OIL SPILL EMERGENCY RESPONSE -
MONITORING THE USE OF DISPERSANTS

In Situ Fluorometry and Fluorescence Signatures

About

Dispersants are chemical agents used to break up oil into smaller droplets throughout the water column. Dispersants are applied to surface oil floating on water, or below the surface closer to an uncontrolled release of crude oil from a well blowout source. This series of fact sheets details monitoring requirements and how to apply the collected data to inform the use of dispersants under **Subpart J of the National Contingency Plan (NCP)**.

Description of the Requirement

The responsible party must collect and analyze water column samples of the ambient background, baseline oil plume, and dispersed oil plume for *in situ* fluorometry and fluorescence signatures targeted to the type of oil discharged and referenced against the source oil. Refer to the regulatory requirement in the Code of Federal Regulations (CFR): **40 CFR 300.913(b)**.

Figure 1: Submersible fluorometry sensor.

Credit: RBR

In Situ Fluorometry and Fluorescence Signatures

Aromatic compounds, such as those in crude oil, fluoresce at specific wavelengths. Fluorescence occurs when light of a shorter wavelength applied to aromatic compounds instantly emits or fluoresces light of a different wavelength of radiation. Fluorometers identify and detect aromatic compounds, either dissolved or dispersed, in water during a discharge by measuring their unique optical signature (fluorescence).

Using Fluorescence Data

***In situ* fluorescence data** are quick indicators of where oil is and of whether oil is dispersing within the water column. The fluorescence approaches for measurements in deep and shallow water dispersant operations are similar. *In situ* data also guide where to take discrete bottle samples for laboratory hydrocarbon analysis.

Lab-analyzed fluorescence data involves taking bottle samples from discrete times, locations, and depths to analyze using benchtop scanning fluorometers and compare to source oil. Source oil fluoresces differently than dispersed oil; thus, fluorescence data from multiple wavelengths (i.e., ratios of fluorescence intensity) can be used to assess dispersion effectiveness.

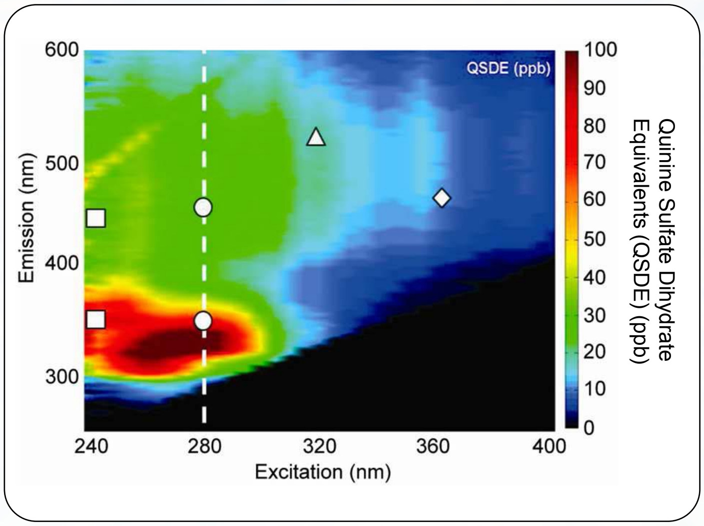
Collecting Fluorescence Data

Dispersed oil in the water column may not be easily visible but may be detectable by a fluorometer. *In situ* measurements can be taken in real time via submersible sensors that use single or multiple wavelength ranges (Figure 1). Fluorescence characteristics of the source oil are important to know when choosing a submersible fluorometer because each sensor has unique wavelength ranges that measure only a portion of oil fluorescence identifiable through benchtop scanning fluorometers (Figure 2). Submersible fluorometers also vary in signal-to-background noise ratios, detection limits, and sampling integration times, which influence instrument sensitivity.

Reporting Fluorescence Data

Fluorescence data are reported as raw fluorescence units calibrated to a standard dilution such as crude oil volume. Data from *in situ* measurements are reported as tables or graphs with the change in fluorescence as a function of depth/distance, time, or both (Figure 3).

Figure 2: Oil fluorescence contour graph from a scanning fluorometer. Dashed line represents an example excitation wavelength used to generate a fluorescence intensity ratio of two emission wavelengths (circles; 340 and 445 nm). Remaining geometric shapes indicate examples of wavelengths measured by separate submersible sensors for a single event; their wavelength locations to show the portion of oil wavelengths measured.

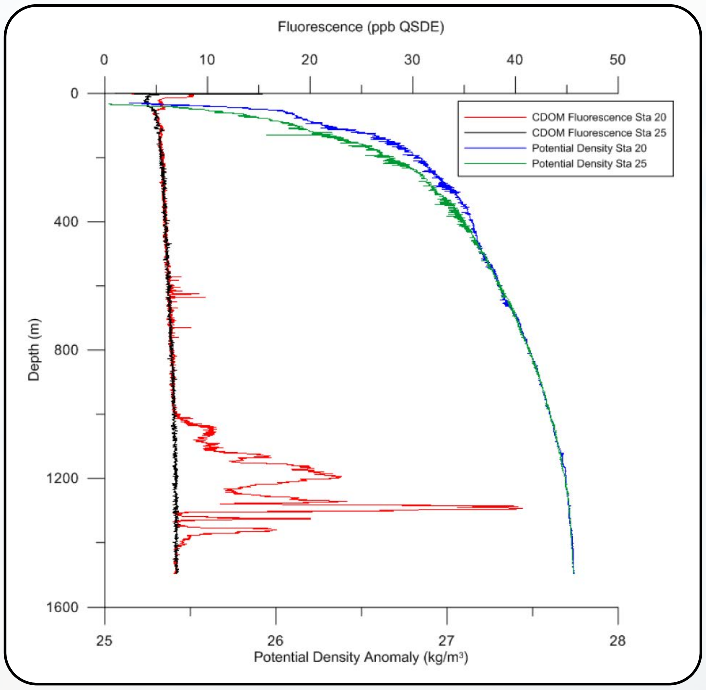


Credit: Conmy, Coble, Farr, et al. (2014)

Decision Points for Responders

The On-Scene Coordinator should consider all available data and information relevant to the response and consult with subject matter experts. *In situ* fluorescence measurements may provide a line of evidence for identifying the location and boundary of the dispersed oil plume. Changes in the ratios of fluorescence intensity support determinations on dispersant effectiveness. For example, intensity ratio increases may indicate a reduction in dispersant effectiveness. With this information, the On-Scene Coordinator can reevaluate whether dispersant application should begin, continue, continue with modifications, or cease.

Figure 3: Example figure showing a vertical profile of fluorescence data as colored dissolved organic matter (CDOM). The red line suggests oil present between 1,000 and 1,400 meters.



Credit: National Oceanic and Atmospheric Administration

Data Collection and Reporting Frequencies

Collection

Fluorescence data from the ambient background water column and baseline oil plume, as appropriate.

Daily: Fluorescence data from the dispersed oil plume.

Reporting

Immediate: Important ecological receptors' exposure to changes in oil or dispersed oil, as indicated by fluorescence data.

Daily: Fluorescence data and analyses.

Additional Resources

NCP Product Schedule Technical Notebook

A compilation of product bulletins summarizing data requirements and test results for dispersant products listed in EPA's NCP Product Schedule. The Technical Notebook includes information on dispersant application methods, toxicity and effectiveness, and physical properties.

Special Monitoring of Applied Response Technologies (SMART), 2006

Oil Spill Emergency Response – Monitoring the Use of Dispersants Fact Sheets

- Dispersant Monitoring Quality Assurance Project Plan
- Water Column Sampling
- Reporting of Dispersant Use
- Conductivity

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