

Field Plan for Water-Column Profiling to Measure Dissolved-Phase Aromatic Hydrocarbons and Free Oil Droplets as a Function of Depth and Location Relative to the Subsurface Oil Release

May 3, 2010 (Revised May 5, 2010)

Prepared by: James R. Payne, Ph.D. (PECI, for NOAA)

Reviewed by W. Barry Gillespie, Jr., Ph.D. (ENTRIX, for BP)

Objectives

1. Use data collected during this cruise to calibrate 3-dimensional modeling of subsurface oil plume structure, fate (dissolution behavior), and transport, by:
 - a. Measuring discrete, free-oil droplet concentrations at multiple depths 2 Km up-current from the release site and at three locations (2, 4, and 8 km) down-current, or further as needed to collect water samples beyond the apparent leading edge of the plume based on updated and most accurate information at the time of sampling), and
 - b. Measuring dissolved phase (BTEX and water-soluble lower-molecular-weight PAH (naphthalenes and phenanthrenes/anthracenes) at the same stations (nominally 2 Km up-current and 2, 4, and 8 Km down-current).
2. In subsequent cruise(s), use the same approach to obtain data on the effects of *in situ* dispersant injection on water quality and exposure issues. If possible, this effort will be combined with the proposed sampling associated with response monitoring undertaken for the testing of dispersant injected at depth.

Approach

1. All operations will be completed from a CSA International, Inc. (a Continental Shelf Associates company) chartered 180 ft vessel capable of working in the oiled zone (all personnel PB Safety or HAZWOPER trained). The vessel is capable of dynamic positioning and will remain in the area overnight to facilitate operations (reducing transit time from port), but due to safety and cost considerations, sampling operations will not be undertaken after dark.
2. Vessels will not operate closer than approximately 2 km of the release site, and a BP industrial hygienist will be present to ensure that OSHA-permitted exposures to benzene and other volatile hydrocarbons will not be exceeded. If levels are observed to spike above regulated levels, sampling operations will be safely terminated and the vessel will be repositioned further from the release point before sampling is resumed.

3. Upon arrival at the station locations up-current of the release site, a series of continuous Conductivity-Temperature-Depth (CTD) casts will be completed to determine the water column structure (vertical profile) for selection of water-sampling depths.¹
4. Water samples will be collected at four depths (near bottom, just below the thermocline, mid mixed-layer (between thermocline and surface), and just below water surface, (a total of 4 samples at 4 stations = 16 total)² using:
 - a. A remotely operated vehicle (ROV) for collecting the near-bottom samples with a 4-5 L Go Flow Bottle and
 - b. A conventional hydrowire with six 5 L Go Flow Bottles and pressure controlled trip mechanisms (certified to 0.05% of specified sampling depth) to collect water samples just below the surface, in the middle of the upper mixed layer, and just below the thermocline (see separate QA Plan for NRDA Chemistry Cruise).
 - c. Split or duplicate samples will be collected on 50% of the samples (VOAs (x2), dissolved-phase, and filtered oil) as specified in the QA Plan for NRDA Chemistry Cruise. These will be transferred to Entirx/BP under full chain-of-custody at the conclusion of the sampling effort. With these duplicates the total number of samples will be 24 plus associated trip, field, and equipment blanks as specified in Table 1 and the QA Plan.
 - d. As available, occasional grab samples of surface oil/mousse will be collected with a jar or bucket from the sampling vessel. This will assess surface oil weathering behavior as a function of distance from the release point.
5. Immediately after sample retrieval a Portable Large Volume Water Sampling System (PLVWSS) (Payne et al., 1999; see separate PLVWSS Sampling Protocol and Water Sample Handling Procedures) will be employed on the research vessel to separate the particulate/oil phase trapped on 0.7 µm glass fiber filter and capture the dissolved phase (filtrate) in 3.8 L (1 gal) I-Chem Certified Clean amber glass jugs.

¹ If available, a series of telemetry-equipped Acoustic Doppler Current Profilers (ADCPs) will be deployed 24 hours before the cruise to provide near-real time data on currents in the area to further guide sample station selection and positioning.

² It would be ideal if we could increase sampling frequency in known biologically active layers where impacts to plankton, turtles, fish, and mammals might be. If time and supplies permit, this will be attempted by increasing sampling intensity in the upper 40 feet of water or an appropriate depth based on previous data sets. This will be facilitated by an *in situ* fluorometer (with telemetry back to the sampling vessel) placed on the hydrowire just below the Go Flow Bottle.

6. The PLVWSS requires ~3.5 L of sample (for enhanced detection limits above the usual 1 L sample size, see Water Sample Handling Procedures), so before filter processing the bulk of the sample, duplicate 40 mL aliquots will be drained from the Go Flow bottle directly into VOA vials for analysis of BTEX and other alkylated benzenes. Then, after the majority of the rest of the sample is processed through the PLVWSS, the remaining 4-500 mL will be saved unfiltered for microscopic (or other) enumeration of droplet sizes and number density.
7. Maintaining complete Chain-of-Custody, freeze the filter containing the finite oil droplets and refrigerate the water sample on the research vessel.
8. Upon returning to port, transfer the NRDA samples under complete chain-of-custody to Alpha Analytical Laboratories in Mansfield, MA and the BP/Entirx duplicate/splits to B&B Laboratories [or if needed, to another lab similarly selected by the trustees and the responsible party (BP represented by ENTRIX)] for analyses of alkylated PAH by Selected Ion Monitoring and Volatile Organic Analytes (VOA) by purge and trap GC/MS.

Vessel:

All operations will be completed on the *M/V Green Provider* (180 ft) operated by Coastal Marine Logistics out of Golden Meadow, LA (see attached document for . This vessel has been chartered by CSA International, Inc. The ROV is a Super Mohawk 10,000 fsw rated ROV with twin manipulators, and a tether management system. It is based in Morgan City, LA and is available at this time.

The cruise is planned for Thursday and Friday (May 6 and 7, 2010).

Safety Plan:

A separate operations and safety plan has been prepared for review and approval before any planned operations.

Estimated Total Costs for Equipment and Ship time:

M/V Green Provider ~\$24K per day (assuming 12 hr/day operations)

ROV ~\$14K per day (assuming 12 hr/day operations)

The sampling activities are currently planned for daylight operations only. Additional boat personnel (crew and captain/pilot) would be required for 24 hr/day operations and this would increase the daily costs by ~\$4-5K. ROV operation costs would also significantly increase for 24 hr/day operations. We will remain on station at night, but sampling activities will be curtailed with only a skeleton crew manning the vessel for safety.

Reference: Payne, J.R., T.J. Reilly, and D.P. French, "Fabrication of a Portable Large-volume Water Sampling System to Support Oil Spill NRDA Efforts," in *Proceedings of the 1999 Oil Spill Conference*, American Petroleum Institute, Washington, D.C., pp. 1179-1184, 1999.

