STATEMENT OF WORK

Sampling, Fingerprinting and Chemical Characterization of BP Tar Balls Remaining along Alabama's Beaches 10 Years after the Spill

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The Deepwater Horizon (DWH) oil spill accident severely impacted Alabama's Gulf Coast region. When the floating emulsified oil approached Alabama's sandy beaches, a portion of the mousse interacted with suspended sediments and sank, forming submerged oil mats (or tar mats). Since their formation, hydrodynamic processes have continually covered and uncovered the tar mats and fragmented them to form tar balls. The tar balls are highly mobile in the nearshore environment and can be found on Alabama's beaches to date. Our research team has been monitoring tar ball activities along the Alabama's beaches since May 2010. So far we have completed over 25 field surveys and the results of these surveys are summarized in our peer-reviewed journal articles (e.g., Mulabagal et al. 2013; Yin et al. 2015; Clement et al. 2017; Han and Clement, 2018). In our recent Clement et al. (2017) and Han and Clement (2018) studies we presented the details of different field data collected from multiple surveys and highlighted the need for establishing background and recovery levels. Clement et al. (2017) study made the following set of important conclusions: 1) the current (2016) background oil contamination levels are much higher than the relatively low (in some cases, negligible) background levels that existed prior to the DWH oil spill; 2) virtually all of the visible oil spill residues currently deposited along the Alabama shoreline, in the form of fragile, brownish, sticky tar balls and tar patties, originated from the DWH oil spill; and 3) several higher molecular weight PAHs, such as chrysene and its alkylated homologs, trapped in DWH oil spill residues are degrading at a much slower rate than they were prior to the oil being submerged near the shoreline; and it is highly likely that these contaminants will remain in the nearshore environment for an extended period of time.

The objective of this proposal to complete a comprehensive 10th year field survey along Alabama's Gulf Coast region (extending from Orange Beach to Fort Morgan) to quantify current oil background levels. We will complete detailed chemical fingerprinting studies to confirm their origin of the tar balls by comparing them with BP's MC242 oil fingerprints which is available in our chemical reference library. Secondly, we will complete PAH characterization studies to document the chemical recovery processes occurring in these amenity beaches. We will quantify all EPA recommended PAH chemicals present in these residues. Furthermore, based on our previous efforts we know that certain heavy toxic PAHs (such as chrysene) are expected to remain in these tar balls for a long time. Therefore, we will carefully track the levels of these PAHs in these tar balls to determine their toxicity effects.

Project deliverable include the following: BP oil spill10[th] year annual tar ball survey report for Alabama's beaches, a peer-reviewed research publication, fingerprinting data, and PAH data.

REFERENCES

Clement, T.P., G.F. Johnson and F. Yin, 2017, Assessing the increase in background oil contamination levels in Alabama's nearshore beach environment resulting from the Deepwater Horizon oil spill, Chapter 16, Oil Spill Science and Technology, Edited by Merv Fingas, 2nd Edition, Elsevier Publishers.

Han Y., and **T.P. Clement**, Development of a field testing protocol for identifying Deepwater Horizon oil spill residues trapped near Gulf of Mexico beaches. PLoS ONE 13(1): e0190508. https://doi.org/10.1371/journal.pone.0190508, 2018.

OSAT-2 (2011). Summary report for fate and effects of remnant oil remaining in the beach environment. Operational Science Advisory Team (OSAT-2), Unified Area Command Report. Shoreline Cleanup Completion Plan (SCCP), 2011, Report by the UC SCCP Core Group, Nov, 2011. <http://www.restorethegulf.gov/sites/default/files/u306/Signed%20SCCP1.pdf>.

Mulabagal V, Yin F, John GF, Hayworth JS, **Clement TP**. (2013). Chemical fingerprinting of petroleum biomarkers in Deepwater Horizon oil spill samples collected from Alabama shoreline. Mar Pollut Bull;70:147–54.

Yin, F., G. F. John, J.S. Hayworth, J.S. and **T. P. Clement**, (2015). Long-Term Monitoring Data to Describe the Fate of Polycyclic Aromatic Hydrocarbons in Deepwater Horizon Oil Submerged Off Alabama's Beaches, Science of the Total Environment Journal, v.508, p. 46–56.

BUDGET

Tarball survey				
1. Personnel				
Prabhakar Clement (0.14)			$	2,459
Leigh Terry (0.15)			$	1,598
GRAs (1) - 9 mo.			$	15,570
Total Salaries			$	19,627
2. Fringes				
Clement - 32%			$	787
Leigh Terry - 32%			$	511
GRAs (1) - FICA + Insurance			$	1,747
Total Fringes			$	3,045
Total Salaries and Fringes			$	22,673
3. Travel			$	2,000
4. Supplies			$	1,300
5. Tuition			$	11,319
Total Direct Costs			$	37,292
8. Indirect - 49% MTDC			$	12,727
Total Cost			$	**50,019**