OIL SPILL EMERGENCY RESPONSE -
MONITORING THE USE OF DISPERSANTS

Water Temperature

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 water temperature, using standard operating and quality assurance procedures. Refer to the regulatory requirement in the Code of Federal Regulations (CFR): **40 CFR 300.913(b)**.

Water Temperature

Water temperature is the measure of water's average thermal energy, or in other words, the warmth or coldness of the water. The temperature of water bodies varies by season, latitude, depth, variations in solar radiation, and the physical properties of water – impacting the fate and transport of the oil, including its dispersion.

Measuring and Reporting Water Temperature

A conductivity-temperature-depth (CTD) device is an instrument cluster that measures conductivity (used to derive the salinity of ocean water), temperature, and depth within the water column (Figure 1). Water temperature measurements are collected with an electronic thermometer on a CTD. Water temperature is reported in degrees Celsius or Fahrenheit.

Decision Points for Responders

Water temperature data, in conjunction with other observed and measured conditions, provide a body of evidence that can inform dispersant use decisions. Based on this body of evidence and in consultation with subject matter experts, the On-Scene Coordinator can reevaluate whether dispersant application should begin, continue, continue with modifications, or cease.

Figure 1: A CTD device.

Credit: EPA

Data Collection and Reporting Frequencies

Collection

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

Reporting

- **Immediate:** Important ecological receptors' exposure to changes in water temperature.
- **Daily:** Water temperature data and analyses.

Using Water Temperature Data

Calculate water density

Water temperature data, combined with salinity and pressure measurements, allow responders to calculate water density. Water density can change along a vertical profile, forming a water density gradient (Figure 2). Sharp gradients in salt water can lead to stratification with different concentrations of salinity. Information on water density gradients is important for predicting how currents may impact the fate and transport of the oil, including its dispersion.

Assess impacts on dispersant effectiveness

Water temperature may affect dispersant performance in several ways:

- **Changing oil viscosity**
  Higher-viscosity oils and oils that have cooled significantly below their pour point are generally less dispersible than light, low-viscosity oils.

- **Shifting the weathering process**
  Oils that have weathered, emulsified, and become more viscous (e.g., due to evaporation of their lighter components) are generally less dispersible. Cold water temperatures may slow the weathering process and expand the timeframe in which dispersants are most effective. Alternatively, warm water may accelerate oil weathering and reduce the timeframe in which dispersants are effective.

- **Altering wave action**
  Wave action is integral to effective dispersant and oil mixing. Ice formation has the potential to reduce wave action if ice sheets are expansive and unbroken. However, in some cases, broken ice can increase turbulence and enhance mixing energy.

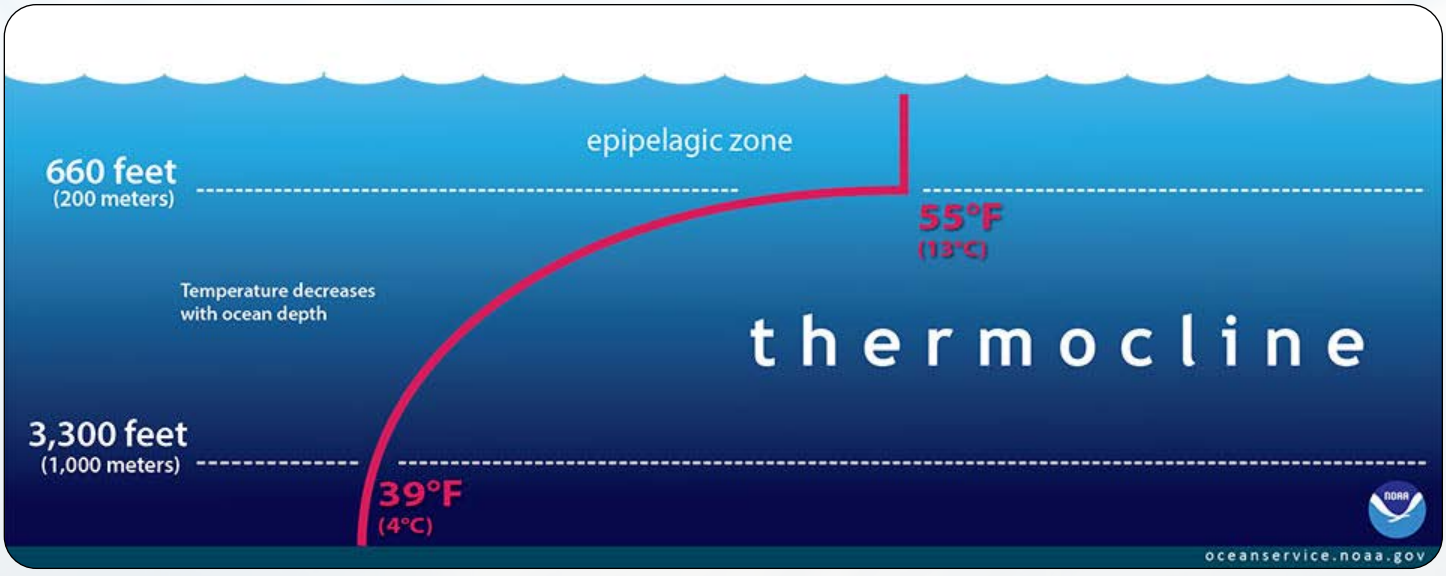
Assess potential exposures to ecological receptors

Water temperature affects water chemistry and biological activity within a water body. Some compounds are more toxic to aquatic life at warmer water temperatures.

Inform dissolved oxygen assessments

Warm water holds less dissolved oxygen than cool water, potentially affecting the survival of different species of aquatic life. Temperature measurements can point to potential dissolved oxygen concerns and can help responders take actions to prevent hypoxic conditions from developing or worsening from dispersant use during a response.

Figure 2: Diagram of a temperature gradient within a body of water (thermocline). Ocean temperatures are warmer in the upper epipelagic zone and colder in the deeper mesopelagic zone.



Credit: National Oceanic and Atmospheric Administration

Additional Resources

NCP Product Schedule

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

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 product use and addresses variables such as weather, salinity, water temperature, and weathering states of oils or other pollutants.

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

- Dissolved Oxygen (Subsurface)
- Conductivity
- Water Column Sampling

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