



GeoInsight, Inc.  
75 Gilcrest Road, Suite 210  
Londonderry, NH 03053-3566  
TEL 603-434-3116  
FAX 603-432-2445  
www.geoinsightinc.com

GeoInsight, Inc.  
319 Littleton Road, Suite 105  
Westford, MA 01886  
TEL 978-692-1114  
FAX 978-692-1115

GeoInsight, Inc.  
Corporate Ten Center  
1781 Highland Avenue, Suite 207  
Cheshire, CT 06410  
TEL 203-271-8036  
FAX 203-271-8038

**PHASE II COMPREHENSIVE SITE ASSESSMENT  
CONCEPTUAL SCOPE OF WORK**

**BARGE B120 SPILL  
BUZZARDS BAY, MASSACHUSETTS  
RTN 4-17786**

Prepared For:

Bouchard Transportation Company, Inc.  
58 South Service Road, Suite 150  
Melville, NY 11747

Prepared By:

GeoInsight, Inc.  
319 Littleton Road, Suite 105  
Westford, Massachusetts 01886  
Phone: (978) 692-1114  
Fax: (978) 692-1115  
www.geoinsightinc.com

May 3, 2004



**TABLE OF CONTENTS**

**1.0 INTRODUCTION..... 1**

**2.0 RELEASE BACKGROUND AND ENVIRONMENTAL SETTING..... 2**

**3.0 PHASE II CONCEPTUAL SCOPE OF WORK ..... 5**

3.1 OBJECTIVES ..... 5

3.2 EXPOSURE PATHWAY CHARACTERIZATION..... 6

    3.2.1 Public Sand Beaches (1A) and Private Sand Beaches (1B)..... 7

    3.2.2 Mixed Sand and Gravel Beaches and Rip Rap Groins (1C)..... 8

    3.2.3 Rip Rap Seawalls, Bulkheads, Piers (1D), and Rocky Shores (1E) ..... 9

    3.2.4 Salt Marshes (1F)..... 10

    3.2.5 Subtidal Surface/Sediment..... 10

    3.2.6 Surface Water..... 11

    3.2.7 Ground Water..... 11

    3.2.8 Air ..... 12

3.3 DATA INTERPRETATION AND RISK CHARACTERIZATION ..... 12

3.4 REPORT PREPARATION..... 13

**4.0 SCHEDULE OF IMPLEMENTATION..... 14**

**TABLES**

Table 1      Potential Exposure Pathways

Table 2      Exposure Pathway Characterization

**FIGURES**

Figure 1      Release Area Overview

**APPENDICES**

APPENDIX A      Bureau of Waste Site Cleanup Transmittal Form BWSC-108

**PHASE II COMPREHENSIVE SITE ASSESSMENT  
CONCEPTUAL SCOPE OF WORK**

**BARGE B120 SPILL  
BUZZARDS BAY, MASSACHUSETTS  
RTN 4-17786**

**1.0 INTRODUCTION**

GeoInsight, Inc. (GeoInsight) prepared this Phase II Comprehensive Site Assessment Conceptual Scope of Work (CSOW) for the release of Number 6 fuel oil from Bouchard Transportation Company, Inc. (“Bouchard” or “RP”) Barge B120 that occurred on April 27, 2003 in Buzzards Bay, Massachusetts. An overview of the release area is presented on Figure 1. The release of No. 6 oil from Barge B120 is identified by the Massachusetts Department of Environmental Protection (MADEP) as Release Tracking Number (RTN) 4-17786 and additional information regarding the release is summarized in Section 2.0. The activities proposed as part of this CSOW are intended to further evaluate the nature and extent of the release and to evaluate potential risks to human and environmental receptors. This CSOW presents a conceptual overview of data to be collected during upcoming comprehensive response actions for the release.

## 2.0 RELEASE BACKGROUND AND ENVIRONMENTAL SETTING

On or about the afternoon of April 27, 2003, Barge B120 released approximately 22,000 to 55,000 gallons (Independent Marine Consulting, 2003) of No. 6 fuel oil soon after entering the western approach of Buzzards Bay. The RP notified the U.S. Coast Guard (USCG) of the release. The USCG notified state and federal oil spill response authorities and directed the tug and barge to proceed to Buoy 10 (Anchorage Lima) in Buzzards Bay, where it anchored and was subsequently boomed. After the remaining cargo and oily water was transferred from the ruptured tank on Barge B120 to other B120 tanks or to Barge B10, both barges proceeded to the Mirant facility in Sandwich, Massachusetts.

In the days following the release, the oil was driven by winds and currents and primarily affected discontinuous areas of shoreline along the north, northwest, and northeast portions of the bay including Westport, Dartmouth, New Bedford, Fairhaven, Mattapoisett, Marion, Wareham, Bourne and Falmouth. Shoreline oiling was localized, unevenly distributed, and generally concentrated at exposed points and peninsulas (e.g., Barney's Joy Point, Mishaum Point, West Island, Sciticut Neck and Long Island). In addition, a few isolated areas of sporadic shoreline oiling were reported in limited parts of the Elizabeth Islands and Rhode Island (e.g., Little Compton and Block Island). However, many shorelines in the project area were unoiled or lightly oiled. As described in the Phase I (Phase I) Initial Site Investigation and Conceptual Site Model (CSM), the released oil primarily impacted the intertidal zone of these shorelines, with the greatest degree of impacts in the upper intertidal zone. In total, approximately 84 miles of shoreline were oiled to varying degrees, although most areas received only light or very light oiling.

The Unified Command, consisting of representatives of the USCG, MADEP, and the RP, was established to direct and oversee clean-up operations. USCG also obtained input from National Oceanic and Atmospheric Administration (NOAA) representatives regarding clean up operations and strategies. The RP's environmental representative for responses conducted under the Oil Pollution Act of 1990 (OPA 90), ENTRIX, Inc. (ENTRIX), arrived on-scene and began to collect environmental data and information in conjunction with the natural

resource trustees (Trustees). Trustee representatives include the NOAA as the lead Administrative Trustee, the U.S. Fish and Wildlife Service (USFWS), Massachusetts Executive Office of Environmental Affairs, the Rhode Island Department of Environmental Management (RIDEM) and the Wampanoag “Aquinnah” Tribe of Gay Head. Additional response actions required under the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000, were conducted by GeoInsight. Richard J. Wozmak, P.E., P.H. of GeoInsight is the Licensed Site Professional (LSP)-of-record for the release. Refer to the Phase I and CSM report prepared by ENTRIX and GeoInsight for additional information regarding the release and the initial cleanup activities that were conducted following the release.

Unified Command classified the shoreline into 149 individual segments to facilitate cleanup operations. Of these 149 segments, 29 segments were subsequently found to be unoiled, and are not considered to be part of the disposal site. The remaining 120 segments were oiled to some degree and these segments comprise the disposal site. The shoreline at individual shoreline segments was classified based upon the shoreline substrate, public use, and vegetation. The shoreline in the vicinity of the release area was divided into the following shoreline classifications:

| Shoreline Classification | Shoreline Type   |
|--------------------------|--|
| 1A                       | Heavily utilized, public recreational sand beaches                                 |
| 1B                       | Less utilized, semi-public and private sand beaches                                |
| 1C                       | Mixed sand and gravel, gravel (pebble to boulder) and rip rap groins (jetties)     |
| 1D                       | Rip rap seawalls, bulkheads, piers, docks, and pilings                             |
| 1E                       | Rocky shorelines   |
| 1F                       | Salt marshes   |
| 2                        | Roseate tern habitat (Ram Island, Bird Island, and Penikese Island, in particular) |
| 3                        | Piping plover habitat  |

This site-specific classification was developed using the Environmental Sensitivity Index (ESI) codes, which were developed by NOAA (1999) in response to other oil spills in the context of evaluating shoreline habitat type. This approach for shoreline classification is accepted by the scientific community in assessing and responding to oil spills.

At a particular shoreline segment, there may be more than one shoreline classification. For example, portions of a particular segment may be classified as 1A (public sand beach), 1C (rip rap groins), 1F (salt marshes), and 3 (piping plover habitat).

Initial characterization was performed as part of Phase I activities, and this characterization is described in the Phase I and CSM report. Based upon the results of this characterization, a condition of No Significant Risk was found to be present at a total of 57 of the 120 oiled segments and Partial Response Action Outcome (RAO) will be filed for these segments. These 57 segments are composed primarily of segments where the degree of oiling was characterized as light or very light. In addition, three segments that were moderately oiled, but are composed of sandy beaches (shoreline classifications 1A and 1B), are also included as part of this Partial RAO. Specific information on the shorelines and risk characterization is included in the forthcoming Partial RAO Report. Additional characterization as part of comprehensive response actions will not be conducted at the segments that were included as part of the Partial RAO.

### 3.0 PHASE II CONCEPTUAL SCOPE OF WORK

#### 3.1 OBJECTIVES

The objectives of the CSOW are to: 1) evaluate the extent and magnitude of residual oil from the release and 2) characterize potential risk to human and environmental receptors. As described in the Phase I and CSM report, the oil characteristics and observed distribution were used to develop a matrix of potential migration pathways and exposure routes. The potentially-impacted media were identified using the shoreline classifications referenced in Section 2.1 above in addition to other media that were not subdivided into separate classifications by the cleanup operations (such as surface water, ground water, and air). These media were then evaluated for the potential exposure to both human and environmental receptors, with potential exposure pathways identified for the receptors. The matrix also includes potential exposures for public welfare and safety characterizations. The risk to public welfare is defined for those segments that are accessible to the public as the potential for residual oil to create a nuisance condition such as rubbing off on skin to the degree that limits public or community use (active or passive) of the shoreline segment. The potential risks to safety are primarily the threat of physical harm or bodily injury from slip and fall hazards due to the presence of oil on rock surfaces because other risks to safety (e.g., corroded drums, a threat of fire or explosion, or open lagoons) are not present.

Multiple potential pathways could exist within a segment or even at a specific location. For example, at public sandy beaches, potential human exposure to oil could be through inhalation of impacted dust particles, ingestion of impacted sand, and dermal absorption of oil through contact with tarballs. These beaches are open to the public, and therefore public welfare is also included as a potential exposure route. However, because this shoreline type has few, if any, rocks where residual oil splatter could be located, a risk to safety is not present. Potential residual oil in the sand could also constitute an exposure pathway to ecological receptors via direct contact or the food web. Refer to Table 1 for the potential exposure routes relative to the impacted media.

## 3.2 EXPOSURE PATHWAY CHARACTERIZATION

The potential exposure pathways identified in Table 1 will be characterized based upon analytical data of potentially-affected media (water, sediment, and tissue samples), visual inspections, and qualitative risk characterizations. The specific characterization methods for the identified media and potential exposure routes are listed in the sections below and summarized in Table 2. The characterization will rely, in part, upon data that have already been collected, such as observations from the Immediate Response Action Completion (IRAC) survey teams, reconnaissance activities conducted by GeoInsight and ENTRIX as part of ongoing Immediate Response Action (IRA) activities, and sampling data collected during the Phase I investigation (which are summarized in the Phase I and CSM report).

Under the Natural Resource Damage Assessment (NRDA) process, it is anticipated that additional assessments of exposure and persistence of oil in the environment will be conducted. These assessments may include field surveys and numerical modeling. The data from these assessments may be incorporated, where available and appropriate, into subsequent characterization under the MCP process.

A qualitative risk characterization will be conducted to evaluate some of the potential ecological exposure pathways where numerical standards are not available. The qualitative risk characterization will be conservative, specific to the potential exposure pathways, and based upon resource-specific criteria and benchmarks that are protective of ecological resources. These benchmarks may be derived from numerical standards or from toxicological studies that are applicable to that exposure pathway. For example, the qualitative risk characterization may use studies conducted at similar sites obtained from the scientific literature and may include visual observations of the health of ecological communities (e.g., barnacles on rocks) to evaluate the visual effects of the release on these organisms.



### **3.2.1 Public Sand Beaches (1A) and Private Sand Beaches (1B)**

Potential human exposure to impacted sediment via inhalation, ingestion (particulates and hand to mouth contact), and dermal absorption will be evaluated using laboratory analysis of sediment samples for extractable petroleum hydrocarbon (EPH) fractions and polynuclear aromatic hydrocarbons (PAH). Potential ecological risk associated with impacted sediment (for organisms that burrow or live in the sediment) will also be evaluated through this sampling program. Sediment samples will be collected from segments considered to be conservatively representative of the degree of oiling for segments within a particular oiling category (e.g., heavy, moderate). The samples will be collected from locations where field reconnaissances identify areas of relatively greater oiling both within the project area and also within a particular segment, with the objective of selecting locations that would provide a conservative, “worst-case” evaluation of oiling at these segments. At least three samples will be collected from each segment, with sampling locations in the upper intertidal zone (the area where oil impacts were observed to be greatest) and the lower intertidal zone. Samples will also be collected from the middle intertidal zone at selected locations to evaluate oil distribution across the intertidal zone.

Potential impacts to shellfish, both from a human consumption exposure scenario and risk to the shellfish ecosystem scenario, will be evaluated through existing and possibly future biota (tissue) samples of shellfish collected from a variety of shoreline types, locations, and dates.

Potential risks to public welfare are present at public beaches but are not present at private beaches. The risk to public welfare at public beaches will be evaluated using existing survey results and additional visual inspections of the shoreline, with a focus on remaining oil that may create a nuisance condition such as rubbing off on skin when touched to the degree that limits public or community use (active or passive) of the shoreline segment.

The potential risk to animals, such as birds, that utilize the impacted areas, will be evaluated using a qualitative risk characterization. The risk characterization may be supported by analytical data collected from other characterization activities described above.

Potential risks to safety or terrestrial plants are not expected to be present at these shorelines (recognizing that these shorelines are defined as being located in the intertidal zone), and therefore data are not required to evaluate these potential risks.

### **3.2.2 Mixed Sand and Gravel Beaches and Rip Rap Groins (1C)**

Potential human exposure to impacted sediment via inhalation, ingestion (particulates and hand to mouth contact), and dermal absorption will be evaluated using laboratory analysis of sediment samples for EPH hydrocarbon fractions and PAH. Potential ecological risk to impacted sediment will also be evaluated through this sampling program. Sediment samples will be collected from segments considered to be conservatively representative of the degree of oiling for segments within a particular oiling category (e.g., heavy, moderate). The samples will be collected from locations where field reconnaissances identify areas of relatively greater oiling within the project area and also within a particular segment, with the objective of selecting locations that would provide a conservative, “worst-case” evaluation of oiling at these segments. At least three samples will be collected from each segment, with sampling locations in the upper intertidal zone (the area where oil impacts were observed to be greatest) and the lower intertidal zone. Samples will also be collected from the middle intertidal zone at selected locations to evaluate oil distribution across the intertidal zone.

Potential impacts to shellfish, both from a human consumption exposure scenario and risk to the shellfish ecosystem scenario, will be evaluated through existing and possibly future biota (tissue) samples of shellfish collected from a variety of shoreline types, locations, and dates.

The risk to public welfare and safety will be evaluated using visual inspections of the shoreline. The public welfare evaluation will focus on remaining oil that may create a nuisance condition such as rubbing off on skin to the degree that limits public or community use (active or passive) of the shoreline segment. The safety evaluation will focus on oil that may be present on rocks to the degree that the oil presents a slip and fall hazard.

The potential risk to animals, such as birds, that may utilize the impacted areas, will be evaluated using a qualitative risk characterization. The risk characterization may be supported by analytical data collected from other characterization activities described above.

Potential risks to terrestrial plants are not expected to be present at these shorelines (recognizing that these shorelines are defined as the intertidal zone), and therefore data are not required to evaluate these potential risks.

### **3.2.3 Rip Rap Seawalls, Bulkheads, Piers (1D), and Rocky Shores (1E)**

Residual oil at these locations would be expected to be present on rocks or other surfaces. Potential human exposure to the residual oil is expected to be direct contact, with ingestion (via hand to mouth contact) and dermal adsorption as exposure pathways. These pathways will be evaluated by visual inspection of the areas with the focus on evaluating whether oil present on these surfaces is available to touch. These visual inspections will also be used to characterize the risks to public welfare (nuisance conditions) and safety (slip and fall hazards).

Potential impacts to shellfish, both from a human consumption exposure scenario and risk to the shellfish ecosystem scenario, will be evaluated through existing and possibly future biota (tissue) samples of shellfish collected from a variety of shoreline types, locations, and dates.

The potential risk to animals, such as birds, that may utilize the impacted areas, will be evaluated using a qualitative risk characterization. The risk characterization may be supported by analytical data collected from other characterization activities described above.

Potential risks to terrestrial or aquatic plants are not expected to be present at these shorelines (recognizing that these shorelines are defined as the intertidal zone), and therefore data are not required to evaluate these potential risks.

### **3.2.4 Salt Marshes (1F)**

Potential human exposure to impacted sediment via ingestion (particulates and hand to mouth contact), and dermal absorption will be evaluated using laboratory analysis of sediment samples for EPH hydrocarbon fractions and PAH. Inhalation is not expected to be an exposure pathway because sediment in salt marshes is generally wet mud that is not carried by winds. Potential ecological risk to impacted sediment will also be evaluated through a sampling program. Sediment samples will be collected from up to three locations in the selected marshes near the upper intertidal zone. Potential impacts to shellfish, both from a human consumption exposure scenario and risk to the shellfish ecosystem scenario, will be evaluated through existing and possibly future biota (tissue) samples of shellfish collected from a variety of shoreline types, locations, and dates. At some locations, sediment samples collected from the marsh may be used as a surrogate for direct shellfish tissue sampling.

Potential risks to public welfare (for bird watchers or others that enter the marsh) will be evaluated using visual inspections of the shoreline. The public welfare evaluation will focus on remaining oil that may create a nuisance condition such as rubbing off on skin when touched to the degree that limits public or community use (active or passive) of the shoreline segment. Risk to safety is not present because residual oil in the marsh environment does not present a slip and fall hazard.

The potential risk to terrestrial plants and animals will be evaluated using a qualitative risk characterization. The risk characterization may be supported by analytical data collected from other characterization activities described above.

### **3.2.5 Subtidal Surface/Sediment**

Current information (described in the Phase I and CSM report) indicates that the large majority of the released oil floated ashore and relatively little oil is present in the subtidal zone. In addition, the potential for human exposure to subtidal sediment is expected to be limited because these sediments are under water. However, there may be limited contact

with subtidal sediments during recreational activities (such as swimming) and commercial activities (such as shellfishing). Potential human exposure to impacted subtidal sediments would be via ingestion (particulates and hand to mouth contact) and dermal absorption. These exposure routes will be evaluated using laboratory analysis of sediment samples for EPH hydrocarbon fractions and PAH. Inhalation of subtidal sediments is not considered to be an exposure pathway. Potential impacts to shellfish, both from a human consumption exposure scenario and risk to the shellfish ecosystem scenario, will be evaluated through existing and possibly future biota (tissue) samples of shellfish collected from a variety of shoreline types, locations, and dates.

### **3.2.6 Surface Water**

The potential impacts to surface water are expected to be limited due to the relatively low solubility of most of the hydrocarbons present in No. 6 fuel oil. In addition, surface water samples collected between April 28 and May 12, 2003 (described in the Phase I and CSM report) also contained relatively low concentrations of dissolved hydrocarbons. However, although the impacts are expected to be comparatively low, it is recognized that potential exposure pathways should be evaluated in the absence of other data. Potential human exposure to surface water includes accidental ingestion and dermal contact during recreational activities (e.g., swimming) or commercial activities (e.g., fishing). These exposure routes will be evaluated using laboratory analysis of surface water samples. Potential impacts to marine and terrestrial organisms will be evaluated using a qualitative risk characterization.

### **3.2.7 Ground Water**

The potential impacts to ground water are expected to be even less than the impacts to surface water because: 1) the release occurred at sea and the bulk of the soluble fraction of the oil is expected to have dissolved into seawater, 2) onshore oil is exposed to wave and tidal action and residual soluble components are expected to dissolve into seawater, not ground water, and 3) ground water below the intertidal zone (which is the location of terrestrial impacts) is expected to flow towards the ocean, not toward potential inland

receptors. However, it is recognized that although the likelihood of impacts to ground water are low, this pathway should be considered as a potential exposure route in the absence of other data. Potential human exposure to ground water includes ingestion and dermal contact. These exposure pathways will be evaluated using laboratory analysis of water samples collected from nearshore supply wells. Other human or ecological exposures are not anticipated for this media.

### **3.2.8 Air**

The likelihood of impacts to air is anticipated to be low because No. 6 oil typically has a relatively low volatile fraction and most of the volatile component is expected to have evaporated in the first week following the release. However, the potential exposures to air will be evaluated in the absence of other data. Potential human exposure to air is by inhalation, which will be evaluated using a qualitative risk characterization and discussion. Other human or ecological exposures are not anticipated for this media.

## **3.3 DATA INTERPRETATION AND RISK CHARACTERIZATION**

The data and information collected during the Phase II CSA as well as the Phase I ISI will be used to further delineate the magnitude and extent of impacts to marine sediment and other shoreline materials, salt marshes, surface water, ground water and air in Buzzards Bay. Note that the data will be evaluated for gaps, and if present, additional data and information may be collected as part of this Phase II CSA. Once data collection is complete, a combination Method 1 and 3 Risk Characterization will be performed. A chemical-specific approach will be used to evaluate risk to human health and a Method 3 Stage 1 Ecological Risk Characterization (Stage I) will initially be used for evaluation of ecological risk.

The Stage I will be performed on individual segments in general accordance with applicable procedures and guidelines. The Stage I will include an effects-based screening analysis by using appropriate benchmarks for water and marine sediment. For exposure pathways where benchmarks have not been derived, a qualitative risk evaluation will be performed. If the Stage I indicates No Significant Risk then the ecological risk characterization will be

considered complete. If the Stage I indicates potential risk, then either: 1) a Stage II Ecological Risk Characterization, 2) an evaluation of background, or 3) an evaluation of the feasibility for additional cleanup will be performed. If a Stage II Ecological Risk Characterization is performed, it will focus only on those segments and exposure pathways that did not pass the Stage I Risk Characterization.

The numerical modeling that is going to be conducted as part of the NRDA process may be used to supplement or support the data collection and risk characterization, where available and appropriate. For example, modeling conducted as part of the NRDA aquatic assessment process may be used to evaluate dissolved hydrocarbon concentrations in surface water, depending upon the modeling parameters.

### **3.4 REPORT PREPARATION**

Data collected during the Phase II activities will be evaluated and compiled into a Phase II Comprehensive Site Assessment report. The report will include:

- additional shoreline characterization data and the scope of response actions that have been conducted at these segments;
- a description of the sampling activities, visual inspections, and other Phase II field activities;
- a description of the nature and extent of the disposal site; and
- a risk characterization, including a comparison of the exposure point concentrations in soil and ground water to the applicable risk characterization standards.

#### **4.0 SCHEDULE OF IMPLEMENTATION**

It is anticipated that sampling and inspection activities will be initiated in May 2004. Based upon the initial schedule of field activities, it is anticipated that the Phase II Comprehensive Site Assessment report will be completed by May 2006. However, the scope and schedule of the assessment activities for the Phase II Comprehensive Site Assessment will be evaluated as additional data is obtained and may be revised, if necessary.



**TABLE 1  
 POTENTIAL EXPOSURE PATHWAYS  
 BARGE B120 SPILL  
 BUZZARDS BAY, MASSACHUSETTS**

| Potentially Affected Media                    | Potential Human Exposure Routes |           |                   |                |        | Potential Ecological Exposure Routes |                 |             |        |
|---|---------------------------------|-----------|-------------------|----------------|--------|--------------------------------------|-----------------|-------------|--------|
|   | Inhalation                      | Ingestion | Dermal Absorption | Public Welfare | Safety | Aquatic                              |                 | Terrestrial |        |
|   |                                 |           |                   |                |        | Shellfish                            | Other Organisms | Animals     | Plants |
| Public Sand Beaches                           | X                               | X         | X                 | X              |        | X                                    |                 | X           |        |
| Private Sand Beaches                          | X                               | X         | X                 |                |        | X                                    |                 | X           |        |
| Mixed Sand/Gravel and RipRap Groins (jetties) | X                               | X         | X                 | X              | X      | X                                    |                 | X           |        |
| RipRap Seawalls, Bulkheads, Piers,            |                                 | X         | X                 | X              | X      | X                                    |                 | X           |        |
| Rocky Shores                                  |                                 | X         | X                 | X              | X      | X                                    |                 | X           |        |
| Marsh   |                                 | X         | X                 | X              |        | X                                    |                 | X           | X      |
| Subtidal Surface/Sediment                     |                                 | X         | X                 |                |        | X                                    | X               |             |        |
| Surface Water                                 |                                 | X         | X                 |                |        |                                      | X               | X           |        |
| Ground Water                                  |                                 | X         | X                 |                |        |                                      |                 |             |        |
| Air   | X                               |           |                   |                |        |                                      |                 |             |        |

Notes:

1. Ingestion includes particulate ingestion, hand-to-mouth, and via food consumption (e.g., shellfish)
2. Surface water is considered an exposure point from both human (e.g., swimming) and ecological perspectives.

**TABLE 2**  
**EXPOSURE PATHWAY CHARACTERIZATION**  
**BARGE B120 SPILL**  
**BUZZARDS BAY, MASSACHUSETTS**

| Potentially Affected Media                    | Potential Human Exposure Routes |           |                   |                |        | Potential Ecological Exposure Routes |                 |             |        |
|---|---------------------------------|-----------|-------------------|----------------|--------|--------------------------------------|-----------------|-------------|--------|
|   |                                 |           |                   |                |        | Aquatic                              |                 | Terrestrial |        |
|   | Inhalation                      | Ingestion | Dermal Absorption | Public Welfare | Safety | Shellfish                            | Other Organisms | Animals     | Plants |
| Public Sand Beaches                           | SS                              | SS/SB     | SS                | I              |        | SB                                   |                 | QRC         |        |
| Private Sand Beaches                          | SS                              | SS/SB     | SS                |                |        | SB                                   |                 | QRC         |        |
| Mixed Sand/Gravel and RipRap Groins (jetties) | SS                              | SS/SB     | SS                | I              | I      | SB                                   |                 | QRC         |        |
| RipRap Seawalls, Bulkheads, Piers,            |                                 | I/SB      | I                 | I              | I      | SB                                   |                 | QRC         |        |
| Rocky Shores                                  |                                 | I/SB      | I                 | I              | I      | SB                                   |                 | QRC         |        |
| Marsh   |                                 | SS/SB     | SS                | I              |        | SB                                   |                 | QRC         | QRC    |
| Subtidal Surface/Sediment                     |                                 | SS/SB     | SS                |                |        | SB                                   | QRC             |             |        |
| Surface Water                                 |                                 | SW        | SW                |                |        |                                      | QRC             | QRC         |        |
| Ground Water                                  |                                 | SW        | SW                |                |        |                                      |                 |             |        |
| Air   | QRC                             |           |                   |                |        |                                      |                 |             |        |

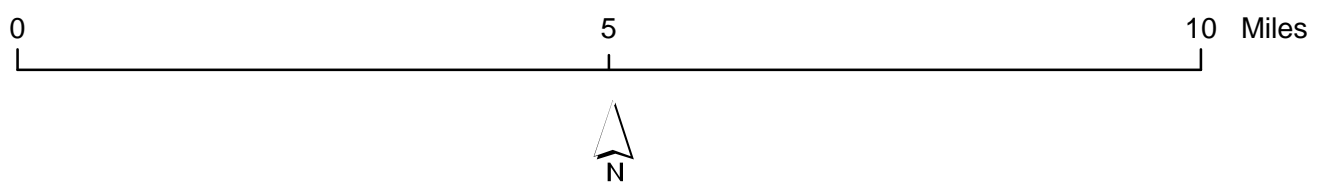
Notes:

1. Ingestion includes particulate ingestion, hand-to-mouth, and via food consumption (e.g., shellfish)
2. Surface water is considered an exposure point from both human (e.g., swimming) and ecological perspectives.
3. SS = Sediment samples.
4. SW = Aqueous samples.
5. SB = Biota (tissue) samples.
6. I = Inspection/visual observations.
7. QRC = Qualitative risk characterization and discussion.



**Legend**

- Barge Location
- + Unconfirmed Grounding Site
- ★ BB10/Anchorage Lima



**E N T R I X**

Figure 1. Site Overview  
Bouchard B No. 120 Oil Spill  
Buzzards Bay, MA  
November 17, 2003

Draft - Work In Progress