

## **BOEM ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES**

**BOEM OCS Region:** [Gulf of Mexico](#)

Planning Area: Gulfwide

**Title:** Pressure Wave and Acoustic Properties Generated by the Explosive Removal of Offshore Structures (GM-13-05)

**Total Cost:** \$149,970.22

**Period of Performance:** FY 2013-2015

**Conducting Organization:** CSA Ocean Sciences, Inc.

**BOEM Contact:** [Dr. Donald \(Tre\) Glenn](#)

### **Description:**

Background: The Secretary of Interior has designated the Bureau of Ocean Energy Management (BOEM) as the administrative agency responsible for the mineral leasing of submerged OCS lands and for the supervision of offshore operations after lease issuance. Effective October 1, 2011, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) was reorganized and separated into two separate bureaus, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE). The BOEM is responsible for managing development of the Nation's offshore resources in an environmentally and economically responsible way. The functions of BOEM include leasing, exploration and development, plan administration, environmental studies, NEPA analysis, resource evaluation, economic analysis, and the renewable energy program. The BSEE is responsible for enforcing safety and environmental regulations. The functions of BSEE include all field operations, including permitting and research, inspections, offshore regulatory programs, oil-spill response, and training and environmental compliance functions.

There is considerable concern about the potential effects of anthropogenic noise on marine mammals and sea turtles. Of particular regulatory concern is the decommissioning of offshore structures using explosives. Decommissioning of offshore structures is an activity that is permitted by BSEE, and BSEE is responsible for both Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) processes and compliance associated with this activity. BSEE, working with the BOEM studies program, is seeking additional information about the pressure wave and acoustic properties generated by the explosive removal of offshore structures for management decision-making relative to the protection of marine mammals and sea turtles. Approximately 2,785 oil and gas platforms exist on the Outer Continental Shelf (OCS). Within one year of lease termination, the BSEE requires that platforms be removed from the OCS.

In 2002, the then Minerals Management Service contracted with Applied Research Associates, Inc. (ARA) to develop a method to determine the shockwave propagation into the water column from the detonation of explosive severance charges. This was a

competitive procurement (MMS Contract 0302P057572) which resulted in the report titled “*Shock Wave/Sound Propagation Modeling Results for Calculating Marine Protected Species Impact Zones During Explosive Removal of Offshore Structures*” (OCS Study 2003-059). In this study, ARA conducted numerical simulations of various explosive, target, sediment, and marine environments to model the level of energy coupled into the water. The numerical simulations predicted that less energy would be released into the water column for detonations within a piling than detonations in open water. The resultant model, the “Underwater Calculator” (UWC) is a spreadsheet application that was used to predict the shockwave, acoustic impulse, and energy flux density for underwater detonations associated with decommissioning activities.

BOEM used the model to calculate impact zones critical to protected species analyses and mitigation planning found in the 2005 Programmatic Environmental Assessment (PEA) “*Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf*” (DOI, MMS, 2005). This information was also used in the 2005 Marine Mammal Protection Act (MMPA) take authorization.

The previous analyses with the UWC were done using a criterion for temporary threshold shift (TTS) for level B take under the MMPA. At that time TTS and associated behavioral disruptions were considered if the peak pressure exceeded 12 psi for an explosive source. The National Marine Fisheries Service has since revised that criteria based on U.S. Navy shock trials (2008) and Level B takes may occur if the peak pressure exceeds 23 psi for an explosive source (<2000lbs).

In addition, new *in situ* data were collected as part of a Technology Assessment and Research (TAR) project titled “*Effect of Depth Below Mudline of Charge Placement During Explosive Removal of Offshore Structures (EROS)*” (TAR Project #570). Data collected in this project will be used for verification and refinement of existing models (e.g. UWC) and similitude equations. Data were collected at 15, 20, 25 and 30 feet below the mudline (BML) as well as in open water. There were 20 internal severance detonations and 2 open water detonations. Data collected indicated that increasing the BML depth of the severance charge increases the attenuation of the pressure wave/acoustic energy and results in a reduction in the size of the marine protected species (MPS) impact zones.

The data collected to date indicates that sediments and the structure itself attenuate the acoustic shockwave of explosives detonated within a well conductor or piling below the mudline, however more *in situ* data are needed to further refine the ARA UWC model to support BSEE’s ESA and MMPA processes associated with decommissioning activities in the GOM.

Objectives: The overarching goal of this study is to better understand and characterize the pressure waves and acoustic properties generated by explosive removals. Specific objectives are:

- Quantitatively measure the underwater pressure waves and acoustic properties generated by the detonation of explosives used for severance during offshore structure removal operations.
- Further document the dampening effects of the target structure and surrounding sediments; particularly by deepening the severance depth or making severance cuts internal to larger tubulars (i.e., cutting conductors within caissons or large jacket legs).
- Provide BSEE with scientifically valid data to update the ARA model so that the “take” harassment impact zones of protected species may be more accurately calculated.

Methods: The Contractor shall collect in situ data on the pressure wave and acoustic energy released during explosive detonations in the Gulf of Mexico (GOM). Data collected will be from both above and below mud line detonations and the amount of explosives used may vary from 5 – 500 pounds (as permitted in the current GOM MMPA authorization). Working with BSEE, determinations will be made in the field regarding the charge size, type (i.e. engineered or bulk) and charge placement (above or below mud line). Field measurements will be coordinated with BSEE to maximize use of existing permitted decommissioning operations.

The Contractor shall collect in situ data (as described above) in an appropriate manner for integration into the existing regulatory framework using units as described in the MMPA regulatory threshold dual criteria (23 psi peak pressure and 182 dB re1  $\mu\text{Pa}^2 \cdot \text{s}$  EFD, 1/3 octave band). Approximately 15-20 detonations with no more than 2 mobilizations will provide data for both near-field and far-field underwater shock parameters of peak overpressure, impulse and energy flux density associated with varying distances from the detonations. BSEE and/or BOEM staff will provide field assistance to determine charge size and type. Field equipment includes but is not limited to transducers, electronics, and other equipment needed for collecting and recording field measurements.

The Contractor shall provide a detailed analysis of the results of their *in situ* data collection. This will include information regarding the structure removed, including the target physical features (type, target diameter, wall thickness), oceanographic conditions (water depth, salinity, etc.) at the detonation site, charge size, depth below mudline, and physical properties of the sediment as well as data collection methods. Shock parameters from these *in situ* measurements will be synthesized with existing information from previous work (TAR #570) and recommendations made on the explosive placements in order to minimize impacts to marine protected species.

The period of performance (POP) is anticipated to be eighteen (18) months, from September 11, 2013 through March 10, 2015. The POP will encompass all tasks from initial planning, through and including BOEM's final acceptance of all deliverables. The modification of scope and schedule will create no change on the contracted budget

for the project.

Products: Field work, data acquisition and storage, published report(s).

Importance to BOEM: The exploration and development of oil and gas resources in the Gulf of Mexico (GOM), as well as potential renewable energy and alternate use projects, will require BOEM to produce information for a variety of NEPA-related decision documents, as well as maintaining compliance with Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). All data acquisition outlined here are covered under federal research permits that comply with federal protection mandates.

**Current Status**: This effort was awarded September 2013 and currently collecting information.

**Final Report Due**: March 2015

**Publications**: None

**Affiliated WWW Sites**: None

**Revised date**: December 2013

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