Shoreline Oiling Report in Holly Woods

Field Inspections

On July 17, 2004, GeoInsight, Inc. received a telephone call from the resident at 8 Holly Woods Road in Mattapoisett, who reported visible globules of "soft, mushy oil and some hardened pancakes of oil" on his private beach at that location. This beach areas is located within shoreline segment W1D-04 (Holly Woods/Peases Point Initial cleanup activities consisting of both active cleanup and shoreline cleanup action team (SCAT) reconnaissance, were conducted in this area during the summer of 2003 following the April 27, 2003 B120 oil spill. Additionally, Massachusetts Department of Environmental Protection (MADEP) conducted a limited cleanup of this area during the summer of 2003 due to the discovery of old oil that was derived from a previous oil spill and not related to the Bouchard Barge B120 incident. The resident indicated that the newly observed oil was similar in appearance to the oil that was stranded on his shoreline in 2003 following the B120 oil spill.

On July 18, 2004, GeoInsight conducted a visual inspection of the subject shoreline. Less than a dozen tar patties ranging between 1 and 5 inches in diameter were observed on the sandy beach in the upper intertidal zone. The tar patties appeared to be fresh, non-consolidated fuel oil based on the consistency and odor of the material. Additionally, weathered tar patties were observed in the supratidal zone and GeoInsight removed these patties at the time of the inspection. Due to the tidal conditions, visual inspection of the intertidal zone was limited to the upper intertidal and supratidal zone, and further inspection of the intertidal zone was deemed to be warranted.

On July 19, 2004, representatives from GeoInsight and Gallagher Marine Services returned to the area during low tide along with the resident that reported the oiling. There were three areas of potential concern identified. First, the sandy beach in the upper intertidal zone had isolated surficial globs of mobile oil in the sand ranging in size from 6 to 8 inches in diameter. The oil was black, semi-liquid, and had a potent petroleum odor. Second, test pit excavations revealed that the oil extended below the surface in the sandy areas, primarily in the upper intertidal zone. Approximately 20 test pits were dug along the shoreline to delineate the overall extent of sporadic oiling in the upper intertidal zone. It was found to measure approximately 70 linear feet along the shoreline, 40 feet in width and 6 to 12 inches in depth. Most of the oil layer was covered with a veneer of sand, and was located on top of a layer of peat.

Third, the resident pointed out a tar layer (pavement) in an adjacent marsh area that appeared to be composed, in part, of some type of petroleum material. The tar mat-layer was approximately 40 feet in length by 4 feet wide, and was located along the edge of an eroding marsh in the lower intertidal zone. The marsh exhibited signs of erosion demonstrated by areas of slumping peat and dislodged mounds of peat proximal to the shoreline. These peat islands (eroded, dislodged fragments of marsh) measured approximately 10 feet in length by 3 feet in width, and were observed to have patches of pavement up to 12 inches in diameter along the marsh edges. The observed oil penetrated the marsh peat to a depth of 6-12 inches below ground surface and was soft and tacky, similar to B120 oil observed during inspections throughout the Buzzards Bay area. The team also observed a slight rainbow sheen on the water surface at the edge of the tarmat, and the sheen disappeared approximately 2 inches from its source. The remainder of the segment was inspected and sporadic tarballs and tar patties ranging from about 1 to 6 inches in diameter were observed (and removed) primarily from the shoreline marsh grass.

The location of the areas of concern along the beach and marsh were recorded with a global positioning system (GPS) and marked with pin flags. Three samples, identified as W1D04-Tarballs, W1D04-Buried Oil, and W1D04-Marsh Tarmat were collected within these three areas of concern. The samples were shipped to B&B Laboratories in College Station, Texas for polycylic aromatic hydrocarbon (PAH) and fingerprinting analyses.

On July 26, 2004, GeoInsight and ENTRIX conducted another visual inspection of the marsh during low tide. Visual observations from this field inspection were consistent with previous inspections conducted by GeoInsight. Additionally, GeoInsight and MADEP conducted a visual inspection of the area on August 31, 2004. The inspection focused on the three areas of concern, which included the marsh and sandy beach habitat. The oiling conditions observed during the August 31 survey were consistent with the results of previous inspections.

Laboratory Results

Analytical results indicated that PAH were detected in the samples and ranged from 2.2 to 5.5 parts per billion (ppb). However, the PAHs did not appear to be related to the B120 source oil based on the fingerprint analysis, as described below. Table 1 summarizes the total PAH concentrations and the laboratory analysis report is presented as an attachment to this report.

Table 1. Summary of PAH Analysis for Holly Woods Tarball Samples

Sampling Date: 7/19/04 **Sample ID and Matrix**	**Total PAH (ppb)**
WID04-Tar Balls	2.2
WID04-Buried Oil	4.8
WID04-Marsh Tarmat	5.5

Geochemical review of the laboratory analysis was conducted of the three tarball samples collected at Holly Woods relative to the B120 source oil. Overall, this geochemical review confirms that the tar samples collected from Holly Woods are **not** associated with the B120 oil spill and the likely source of the oil is some type of asphalt. The basis for this conclusion are based on specific dissimilarities between the chemical composition of the Holly Woods samples and the B120 oil, as described further below.

As shown in Figure 1 (attached), the PAH fingerprints in the Holly Woods samples are distinctive due to a high concentration of dibenzothiophenes relative to other aromatic compounds. The dibenzothiophene pattern is consistent and distinctive among the three Holly Woods samples. This pattern is not seen in the B120 source oil and any difference between the Holly Woods samples and the B120 oil cannot be accounted for by known weathering processes.

Figure 2 (attached) illustrates the overall pattern of aliphatic hydrocarbons in the B120 source oil compared to the Holly Woods samples. The aliphatic hydrocarbons in the "buried oil" sample from the beach and the "tar mat" sample from the marsh are distinctly different from the B120

source oil. The differences between the overall pattern of the unresolved complex mixture (UCM) in the two Holly Woods samples relative to the B120 UCM cannot be accounted for by known environmental processes. The "tar ball" sample is highly weathered and the aliphatic pattern is less distinguished, but still differs from that of the B120 oil. Although the "tarball" sample is not as conclusive based on the aliphatic hydrocarbons, it can readily be distinguished from the B120 oil based on specific biogeochemical marker compounds as discussed below.

Figure 2 also shows the "ion 191 chromatogram" for the B120 source oil and Holly Woods samples. This 191 ion is produced when fossil fuels are analyzed by mass spectroscopy due to the presence of "terpenoid" biomarker compounds, which are natural biological compounds found in fossil fuels. Quantitative results are sometimes reported for individual terpenoid compounds, such as C_{30}-hopanes, to assist in determining if hydrocarbons are from the same source. The 191 chromatograms in Figure 2 provide distinctive fingerprints that clearly show that the Holly Woods samples are all of the same source and that they are not derived from the B120 source oil.

Figure 3 (attached) provides additional evidence of the similarity among the Holly Woods samples and the dissimilarity with the B120 source oil based on the fingerprint of sterane and diasterane biomarker compounds. These compounds, like terpenoid compounds, are numerous in fossil fuels and provide an additional fingerprint that can be used to distinguish fossil fuels. This class of compounds is represented by two characteristic ions (217 and 218), which are also found during analysis of samples by mass spectroscopy. Both ion chromatograms provide additional evidence that the Holly Woods samples are from the same source and that they are not derived from the B120 source oil.

The forensic analyses are consistent in showing that, although there are differences in the weathering of the various Holly Woods samples (indicated by the aliphatic and PAH analyses), the Holly Woods samples are from the same source, and the source is **not** the B120 oil. Based on the proportion of dibenzothiopenes and its alkylated isomers, it appears that the Holly Woods samples are some type of asphalt, completely unrelated to the B120 incident.

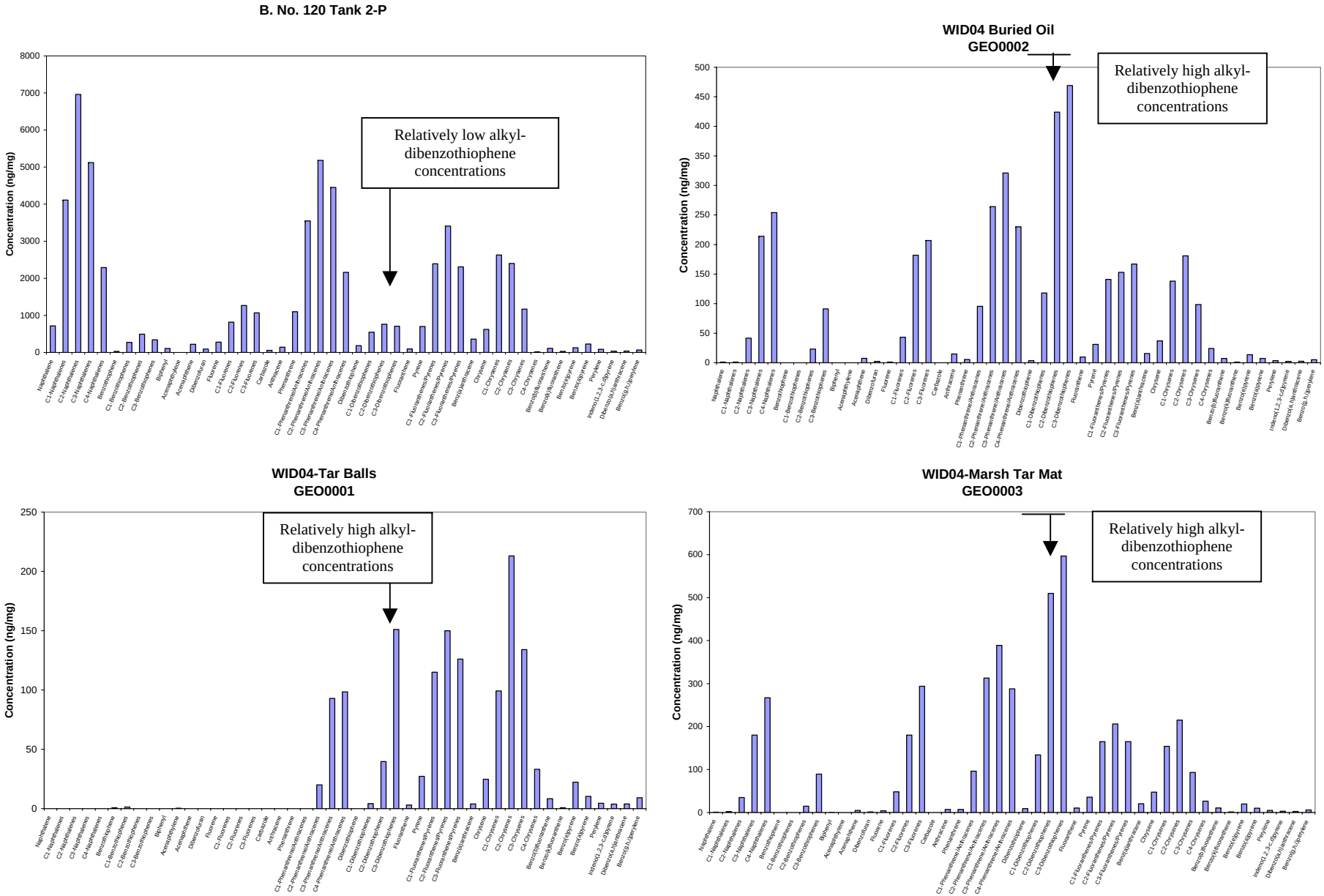

Figure 1. Comparison of PAH Fingerprint between B120 Oil and Samples of "tar" Material from Holly Woods