Analytical Resources and North Creek obtained from the analysis of 26 soil samples and 38 groundwater/liquid samples collected throughout the western portion of the site (onsite locations).

D) Review of hydrocarbon chromatograms provided by North Creek obtained from the analysis of 56 soil samples and 31 water/liquid samples from off-property locations.

The results of this evaluation are presented in the following sections. The locations of the soil borings and monitoring wells from which the samples were collected are shown on the attached Figure 1. A list of ARI and NCA samples for which CG traces were evaluated is provided in Table 1.

Review of Parent and Alkylated PAHs

The relative proportions of the parent and alkylated PAHs was determined using EPA Method 8270. Eleven samples (B1-25.5, B3-20.5, B13-21-22, B19-21-22, B32-19-20, B35-32-33, B36-31-32, MW-28(R), MW-31, MW-8-LNAPL and MW-28-NAPL) were analyzed by Friedman & Bruya for parent and alkylated PAHs. Analytical reports for these sample analyses are provided in Attachment 2. The findings are provided in Charts 1 through 11 below.
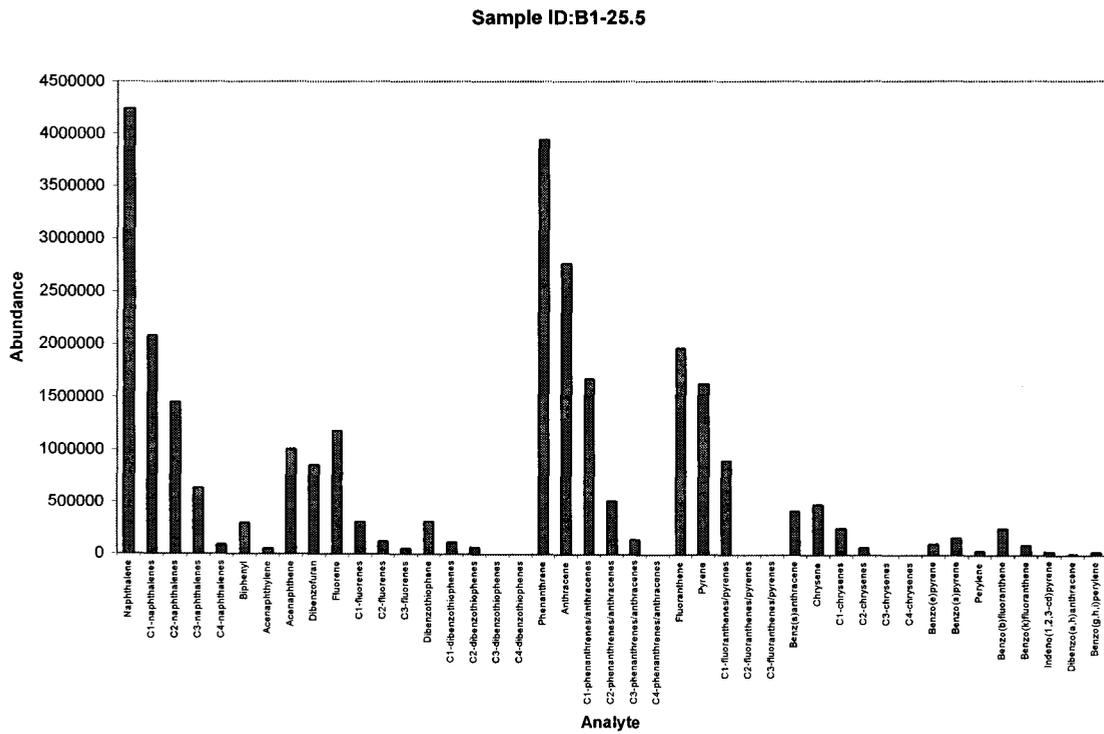
Sample ID:B1-25.5

Chart 1. Relative PAH Levels for Sample B1-25.5

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Sample ID: B3-20.5

Chart 2. Relative PAH Levels for Sample B3-20.5

Sample ID: B13-21-22
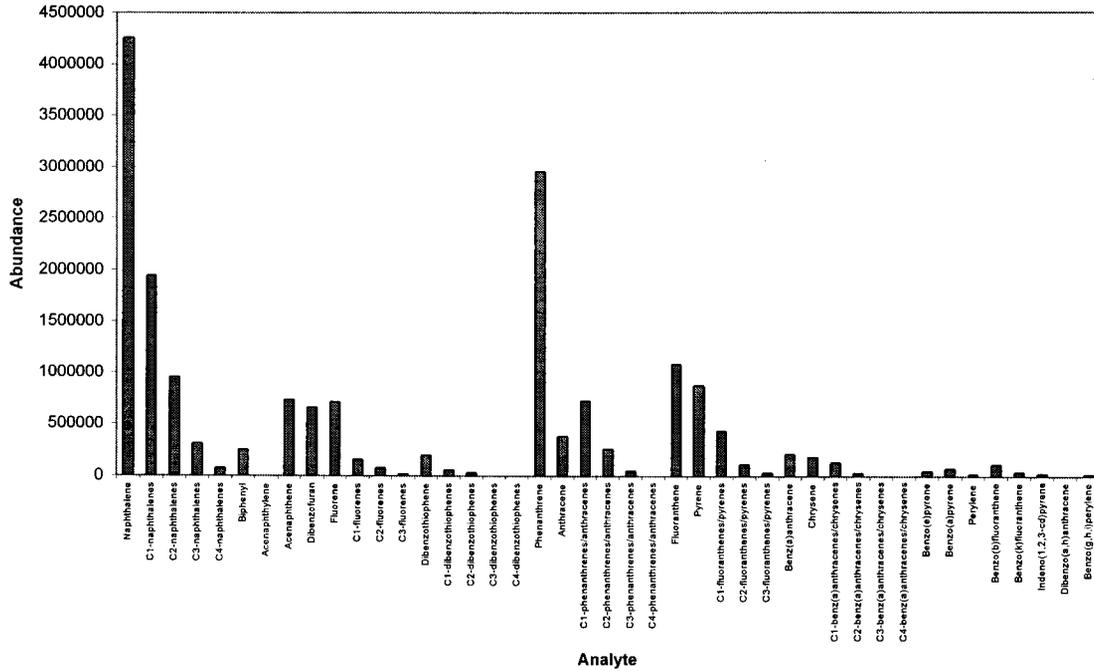
Chart 3. Relative PAH Levels for Sample B13-21-22

Sample ID: B-19-21-22

Chart 4. Relative PAH Levels for Sample B19-21-22

Sample ID: B32-19-20

Chart 5. Relative PAH Levels for Sample B32-19-20
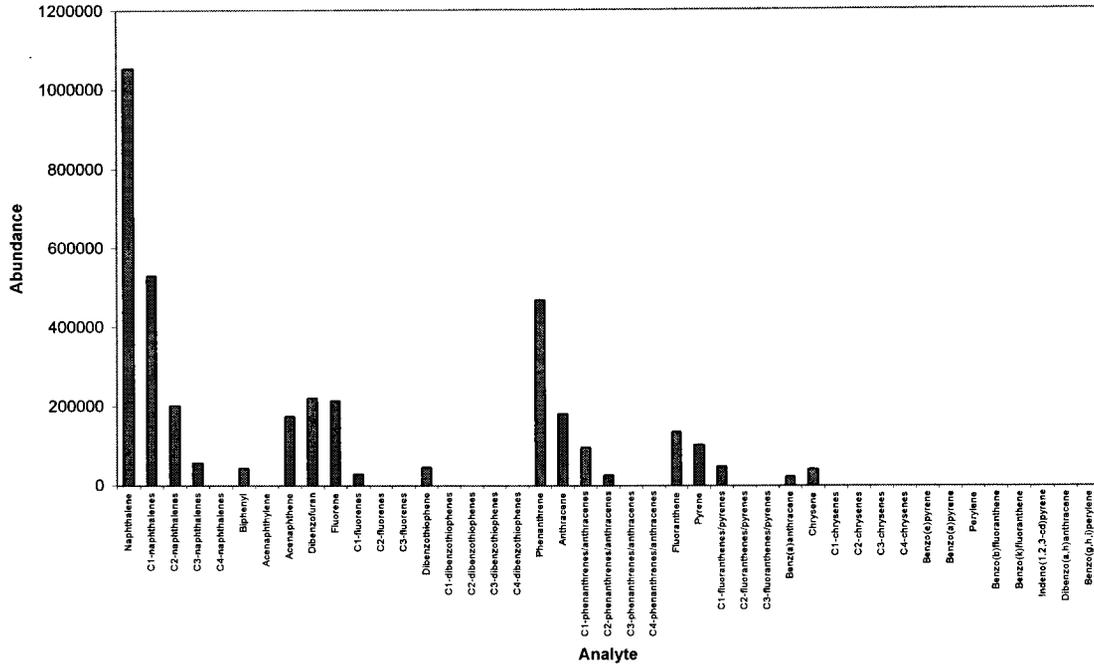
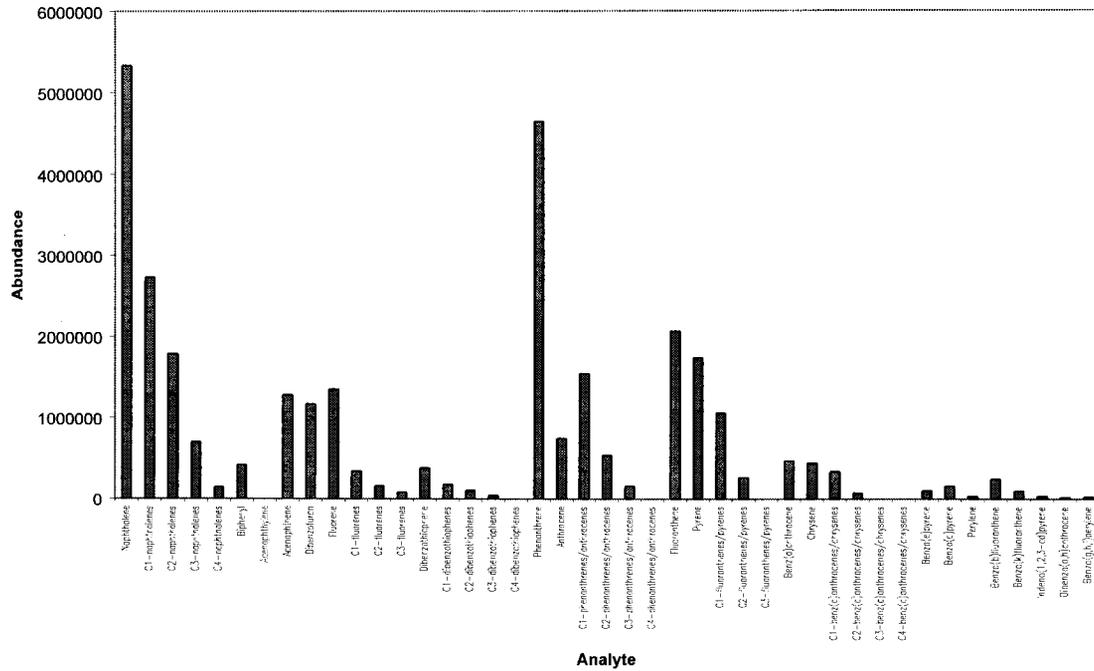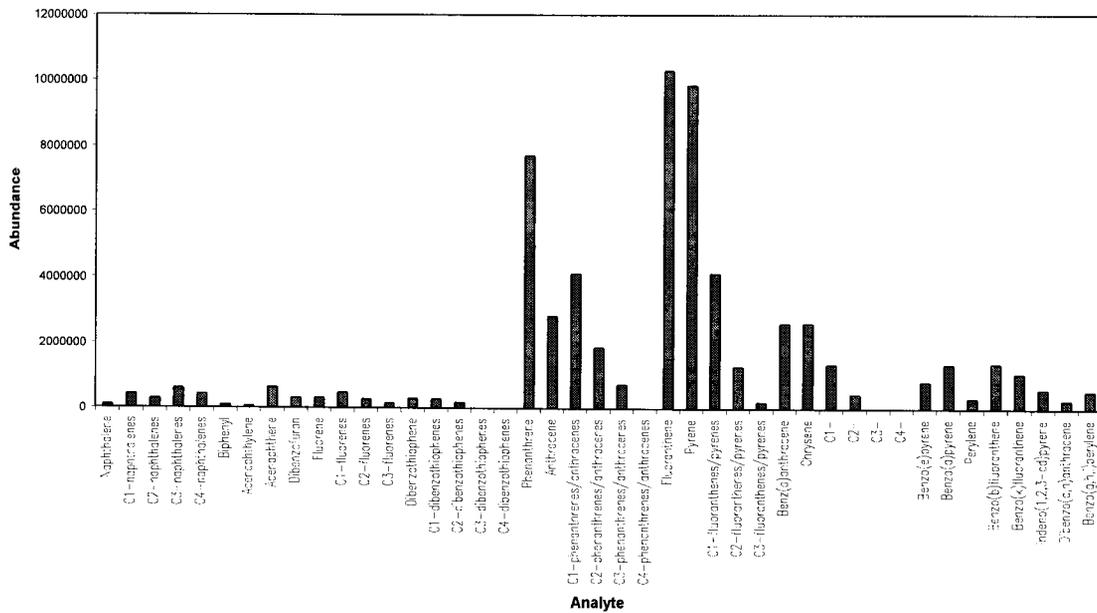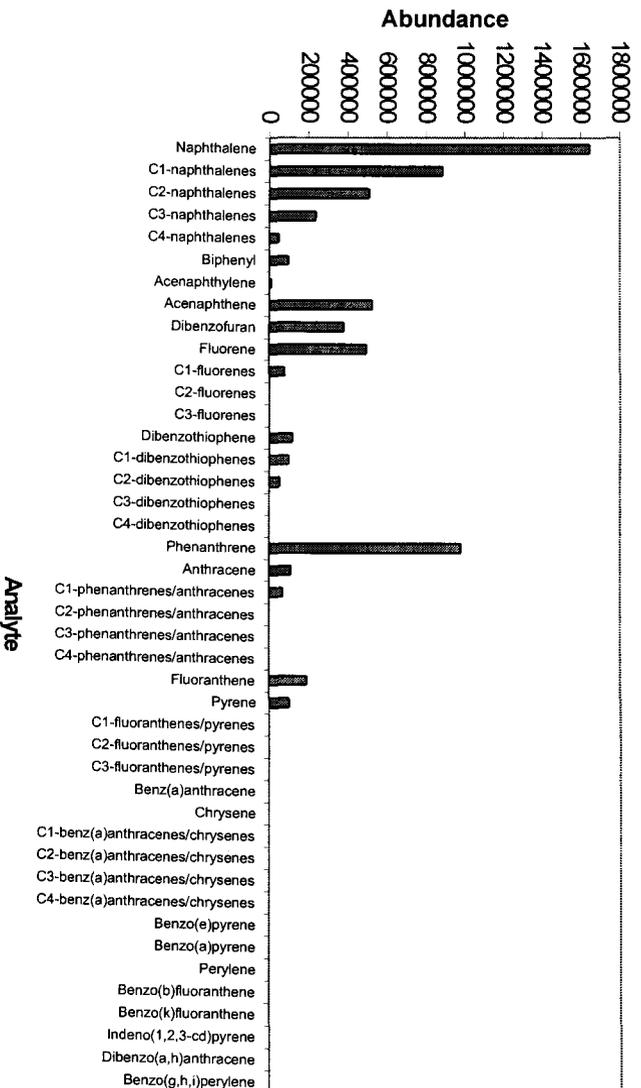Sample ID: B35-32-33
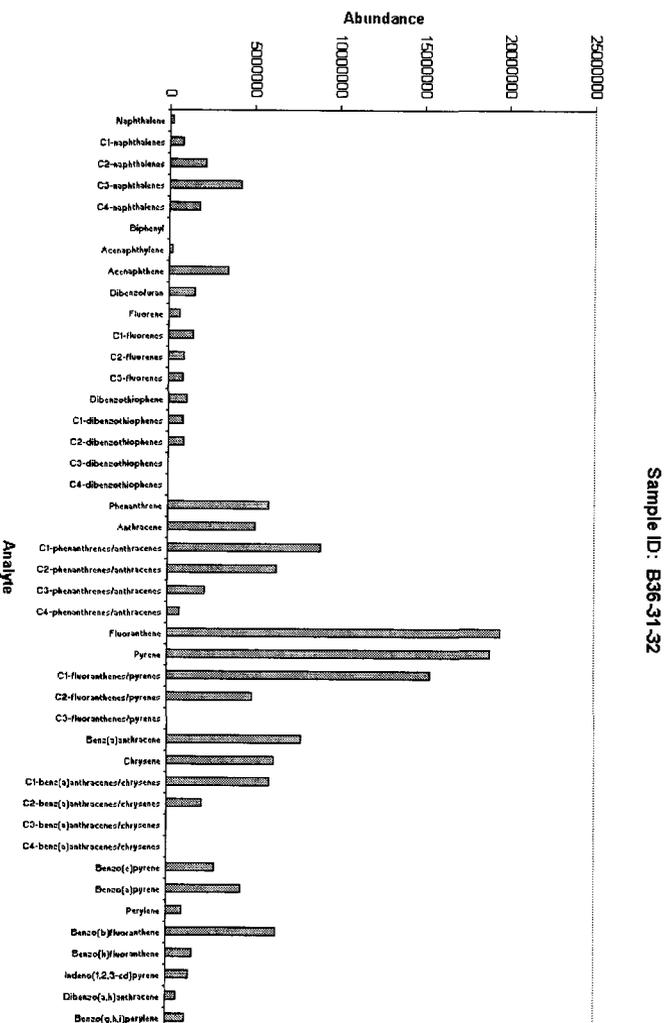

Chart 6. Relative PAH Levels for Sample B35-32-33

Sample ID: B36-31-32

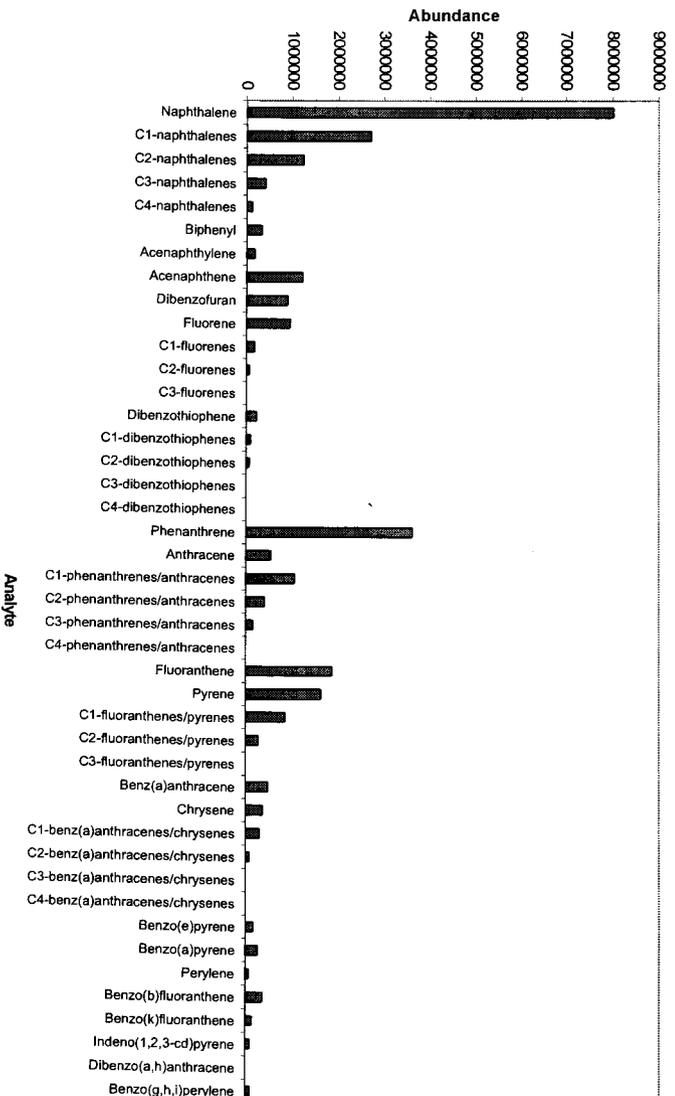Chart 7. Relative PAH Levels for Sample B36-31-32

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Sample ID: MW-28

Abundance

Analyte

Naphthalene
C1-naphthalenes
C2-naphthalenes
C3-naphthalenes
C4-naphthalenes
Biphenyl
Acenaphthylene
Acenaphthene
Dibenzofuran
Fluorene
C1-fluorenes
C2-fluorenes
C3-fluorenes
Dibenzothiophene
C1-dibenzothiophenes
C2-dibenzothiophenes
C3-dibenzothiophenes
C4-dibenzothiophenes
Phenanthrene
Anthracene
C1-phenanthrenes/anthracenes
C2-phenanthrenes/anthracenes
C3-phenanthrenes/anthracenes
C4-phenanthrenes/anthracenes
Fluoranthene
Pyrene
C1-fluoranthenes/pyrenes
C2-fluoranthenes/pyrenes
C3-fluoranthenes/pyrenes
Benz(a)anthracene
Chrysene
C1-benz(a)anthracenes/chrysenes
C2-benz(a)anthracenes/chrysenes
C3-benz(a)anthracenes/chrysenes
C4-benz(a)anthracenes/chrysenes
Benzo(e)pyrene
Benzo(a)pyrene
Perylene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene

Chart 8. Relative PAH Levels for Sample MW-28(R)

Sample ID: MW-31

Abundance

Analyte

Naphthalene
C1-naphthalenes
C2-naphthalenes
C3-naphthalenes
C4-naphthalenes
Biphenyl
Acenaphthylene
Acenaphthene
Dibenzofuran
Fluorene
C1-fluorenes
C2-fluorenes
C3-fluorenes
Dibenzothiophene
C1-dibenzothiophenes
C2-dibenzothiophenes
C3-dibenzothiophenes
C4-dibenzothiophenes
Phenanthrene
Anthracene
C1-phenanthrenes/anthracenes
C2-phenanthrenes/anthracenes
C3-phenanthrenes/anthracenes
C4-phenanthrenes/anthracenes
Fluoranthene
Pyrene
C1-fluoranthenes/pyrenes
C2-fluoranthenes/pyrenes
C3-fluoranthenes/pyrenes
Benz(a)anthracene
Chrysene
C1-benz(a)anthracenes/chrysenes
C2-benz(a)anthracenes/chrysenes
C3-benz(a)anthracenes/chrysenes
C4-benz(a)anthracenes/chrysenes
Benzo(e)pyrene
Benzo(a)pyrene
Perylene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene
Benzo(g,h,i)perylene

Chart 9. Relative PAH Levels for Sample MW-31

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Sample ID: MW-8-LNAPL
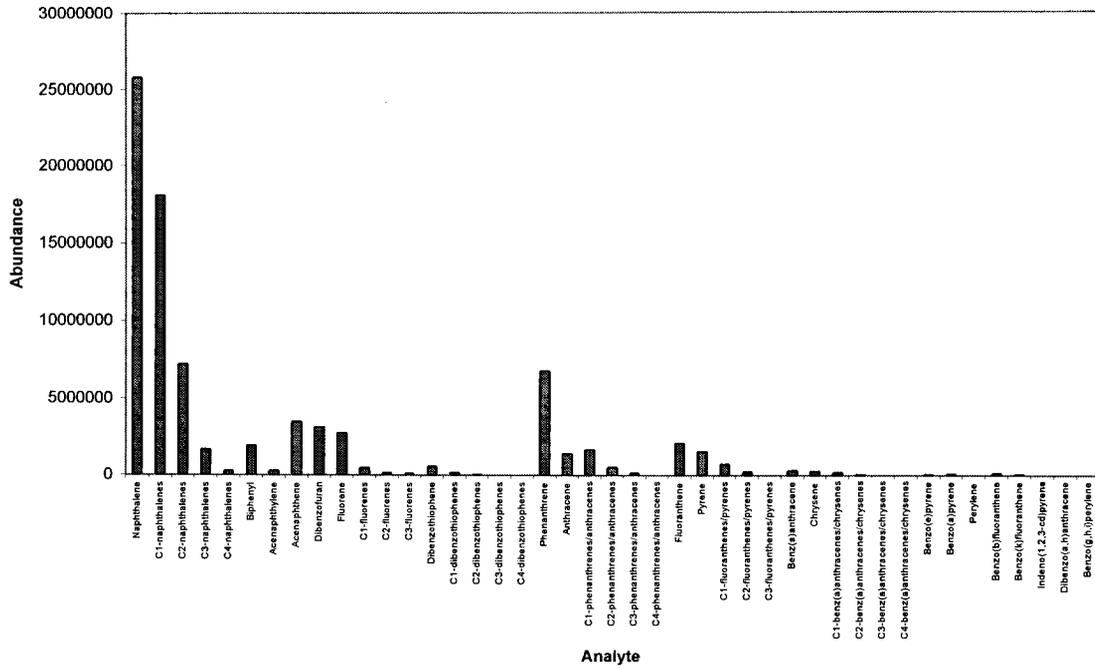

Chart 10. Relative PAH Levels for Sample MW-8-LNAPL

Sample ID: MW-28-NAPL

Chart 11. Relative PAH Levels for sample MW-28 NAPL

Review of the PAH data shows that the seven soil samples, two product samples and two water samples display the pyrogenic PAH pattern. One soil sample, B36-31-32 (Chart 7), contained very low levels of PAH and a pyrogenic pattern appeared to be present, however, it could not be fully documented. For the remaining samples, the concentration of parent PAH compounds exceeds that of alkylated PAHs. Within the alkylated PAHs, the concentrations decrease as the number of alkylated groups increases. PAHs from petrogenic sources, like kerosene and diesel fuel, do not show this decreasing pattern. Therefore, the PAHs present in these samples are from a pyrogenic source such as creosote.

Review of GC Traces

Numerous GC traces generated by Analytical Resources and North Creek were reviewed by Friedman & Bruya.[9] Of particular use were the GC traces generated when the site samples were analyzed for TPH as diesel and motor oil. Silica gel was used in many cases to remove fats and natural oils from the sample extracts in order to remove interferences caused by biological degradation. The GC traces generated when silica gel was used in the sample processing are of particular importance because they represent the hydrocarbon material present in the sample.

Based on our review of the GC traces, three types of product are present: a pyrogenic material such as creosote, a high-boiling oil such as lubricating or hydraulic oil, and a low-boiling middle distillate such as kerosene or diesel.

The samples analyzed fell into six groups:

- Group 1 contained creosote;

- Group 2 contained a mixture of creosote and an oil;

- Group 3 contained a mixture of creosote, oil and a middle distillate;

- Group 4 contained creosote and a middle distillate;

- Group 5 consisted of samples which showed the apparent presence of petroleum but no obvious presence of creosote; and

- Group 6 consisted of samples which either did not show any evidence of contamination or the data provided was insufficient to identify the material that was present.

Sample groups are discussed below and summarized in Table 1.

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[9] Copies of gas chromatograph traces for samples analyzed by ARI and NCA are provided in Attachment 3.

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Review of data from repeated analysis of samples collected from the same location as duplicates within a single sampling event, or over time at separate sampling events, yielded the same result.

Group 1 consisted of 55 (2 duplicates not included in total, refer to Table 1) water/liquid samples and 30 soil samples. The water/liquid samples containing only creosote are MW-8R (2003), MW-10 (2003), MW-11 (2003), MW-14 (2003-2 samples), MW-15 (2003-2 samples), MW-16 (2003-2 samples), MW-17 (2003-2 samples), MW-18 (2003-2 samples), MW-19 (2003-2 samples), MW-20 (2003-2 samples), MW-21 (2003-2 samples), MW-22 (2003), MW-18 (2004), MW-23 (2004), MW-24 (2004), B-18-GW (2004), B-19-GW (2004), B-20-GW (2004), B-21-GW (2004), B-22-GW (2004), B-23-GW (2004), MW-26 (2005), MW-28 (2005), B24-RGW (2005), B25-RGW (2005), B26-RGW (2005), B27-RGW (2005), B28-RGW (2005), B29-RGW (2005), B30-RGW (2005), B31-RGW (2005), B32-RGW (2005), B33-RGW (2005), MW-8(R) (2006), MW-11 (2006), MW-18 (2006), MW-20 (2006), MW-21 (2006), MW-22 (2006), MW-23 (2006), MW-24 (2006), MW-25 (2006), MW-26 (2006), MW-28(R) (2006), MW-29 (2006), MW-30 (2006), and MW-31 (2006). The soil samples containing only creosote are B1-10.5, B1-20.5, B1-26, B2-21, B-13-14-15, B-18-24-25, B-19-9-10, B-19-14-15, B-19-21-22, B-20-19-20, B-21-13-15, B-21-18-19, B-22-19-20, B-23-6.5-7.5, B-23-18-20, B25-30-31, B26-18-19, B26-25-26, B27-22-23, B28-23.5-24.5, B29-11-12, B29-22.5-23.5, B30-22-23, B31-19-20, B31-24-25, B34-30-31, B35-32-33, B35-39-40, B36-23-24, and B36-31-32. Most of these samples were collected at or below the water table. The GC traces are the same or very similar to the traces seen for some of the samples analyzed by Friedman and Bruya (B1-25.5, B3-20.5, B13-21-22, B19-21-22, B32-19-20 and MW-8-LNAPL).

Group 2 consisted of 1 water sample and 18 soil samples. This group contained low levels of creosote and somewhat higher levels of an oil-like material, possibly lube or hydraulic oil. Based on the expected solubility of the oil-like material in water, it is likely that its presence is due to the presence of a sheen or suspended soil particles in the sample, not to a water-soluble material. Water sample MW-12 (2003) contained a mixture of a low level of creosote and lube oil-like material. Friedman & Bruya understands that this sample was collected from an area where there was a known release of hydraulic fluid that was not associated with former wood treating activities. The soil samples containing low levels of creosote and lube oil-like material are B-12-4-5, B-13-1-3, B-13-5-6, B-14-1-2, B-14-5-6, B-15-5-6, B-15-7-8, B-15-10-11, B-16-3-4, B-17-3-4, B-17-5-6, B-17-7-8, B-18-6-6.5, B-18-12-13, B-21-8-9, B-22-6-7, B34-7-8, and B35-6-7. All of these samples were collected from above the water table.

Group 3 consisted of 9 soil samples that contained a mixture of creosote, oil-like material, and a middle distillate such as kerosene, or other similar boiling range hydrocarbon compound. The soil samples containing this mixture are MW13-17.5, B-12-6.5-7.5, B-12-9-10, B-14-9-10, B-16-5-6, B-20-7-8, B-22-11-12, B-23-9-10, and B36-8-10.

Group 4 consisted of 8 water samples and 2 soil samples that contained a mixture of creosote and middle distillate material. The presence of a mixture of creosote and a middle distillate is not unexpected because of the standard practice of using a creosote-petroleum mixture for wood treatment.[10] It should be noted that the petroleum material seen in these samples is not due to the presence of gasoline which displays a much lower boiling range of material than a middle distillate. The water samples are MW-13 (2002), MW-13 (2003), MW-25 (2004), MW-10 (2006), MW-14 (2006), MW-15 (2006), MW-16 (2006), and MW-17 (2006). The soil samples are B-16-10-11 and B-20-10-11.

Group 5 consisted of 7 soil samples that appeared to contain petroleum but there was no obvious sign of creosote. The soil samples showing this characteristic are B26-6.5-7.5, B27-7-8, B28-6-7, B29-6.5-7.5, B30-5.5-6.5, B31-6-7, and B32-11-12. All of these samples were collected from offsite and above the water table. Therefore, it does not appear that petroleum hydrocarbons detected in these samples could have originated from the Tacoma Metals site.

Group 6 consists of 3 water samples and 15 (one duplicate sample not included in total, refer to Table 1) soil samples which either did not show any evidence of contamination or the data provided was insufficient to identify the material that was present. The water samples are MW-27 (2005), MW-19 (2006), and MW-27 (2006). The soil samples are B3-10, B3-21.5, B24-9-10, B24-15-16, B24-30.5-31.5, B25-14-15, B27-24.5-25.5, B28-11-12, B30-11-12, B32-6-7, B32-19-20, B33-6-7, B33-18-19, B33-20.5-21.5, and B34-18-19.

Conclusions

Based on our review, all (162) samples analyzed from onsite locations contained a pyrogenic material which appears to be creosote. With the exception of Group 5, all of the off-site samples also contained creosote. All but eight of the groundwater samples showed impacts only from the creosote material. These samples, which include MW-13 (2002), MW-13 (2003), MW-25(2004), MW-10 (2006), MW-14 (2006), MW-15 (2006), MW-16 (2006), and MW-17 (2006), indicate that a petroleum-based material was present in addition to creosote.

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The low level of the middle distillate petroleum material seen in these samples is likely due to the presence of a creosote-petroleum formulation used for wood treatment. There was no evidence of groundwater impact by gasoline.

The locations where free product was observed (MW-8(R), MW-28(R) and MW-12) showed the presence of the creosote material. MW-8(R) (located down gradient of the former retort area) and MW-28(R) (located off-property) contained only the creosote, while MW-12 (located close to a former hydraulic shear) contained a mixture of creosote and a high-boiling material such as motor or hydraulic oil. Many of the shallower soil samples contained a mixture of creosote and the high-boiling material seen in MW-12.

Based on the composition and boiling range of the material, the pyrogenic material most likely originated from releases of creosote from historical wood-treating activities. The creosote came from a coal tar and was either refined from the tar, the tar was used directly as creosote, or the tar was mixed with petroleum before use. The high-boiling oil detected in shallower soil samples and one well (MW-12) probably originated from releases of motor oil or shear oil (hydraulic oil) during the metal recycling operations. The origin of the middle distillate material, is likely due to a creosote-petroleum formulation where the petroleum was used as a dilutent in the preparation of creosote. While a middle distillate compound such as kerosene or diesel may also have been associated with an onsite release from metal recycling operations, these compounds only occur in the presence of creosote. Since there were no diesel or kerosene soil sources at the site, these compounds are more likely associated with historic wood treating activities.

Respectively submitted,

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