APPENDIX F

Entrix's Shellfish Survey April 12, 2006 Quahog Tissue Analytical Results

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June 29, 2006

Mr. Dave Whittaker
Massachusetts Division of Marine Fisheries
Pocasset Office
50A Portside Drive
Pocasset, Massachusetts 02559

Mr. Kevin J. Villa
Fairhaven Shellfish Constable
40 Center Street
Fairhaven, Massachusetts 02719

RE: Shellfish Survey April 12, 2006
Quahog Tissue Analytical Results

Dear Mr. Whitaker and Mr. Villa,

Attached are the laboratory results for the shellfish tissue samples we collected with you on April 12, 2006 between Wilbur Point and West Island Town Beach (Appendix A). The purpose of this laboratory analysis was to further investigate the concern that oil from the April 2003 B120 oil spill may be causing "dead zones" in these shellfish beds, as reported by Captain Tim Power of the F/V Pilgrim Maid. Captain Powers is concerned that his observation of a relatively large number of recently dead shellfish (i.e., empty, paired shells; a.k.a. "clappers") was somehow related to the B120 oil spill. Since qualitative and quantitative surveys of the shellfish beds in the general area have found no evidence of oiling (e.g., tarballs, staining) in the shellfish beds since 2003, this investigation focused on the potential for toxic effects to shellfish from oil-related constituents. Specifically, this analysis was completed to confirm that the limited amount of weathered, residual oil that remains at portions of the nearby shoreline of Hoppy's Landing, was not causing the death of the shellfish.

Figure 1 identifies the area where collections were made as part of our survey onboard the F/V Pilgrim Maid. After each tow, the dredge was hauled up, and the contents deposited onto the sorting table. From each tow we collected 12 to 15 individual quahogs, and handled and packaged them using standard sample handling procedures. On the last tow, we also collected 10 bay scallops that we handled and composited similarly.[1] These samples were sent on ice to B&B Laboratories, Inc., the same laboratory that analyzed the shellfish samples that were collected as part of the initial response activities associated with this spill between April 2003 and May 2004. At the laboratory, shellfish were shucked and the sample from each tow homogenized. Each composite quahog sample was analyzed for the potentially harmful constituents of oil known as polycyclic aromatic hydrocarbons (PAH), with a gas chromatograph/mass spectrophotometer (GC/MS) in accordance

[1] *This sample was not analyzed because the majority of recently empty shells were quahogs, and because of the two year life span of the scallop, this cohort was not alive when the spill occurred three years ago.*

with the EPA guidance (EPA 1995, ANSI/ASQC 1995). The laboratory report is provided in Appendix A.

Total PAH concentrations are the sum of all detected constituents, including estimated concentrations that are below detection limits (qualified with "J"). This is the same analysis that was used during previous shellfish tissue surveys to assess potential impacts of the B120 oil on shellfish. The total PAH concentrations in the three quahog samples ranged from 9.0 to 24.7 micrograms per kilogram[2] (µg/kg). These concentrations are less than the average total PAH concentrations detected in shellfish collected from areas unaffected by the spill in 2003 (less than 200 µg/kg) as described more fully in Appendix B. These concentrations are also significantly less than the average total PAH concentrations in shellfish (specifically blue mussels) reported prior to the spill in Buzzards Bay as part of NOAA's Mussel Watch program (average of 275 µg/kg, range of 75 to 1,125 µg/kg between 1989 and 2002).

It should also be noted that federal and state resource agencies involved in evaluating potential spill-related impacts to the aquatic habitat and fisheries resources have concluded that B120 oil has not resulted in oil concentrations in shellfish tissue to the degree that it would cause any lethal or sublethal impacts to shellfish since at least July 2003. In some places, B120 oil probably never caused lethal or sublethal impacts. Although this determination was based on potential toxicity associated with individual PAHs, the total PAH concentrations in the samples[3] where concentrations may have caused sublethal effects in the weeks following the spill were at least 100 times higher than the concentrations detected in the April 2006 samples (ENTRIX 2005)

It should also be noted that the continued closure of a portion of the shellfish bed at Hoppy's Landing is related to the B120 oil spill (and at times algal blooms), but it is not related to any continued concerns with shellfish tissue concentrations or oiling within the shellfish beds. Shellfish tissue concentrations at this location have been within acceptable levels for human consumption since at least May 2004 as determined by the Massachusetts Department of Public Health. The Massachusetts Department of Environmental Protection has requested the portion of the bed closest to the southern point at Hoppy's Landing remain closed to shellfishing due to the potential for future cleanup activities of residual oil on some rocks on this point. Lastly, it should be noted that the residual oil at Hoppy's Landing is not as extensive as previously reported by the Wood's Hole Group (WHG 2005) since they apparently mistook extensive algal mats for oil during their field reconnaissance (see Appendix C).

While recently empty shells were observed during the April 2006 survey, there was no evidence in the field that this observation was associated with the B120 oil spill. The empty paired shells or clappers that were identified as remnants of recently (i.e., this winter) deceased shellfish were smooth and closely resembled the condition of shellfish captured alive. Shells that had been vacated for a longer period of time clearly showed signs of degradation; the shells were pitted and somewhat decomposed. No oil was visible on any of the shells (occupied or otherwise), and no oil has been observed during

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[2] *Note: Results are provided in units of nanograms PAH per gram of tissue. These units are equivalent to micrograms PAH per kilogram of tissue (parts per billion)*

[3] *The lowest PAH concentration that exceeded the sublethal threshold was 2,523 µg/kg Total PAH.*

field investigations in the subtidal zone. Since the resulting tissue concentrations in shellfish samples collected from this area (ranging from 9.0 to 24.7 µg/kg) are significantly less than those reported to result in sublethal impacts to shellfish, and the concentrations in these April 2006 samples are at the lower end of reported baseline conditions in Buzzards Bay, there is no evidence that B120 oil is responsible for the increase in recently empty quahog shells.

If you have any questions or comments, please feel free to contact me at (978) 687-6180 x 23 or via email at aguinan@entrix.com.

Sincerely,

Allison W. Guinan
Sr. Staff Scientist
ENTRIX, Inc.

Attachments:

Figure 1	Hoppy's Island Shellfish Survey
Appendix A	B&B Laboratory Results
Appendix B	Executive Summary of Shellfish Pre-Assessment Report (ENTRIX 2003)
Appendix C	Response to June 30, 2005 Woods Hole Group Letter

Cc: Mr. Richard J. Wozmak, P.E., LSP, EnviroSense, Inc
Mr. Kevin Trainer, LSP, GeoInsight, Inc.
Project File

References Available Upon Request:

ANSI/ASQC. 1995. Specification and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs. E4-1994. January.

ENTRIX, 2003. Evaluation of Appropriate Criteria and Technical Approaches for Re-Opening Shellfish Areas. For Buzzards Bay Oil Spill, Massachusetts. October 24.

ENTRIX, 2005. Memorandum to Aquatic Technical Working Group for Bouchard B-120 Oil Spill. Literature-Derived Sublethal Toxicity Benchmarks for Tissue and the Bouchard B-120 Shellfish Tissue Data. October 14.

U.S. Environmental Protection Agency (EPA). 1995. Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents, EPA QA/G-6. Office of Research & Development. November.

Appendix A

B&B Laboratory Results

B&B Laboratories
Project J03318
Report 06-1631

Entrix, Inc.
Buzzards Bay Oil Spill Project
Polycyclic Aromatic Hydrocarbon Data
Client Submitted Samples

Client Project #7079608-2000

Sample Name	ETX6074.D		ETX6075.D		ETX6076.D		ETX6077.D	
Client Name	T-1-QH (A,B,C)		T-2-QH (A,B,C)		T-3-QH (A,B,C)		T-3-QH (A,B,C)	
Matrix	Tissue		Tissue		Tissue		Tissue	
Collection Date	04/12/06		04/12/06		04/12/06		04/12/06	
Received Date	04/13/06		04/13/06		04/13/06		04/13/06	
Extraction Date	04/20/06		04/20/06		04/20/06		04/20/06	
Extraction Batch	ENV 1388		ENV 1388		ENV 1388		ENV 1388	
Date Acquired	05/09/06		05/09/06		05/09/06		05/09/06	
Method	PAH-2002		PAH-2002		PAH-2002		PAH-2002	
Sample Wet Weight (g)	13.0		12.9		13.0		13.1	
Sample Dry Weight (g)	0.9		1.0		0.8		1.8	
%Lipid Wet Weight	0.2		0.2		0.1		0.6	
%Lipid Dry Weight	2.4		2.1		2.3		4.6	
% Moisture	93		92		94		86	
% Dry	7		8		6		14	
Dilution	NA		NA		NA		NA	
Target Compounds	Su Corrected Conc. (ng/wet g)	Q	Su Corrected Conc. (ng/wet g)	Q	Su Corrected Conc. (ng/wet g)	Q	Su Corrected Conc. (ng/wet g)	Q
Naphthalene	0.7	J	0.8	J	0.7	J	1.2	J
C1-Naphthalenes	0.5	J	0.5	J	0.4	J	0.9	J
C2-Naphthalenes	0.9	J	0.8	J	0.5	J	1.4	J
C3-Naphthalenes	0.9	J	1.0	J	0.8	J	1.7	J
C4-Naphthalenes	1.2	J	1.1	J	0.7	J	1.8	J
Benzothiophene	<0.6	U	<0.6	U	<0.6	U	<0.6	U
C1-Benzothiophenes	<1.2	U	<1.2	U	<1.2	U	<1.2	U
C2-Benzothiophenes	<1.2	U	<1.2	U	<1.2	U	<1.2	U
C3-Benzothiophenes	<1.2	U	<1.2	U	<1.2	U	<1.2	U
Biphenyl	0.4		0.4		0.5		0.5	
Acenaphthylene	0.1	J	<0.4	U	<0.4	U	0.1	J
Acenaphthene	0.1	J	0.1	J	0.1	J	0.3	J
Dibenzofuran	0.4		0.3	J	0.2	J	0.4	
Fluorene	0.2	J	0.1	J	0.1	J	0.4	J
C1-Fluorenes	0.4	J	0.3	J	0.3	J	0.7	J
C2-Fluorenes	0.8	J	0.6	J	<0.9	U	1.2	
C3-Fluorenes	<0.9	U	<0.9	U	<0.9	U	<0.9	U
Carbazole	<1.7	U	<1.7	U	<1.7	U	<1.7	U
Anthracene	0.2		<0.2	U	<0.2	U	0.1	J
Phenanthrene	0.5	J	0.6		0.4	J	2.2	
C1-Phenanthrene/Anthracenes	0.7	J	0.9	J	0.5	J	2.6	
C2-Phenanthrene/Anthracenes	1.2		1.1	J	0.8	J	2.5	
C3-Phenanthrene/Anthracenes	1.8		1.6		1.0	J	4.4	
C4-Phenanthrene/Anthracenes	0.5	J	0.3	J	0.2	J	0.7	J
Dibenzothiophene	0.1	J	<0.3	U	<0.3	U	0.2	J
C1-Dibenzothiophenes	0.2	J	<0.5	U	<0.5	U	0.6	
C2-Dibenzothiophenes	0.5	J	<0.5	U	<0.5	U	0.8	
C3-Dibenzothiophenes	0.4	J	<0.5	U	<0.5	U	1.0	
Fluoranthene	2.0		0.9	J	0.6	J	3.1	
Pyrene	1.5		0.8	J	0.5	J	1.2	
C1-Fluoranthenes/Pyrenes	0.9	J	0.5	J	0.3	J	1.6	J
C2-Fluoranthenes/Pyrenes	0.4	J	<1.8	U	<1.8	U	0.6	J
C3-Fluoranthenes/Pyrenes	<1.8	U	<1.8	U	<1.8	U	0.3	J
Naphthobenzothiophene	<0.5	U	<0.5	U	<0.5	U	0.4	J
C1-Naphthobenzothiophenes	<0.9	U	<0.9	U	<0.9	U	0.5	J
C2-Naphthobenzothiophenes	<0.9	U	<0.9	U	<0.9	U	0.4	J
C3-Naphthobenzothiophenes	<0.9	U	<0.9	U	<0.9	U	<0.9	U
Benz(a)anthracene	0.6		0.1	J	0.1	J	0.2	J
Chrysene	1.2		0.4	J	0.3	J	1.9	
C1-Chrysenes	0.3	J	<1.6	U	<1.6	U	0.7	J
C2-Chrysenes	<1.6	U	<1.6	U	<1.6	U	0.5	J
C3-Chrysenes	<1.6	U	<1.6	U	<1.6	U	<1.6	U
C4-Chrysenes	<1.6	U	<1.6	U	<1.6	U	<1.6	U
Benzo(b)fluoranthene	1.3		0.3	J	<0.6	U	1.2	
Benzo(k)fluoranthene	0.6		0.2	J	<0.3	U	0.5	
Benzo(e)pyrene	0.9		0.4	J	<0.4	U	1.2	
Benzo(a)pyrene	0.5		0.1	J	<0.3	U	0.3	
Perylene	0.3	J	<0.9	U	<0.9	U	0.2	J
Indeno(1,2,3-c,d)pyrene	0.6		0.1	J	<0.5	U	0.3	J
Dibenzo(a,h)anthracene	0.1	J	<0.4	U	<0.4	U	<0.4	U
Benzo(g,h,i)perylene	0.8		0.2	J	<0.4	U	0.3	J
Total PAHs	24.7		14.5		9.0		41.1	
Individual Alkyl Isomers and Hopanes								
2-Methylnaphthalene	0.5	J	0.5	J	0.4	J	0.8	J
1-Methylnaphthalene	0.3	J	0.3	J	0.3	J	0.6	J
2,6-Dimethylnaphthalene	0.3	J	0.3	J	0.2	J	0.6	
1,6,7-Trimethylnaphthalene	0.2		0.1	J	0.1	J	0.2	
1-Methylphenanthrene	0.2		0.3		0.1	J	0.6	
C29-Hopane	3.3		1.6	J	<2.2	U	1.5	J
18a-Oleanane	<2.2	U	<2.2	U	<2.2	U	<2.1	U
C30-Hopane	3.0		2.7		<2.2	U	5.0	
Surrogate (Su)	Su Recovery (%)		Su Recovery (%)		Su Recovery (%)		Su Recovery (%)	
Naphthalene-d8	38	*	45		33	*	42	
Acenaphthene-d10	68		69		61		58	
Phenanthrene-d10	69		69		70		64	
Chrysene-d12	76		59		57		54	
Perylene-d12	33		23		39		29	

Qualifiers (Q): J=Below the MDL, U=Not detected, B=In procedural blank > 3x MDL, I=Interference, D=Diluted value, NA=Not Applicable, *=Outside QA limits, refer to narrative

Appendix B

Executive Summary of Shellfish
Pre-Assessment Report (ENTRIX 2003)

Buzzards Bay, Massachusetts
Evaluation of Appropriate Criteria and Technical Approaches for Re-Opening Shellfish Areas

On April 27, 2003, an undetermined amount of Number 6 fuel oil was released from the Barge B-120 into Buzzards Bay, Massachusetts. In response to the spill, the Massachusetts Division of Marine Fisheries (DMF) closed state shellfish areas BB-1 through BB-58 (within Buzzards Bay) and E-1 through E-14 (adjacent to the Elizabeth Islands) on April 28, 2003 and April 30, 2003.

This comprehensive risk evaluation shows that if concentrations of total polycyclic aromatic hydrocarbons (TPAH) are less than 1,400 parts per billion (ppb), the potential human health risks from shellfish consumption are below a carcinogenic risk level of 10^{-5} and a Hazard Index of 1 for non-carcinogenic effects (the risk level and Hazard Index values are the same as those cited in the Massachusetts Contingency Plan). All composited samples collected on August 27 and 28, 2003, contained TPAH tissue concentrations below 1,400 ppb, and so meet the risk-based criteria. The risk evaluation also concluded that tissue samples with TPAH concentrations below 200 ppb would be well below the threshold risk criteria. Tissue samples from all but two shellfish areas (BB-15 and BB-17) contained less than 200 ppb TPAH as of the August 27 - 28, 2003 sample collection period. Additional samples from these two areas were collected on October 23, 2003 and are being analyzed.

The Responsible Party (RP) retained ENTRIX, an environmental consulting firm, to represent it on environmental issues related to the spill including the shellfish area closures. ENTRIX contacted DMF on May 1, 2003 to discuss what criteria the state would use to open the shellfish areas and to develop a plan to collect the appropriate supporting data. While state and federal criteria for re-opening shellfish areas contaminated with petroleum hydrocarbons do not exist, DMF indicated that shellfish tissue concentration data would be needed for any re-opening decision.

From May 5 through May 7, 2003, ENTRIX and DMF collected samples of five bivalve mollusk species from selected state shellfish areas for tissue analyses of polycyclic aromatic hydrocarbons (PAHs) and other fossil fuel-related compounds. Samples were obtained from areas with heavily and lightly oiled beaches, as well as from beaches that appeared unoiled. PAHs were selected for analysis because these components of petroleum may increase the potential lifetime risk of cancer or may affect human health in other ways, such as effects on development or reproductive capacity.

After technical review of the tissue analyses and discussions between the Massachusetts Department of Public Health (DPH) and DMF, 33 shellfish areas (about 90,000 acres) were re-opened on May 22, 2003, subject to local rules and regulations. The 33 areas that were re-opened in May shared the following characteristics: (1) the beaches within the shellfish area received little to no oiling; and (2) tissue samples from the shellfish area had concentrations of total PAHs (TPAH) below approximately 200 parts per billion (ppb). The approximate maximum concentrations in tissue samples from areas documented to have received little to no oiling from the spill were also below approximately 200 ppb. On October 13, 2003, DPH re-opened an additional approximately 50,000 acres by fully re-opening eight shellfish areas and

partially re-opening seven shellfish areas. As of October 13, 2003, 14 full shellfish areas and seven partial shellfish areas representing approximately 40,000 acres of state shellfish areas remained closed due to the spill.

Additional re-openings of state shellfish areas are subject to meeting criteria designed to be protective of human health and welfare, although numerical criteria, related regulations or guidelines, or expedited procedures for establishing criteria did not exist at the time of the initial re-openings. Subsequently, ENTRIX has assessed various incident- and site-specific criteria and technical approaches that could be used for re-opening shellfish areas that have been closed because of exposure to oil. These approaches include techniques to assess the potential risks of an oil spill incident relative to appropriate criteria.

To monitor tissue PAH concentrations in areas that remained closed after May 2003, ENTRIX and DMF periodically collected additional samples through August 29, 2003. Tissue samples were classified as containing spilled-oil PAHs, PAHs from other sources (such as soot), or a combination of the two. The TPAH concentrations in tissue samples from oiled and unoiled areas ranged from 35 to approximately 60,000 ppb, and from 28 to approximately 240 ppb, respectively. In general, shellfish eliminated spilled oil (a process termed "depuration") fairly rapidly, with tissue TPAH concentrations in even most of the highest samples dropping to less than 200 ppb within one to four months after the spill. ENTRIX used the most recent tissue concentration data for each sampling location in the risk assessments. Additional samples were collected on October 23, 2003 and are being analyzed.

ENTRIX conducted a review of relevant regulatory and scientific publications, guidance documents, and databases, and consulted with Ruth Yender, a NOAA expert in assessments of potential health risks associated with consuming oil-contaminated seafood. This review indicated that: (1) a risk-based approach is most commonly recommended and used for establishing criteria for opening shellfish areas after oil spills; and (2) a toxicity equivalency approach is often used in risk-based assessments to calculate potential risk levels for both carcinogenic and non-carcinogenic PAHs. Because the effects of individual PAH compounds that are present in oil are considered to be additive, the toxicity equivalency approach is used to integrate the relative toxicity of each PAH compound into a single carcinogenic risk value and a single non-carcinogenic risk value.

ENTRIX used the risk-based toxic equivalency approach described by the U.S. Environmental Protection Agency (EPA) in its report entitled *National Guidance Document for Assessing Chemical Contaminant Data for Use in Fish Advisories* (EPA 2000; see http://www.epa.gov/waterscience/fish/guidance.html), with modification of two exposure values. These modifications were made in accordance with EPA recommendations in the guidance document to use site-specific information to more accurately reflect potential health risks. The two modified exposure values were the duration of exposure and the ingestion rate. The latter was modified to account for consumption of only bivalve mollusks, the relevant concern for shellfish area re-openings, instead of total seafood. These modifications allowed consideration of the effects of depuration (duration of exposure) as well as the use of values comparable to those used in other comparable spill risk assessments. Separate calculations were made using more restrictive exposure values to evaluate potential health risks to "special populations". These special populations include children, who may be more sensitive to PAH exposure, and

subsistence fishers and Native American subsistence fishers, who may consume larger amounts of bivalve mollusks than the general population.

The acceptable carcinogenic risk level used in the assessment was 10^{-5}, or the lifetime potential for one cancer case to occur in a population of 100,000 as a result of consuming bivalve mollusks from Buzzards Bay. Potential non-carcinogenic risks were assessed using the Hazard Index method, which is the sum of ratios of chemical concentrations to appropriate reference concentrations. Harmful effects may occur when this sum exceeds a value of 1. These criteria have been established for use as benchmarks in risk evaluations by the Massachusetts Department of Environmental Protection in its Massachusetts Contingency Plan at *310 CMR 40.0955(2)(a)* for Imminent Hazard Risk Characterization and Outcome, and the associated *310 CMR 40.0993(6)* for Method 3 Human Health Risk Characterization.

ENTRIX determined that potential non-carcinogenic health risks to the general public and all special populations due to ingestion of bivalve mollusks contaminated with spilled oil were substantially lower than the risk criterion. The potential carcinogenic risk was also lower than the risk criterion for all populations at all closed shellfish areas, except for Native American subsistence fishers at two locations. For this special population, the carcinogenic risk criterion was exceeded only in tissue samples from Areas BB-15 and BB-17. However, the potential risk to Native American subsistence fishers was likely overstated because the risk calculation assumed an ingestion rate of 540 grams (about one pound) per day for two years of bivalve mollusks from Areas BB-15 and BB-17, and assumed that the PAH concentrations remained at the levels present in samples collected in August 2003. The assumed ingestion rate is cited in the National Guidance Document to account for total seafood consumption by Native American subsistence fishers in general. A shellfish-specific ingestion rate of 175 grams per day for Native American subsistence fishers has been cited in the literature (Harper, *et al.* 2002). The actual consumption of bivalve mollusks by Native American subsistence fishers in Buzzards Bay would likely be less than this assumed rate, and depuration is expected to substantially reduce PAH concentrations in the mollusks in these areas before the end of 2003.

The assessment also determined that for samples that did not contain PAHs from the oil spill, potential non-carcinogenic and potential carcinogenic risks to the general public and all special populations were lower than the risk criteria.

In summary, even using a 200 ppb threshold criterion and an ingestion rate for Native American subsistence fishers of 540 grams per day, the risk assessment indicates that the health of the general public, children, and subsistence fishers would be protected if all shellfish areas sampled, except Areas BB-15 and BB-17, were re-opened (subject to local rules and regulations). To protect the health of Native American subsistence fishers who theoretically may consume large amounts of bivalve mollusks, it would be desirable that Areas BB-15 and BB-17 remain closed until further tissue sampling indicates that TPAH concentrations are below approximately 200 ppb. Additional samples from these two shellfish areas were collected on October 23, 2003 and are being analyzed. Based on observed TPAH depuration rates, this background criterion is

likely to be met. However, based on the same risk thresholds and a more realistic shellfish-specific ingestion rate for Native American subsistence fishers, areas with shellfish tissue concentrations below 1,400 ppb would protective of the health of all populations. Based on samples collected in August 2003, this condition is already met for all shellfish areas, including BB-15 and BB-17.

Appendix C

Response to June 30, 2005
Woods Hole Group Letter

April 10, 2006 GeoInsight Project 3871-002

Richard F. Packard
Massachusetts Department of Environmental Protection
Southeast Regional Office
Bureau of Waste Site Cleanup
20 Riverside Drive
Lakeville, Massachusetts

Re: Response to June 30, 2005 Woods Hole Group Letter
Barge B120 Spill
Buzzards Bay, Massachusetts
DEP RTN 4-17786

Dear Mr. Packard:

GeoInsight, Inc. (GeoInsight) prepared this letter on behalf of Bouchard Transportation Company, Inc. (Bouchard) to correct several inaccuracies in the June 30, 2005 letter prepared by the Woods Hole Group (WHG) to the Town of Fairhaven. The WHG letter was prepared to identify resource damages to areas of the Fairhaven shoreline for consideration as part of the Natural Resource Damage Assessment (NRDA) process that is being conducted for the release of No. 6 fuel oil from Bouchard Barge 120 (B120)

However, several of the shoreline features characterized in the WHG letter were evaluated as part of the response actions conducted under the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000, and these shoreline features are <u>not</u> associated with B120 oil. The WHG letter contained several inaccuracies, including:

- identification of algal mats in marsh areas as B120 oil;
- identification of slag at Pope's Beach as "oiled covered sand nodules" (sp.); and
- identification of blue-green algae on rocks as remnant oil.

Additional information regarding these conditions is presented below.

ALGAL MATS

The WHG letter identified "remnant oil" or "oil mat" in several areas on the surface of the marsh at Pope's Beach and at Hoppy's Landing. Photographs of these features were included in the WHG letter. The black-colored bare areas of the marsh surface shown in the photographs from Pope's Beach and some of the Hoppy's Landing photographs are actually mats composed of algae and cyanobacteria ("bluegreen algae"). The black color of the algal mats may superficially resembles oil, but there are several important characteristics that can be used to distinguish between oil and algal mats, including:

Residual B120 Oil	Algal Mat
Black color	Black color with occasional greenish tinge (or green color when scraped with fingernail)
Sticky or tacky on unweathered surface, often with small particles (sand or shell fragments) embedded in the oil	Slippery and smooth
Oil odor	Marine odor
Dense, solid or semi-solid	Spongy, saturated with water
Can produce an oil stain when vigorously disturbed or rubbed	Disintegrates when vigorously disturbed or rubbed

There is a small amount of residual B120 oil present at Pope's Beach; however, this residual oil is present as small, discontinuous patches of pavement that typically measure between one to three inches in diameter. These patches are predominantly observed in three separate areas that are typically less than ten square feet in area. In each of these separate areas there are typically fewer than ten patches. Some of these small oil patches are present in the bare/algal mat areas, and others are located in areas that are predominantly grass.

These bare areas were observed in other fringing marshes along Buzzards Bay, including in fringing marshes that were not oiled by the release. Because these bare areas are present in unoiled marshes, it is evident that natural processes can cause the formation of the bare areas and not necessarily B120 oil. To evaluate these bare areas in marshes, personnel from GeoInsight and ENTRIX, Inc. (ENTRIX) collected samples of the marsh surface in bare areas located in three separate fringing marshes: two marshes that were oiled by the B120 spill (Hoppy's Landing [W2A-10] and Pope's Beach [W2A-03]) and one marsh that was not oiled by the B120 spill (Long Island North [W2A-16]). The samples were submitted to Dr. Jim Sears, Chancellor Professor Emeritus of the University of Massachusetts at Dartmouth, for identification of the species that comprised the algal mats. A copy of Dr. Sears's report is attached. The report indicated that the samples collected from both the oiled and unoiled marshes contained several genus of algae and cyanobacteria.

The WHG letter also states that "Additional remnant contamination from the oil covered sediment will remain toxic to benthic fauna for the forseeable future." However, the WHG letter did not include information or documentation to support such a broad claim. It is important to point out that an ecological risk characterization is currently being conducted and this ecological risk

characterization will be included as part of the forthcoming Phase II Comprehensive Site Assessment (CSA) report. Several sets of data are used in the ecological risk characterization, including visual observations of shoreline flora and sediment samples collected from marsh areas (including samples collected from the bare areas in the fringing marshes at Pope's Beach and Hoppy's Landing). The results of these evaluations will be included as part of the ecological risk characterization section of the Phase II CSA report. Initial evaluation of these data indicate that concentrations of polynuclear aromatic hydrocarbons (PAH) and extractable petroleum hydrocarbon (EPH) fractions in the marsh sediment do not present a significant risk to the environment.

SLAG AT POPE'S BEACH

The WHG letter identified "oiled covered sand nodules" (sp.) near the high tide line at Pope's Beach, and a photograph of these "nodules" was included as Figure 5. These "nodules" are not associated with the B120 spill, and are not derived from oil. These "nodules" do not exhibit the characteristics of oil and the WHG letter noted that:

> "The nodules were very hard and required considerable effort to break them apart. Once the nodule was broken, the broken face was friable."

The limited amount of residual B120 oil remaining at Buzzards Bay is typically present in the form of pavement (i.e., oil mixed with sand or gravel that superficially resembles roadway pavement) or as splatter on rock surfaces. This residual B120 oil is soft when firmly pressed with a fingernail, may have a slight tackiness on the surface (depending upon the degree of weathering), has a slight oil odor, and will leave a sticky oil stain if vigorously rubbed or disturbed. It is important to reiterate that the fresh B120 oil was sticky, which resulted in small particles (e.g., sand, shell fragments) becoming adhered to the oil.

These "nodules" observed at Pope's Beach are vesicular (i.e., have a "bubbly" or "frothy" texture), hard, and brittle. These "nodules" are suspected to be residual material from coal combustion, commonly termed "slag" or "boiler slag." The American Coal Ash Association defines slag and boiler slag as follows:

> Slag – the nonmetallic product resulting from the interaction of flux and impurities in the smelting and refining of metals. Also the molten or fused ash in the furnace of a coal fired power plant. (*See boiler slag*)
>
> Boiler slag – a molten ash collected at the base of slag tap and cyclone furnaces that is quenched with water and shatters into black, angular particles having a smooth, glassy appearance.

This material is sometimes also colloquially referred to as "clinkers" or "cinders." In *Methods for Evaluating Application of the Coal Ash and Wood Ash Exemption Under the Massachusetts Contingency Plan* published by the LSP Association, the terms slag, clinkers, and cinders are defined as "Mass of coal ash that is a byproduct of combustion. Usually forms by condensation of

molten coal material and ash that, when cooled, forms into a hard porous material." These definitions of slag, clinkers, and cinders match the "nodules" observed at Pope's Beach.

It is important to note that the field reconnaissance teams have found pieces of coal, as well as slag, at Pope's Beach and Harbor View (which is the segment adjacent to Pope's Beach to the southwest). These two segments are located very close to the Atlas Tack Superfund Site, which formerly used coal as part of their manufacturing processes. Impacts from the Atlas Tack Superfund Site, including PAH from coal combustion, have been documented in Boys Creek, which is located adjacent to Pope's Beach and Harbor View. In addition, these segments are located near the entrance to New Bedford harbor, where coal-powered vessels formerly operated, and slag would be expected to be present near this area. Vessels from New Bedford Harbor and the Atlas Tack Superfund Site are considered to be the likely sources for the slag observed at Pope's Beach.

BLUE-GREEN ALGAE

The WHG letter included several photographs of "remnant oil" on or between rocks at Wilbur Point Beach. Some of the photographs showed rocks with black color on the surface that is not residual oil. This black color appears to be black lichens (*Verrucaria* spp.) and blue-green algae (*Calothrix* spp.) that grow on the rock surface. In contrast to the spilled oil, that tends to be tacky and has a petroleum odor, the lichens and algae are slippery on the surface and generally have a marine odor or no odor at all. In addition, the lichens and algae often show a slight greenish tinge when scraped with a fingernail.

Please feel free to call me at (978) 692-1114 if you have any questions or if you would like to discuss this project.

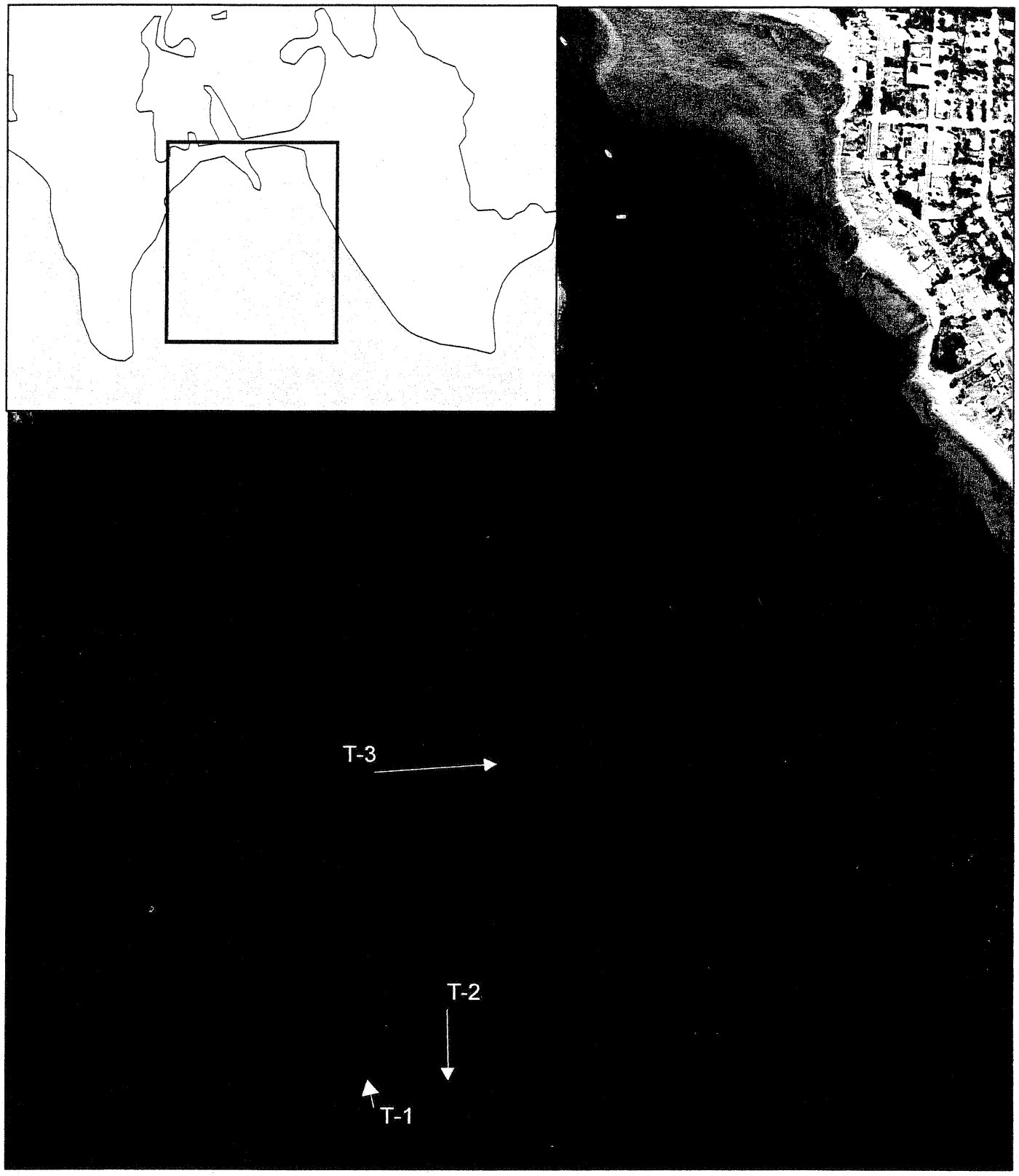
Sincerely,
GEOINSIGHT, INC.

Kevin D. Trainer, P.G., C.P.G., L.S.P.
Senior Project Geologist

Attachment: Report on identification of algae and Cyanobacteria ('bluegreen algae') in saltmarsh mat samples observed

cc: Morton Bouchard III, Bouchard Transportation Company, Inc.
Andrew Davis, LeBoeuf, Lamb, Greene & MacRae LLP
Austin P. Olney, LeBoeuf, Lamb, Greene & MacRae LLP
Richard J. Wozmak, LSP-of-Record, EnviroSense, Inc.
Wayne Kicklighter, ENTRIX

Figure



Legend

Shellfish Survey

0 0.05 0.1 0.2 Miles

N

E N T R I X

Hoppy Island
Shellfish Survey
Massachusetts
April 2006