Conference Abstract Submission

Emerging Technology & Recent Research Results (2020-22) of Oil Detection Canines
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In 2015 the American petroleum Institute funded field trials to investigate the potential of trained canines to detect subsurface oil. The canines demonstrated a capability to reliably (99.7% accuracy) detect oil down to 1 meter (3 feet).

In the early part of 2020, the American Petroleum Institute (API) funded a second round of research that tested the ability of canines to detect heavy and weathered oil targets.

The research was formed of three phases:

Phase 1 – A laboratory-based odor discrimination trial
Phase 2 – A field-based trial of targets at 5 meters (15 feet)
Phase 3 – A laboratory trial to investigate the ability to calibrate canines to specific oil concentrations

Phase 1 was conducted at the Chiron K9 facility in Somerset, Texas. A specially designed twelve port scent carousel was utilized throughout the laboratory phase. The carousel contained eleven jars with sand inside and one jar containing sand mixed with target oils during a series of trials. Five target oils were tested:

- CTC (a Macondo oil)
- Juniper (a Macondo oil)
- Bunker C
- Dilbit
- South Padre Island (Texas) tarball

The canines correctly identified all targets. All trials were double-blind.

Phase 2 was conducted at the Chiron K9 facility. Ten 5-meter (15 feet) outer casing PVC pipes were placed in boreholes in a field designated for the research trials. The pipes were placed in a zig-zag fashion 20 meters apart in two rows, five per row. 5-meter PVC Inner pipes were capped on one end and of sufficient diameter to fit inside the outer casing pipes. Five of the pipes contained target samples (one each from the targets used in Phase 1) in the base. The bases were capped and sealed before lowering the inner PVC pipes into the outer casing. The pipes were filled with native soil removed during the borehole construction process. Of the remaining five pipes, three were blank (soil only), and two were empty.

The trials were double-blind, and the canines were not exposed to the pipes before the trials.

Both Phase 1 and 2 had comparisons of detection capability of the canines, and a Photoionization Detector (PID) demonstrated the sensitivity and consistency of the canines' abilities.

Phase 3 - A separate component of the API research conducted with Texas Tech University established the potential capability for Oil Detection Canines (ODCs) to be calibrated to a specific detection threshold, which means that the canines could be trained to respond on a certain threshold level of oil, or higher, but ignore lower-level concentrations.

Two recent projects will be discussed.

The first research trial will discuss the development of a novel underwater training device that utilizes crude oil, releasing the volatile components and pushing them out through a pipe placed within a water source. Volatiles are then detected at the surface of the water source.

Following laboratory testing, and underwater detection device was developed for field-based testing. The device comprises an air compressor, an airtight container for oil, and a 200 ft hose. The system was set up with the air/odor supply on the shoreline of a lake. The outlet pipe was deployed into the lake, and initially, the end of the pipe was weighted to deliver the odor into the water column just below the lake surface. After several trials, the system was reconfigured to anchor the entire pipe to the lakebed. The air supply rate was controlled on land and varied during the tests with one set of tests that had low, intermittent supply rates. In these shallow water depths (<5 feet), this did not affect successful detection by the canine.

Preliminary protocols for training canines in this technique were evaluated by a systematic approach adjusted to provide an effective and efficient set of training steps for this detection application. After the field testing of the system was completed, a canine was trained to work from the bow of a small electric-powered boat to search for the odor source. The boat was positioned downwind of the submerged source, which had no visual markers, and searches were conducted with both zig zag and linear patterns. The handler/boat operator observed the changes in the canine's behavior to steer towards the source. In the final phase of the training, the canine was encouraged to communicate the direction to the source to the boat operator. This was a significant innovation in communication between the canine and the handler.

A third project will investigate the ability to train canines to locate an incident-specific spilled oil on a beach or riverbank and ignore other oils present within a survey area, such as background tarballs. Two Chiron K9 canines have been trained to support the project. The research phase, which was to determine the ability of canines to be trained to alert to fresher oils and ignore weathered oils, has been completed at the Canine Olfaction Lab, Texas Tech University. The two canines are now undertaking field training and will be paired with volunteer handlers to be deployed on the Gulf Coast in Texas. The field phase will assess the transition of the laboratory-

based results to a field-deployable canine team. The research will last for 1-year with an option of a second year.

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