Conductivity

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 from the ambient background, baseline oil plume, and dispersed oil plume for conductivity, using standard operating and quality assurance procedures. Refer to the regulatory requirement in the Code of Federal Regulations (CFR): **40 CFR 300.913(b)**.

Conductivity

Conductivity is the degree to which a material allows electricity to pass through it. Conductivity is influenced by dissolved salts or other impurities; nearly all water, even rainwater, contains dissolved chemicals. In the context of dispersant monitoring, conductivity is a fast, simple measurement used to derive the salinity of seawater. Salinity measurements are used to calculate water density, which affects behavior of dispersed oil in the water column.

Measuring and Reporting Conductivity

Conductivity-temperature-depth (CTD) instruments collect measurements of electrical conductivity (EC) by passing an electric current through a water sample (Figure 1). EC is then converted into salinity using a mathematical equation that compares the measured EC against known salinities. Conductivity is reported in microsiemens or millisiemens per centimeter (uS/cm or mS/cm). Salinity is reported in Practical Salinity Units (PSU), parts per thousand (ppt), or grams per liter (g/L), which are often used interchangeably.

Figure 1: A CTD sensor package located at the bottom of the sampling rosette.

Credit: EPA

Using Conductivity Data

Salinity impacts on dispersant behavior

When a dispersant is applied to an oil slick, its effectiveness in dispersing the spilled oil depends on multiple factors including wave-mixing energy, water temperature, and water salinity. Average range of ocean salinity is between 33 and 37 grams per liter. Dispersants are generally designed for use in salinities in that average range; dispersant effectiveness may decrease at lower (freshwater) and higher (brine pools) salinities.

Salinity impacts on oil transport

Combined with temperature and pressure data, salinity data are used to calculate water density. In the ocean, salinity generally increases with increasing depth and decreasing temperature, thus increasing the density of the seawater (Figure 2). In the context of dispersant monitoring, water density is important because:

- Water density may change significantly at multiple depths throughout the water column, forming a water density gradient.
- Ambient water density gradients, subsurface currents, and the rise velocities of dispersed oil impact the behavior of the dispersed oil plume in the water column.

Decision Points for Responders

Local salinity conditions that vary from the average range may indicate less favorable conditions for dispersant use. Water density gradients may affect the trajectory of the oil plume and where dispersed or undispersed oil may interact with sensitive species or ecosystems. For example, a dispersed oil plume may be trapped between two different ocean density layers. In consultation with subject matter experts, the On-Scene Coordinator can use this information to evaluate whether dispersant application should begin, continue, continue with modifications, or cease.

Data Collection and Reporting Frequencies

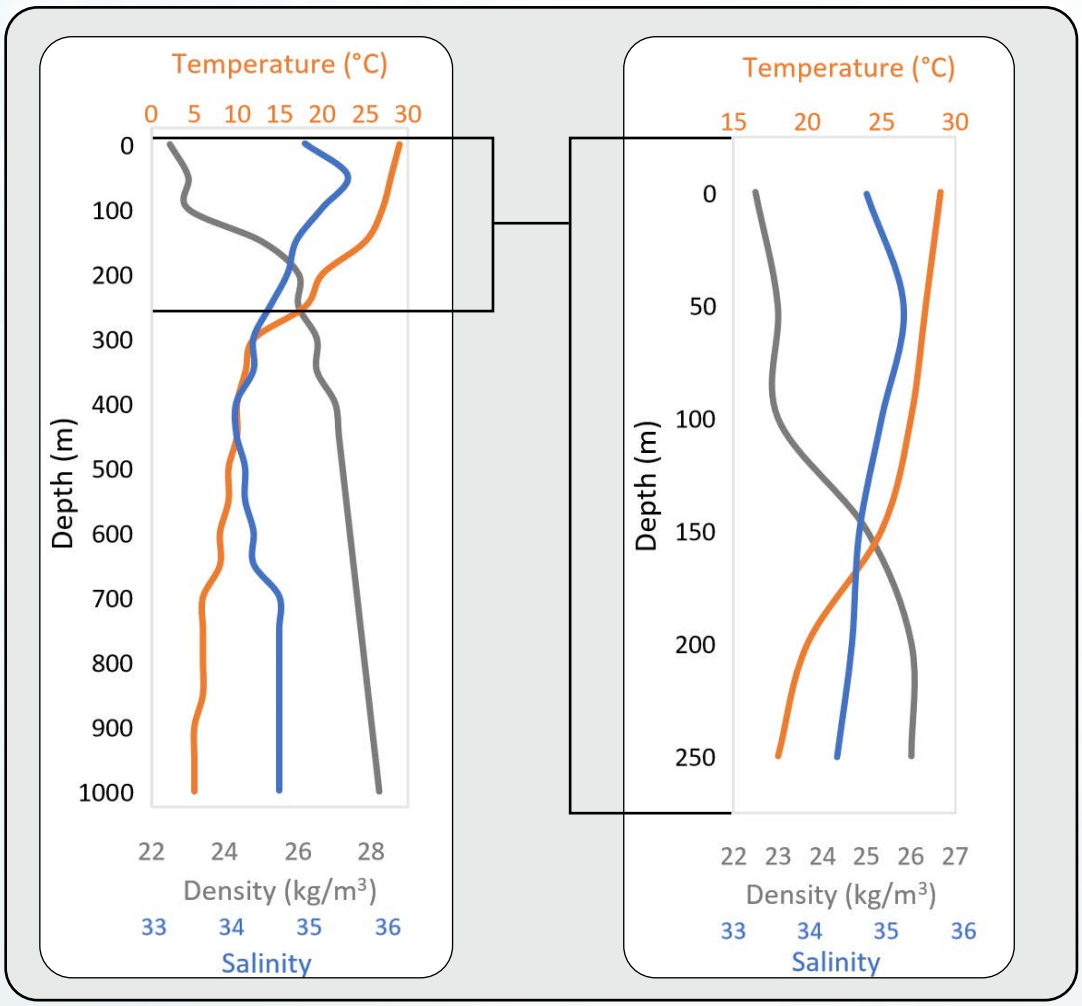
Collection

- Conductivity data from the ambient background water column and baseline oil plume, as appropriate.
- **Daily:** Conductivity data from the dispersed oil plume.

Reporting

- **Immediate:** Important ecological receptors' exposure to changes in conductivity.
- **Daily:** Conductivity data and analyses.

Figure 2: Conceptual diagram of vertical depth profiles of salinity, temperature, and density; illustrating the variability of each parameter in shallow and deep waters.



Credit: EPA

Additional Resources

NCP Product Schedule

Lists dispersant products and data submitted to EPA as required by Subpart J of the NCP.

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 data, and physical properties.

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

- Water Column Sampling

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