

NOAA's Oil Spill Response

Deepwater Horizon Information Resources



Atlantic Oceanographic and Meteorological Laboratory (AOML)

- Monitoring the Gulf of Mexico Conditions
<http://www.aoml.noaa.gov/phod/dhos/index.php>
- AXBT data from P-3 flights
ftp://ftp.aoml.noaa.gov/phod/pub/DHI_Response

Center for Operational Oceanographic Products and Services (CO-OPS)

- CO-OPS current meter data in the Gulfport, Pascagoula, and Mobile Bay areas
<http://tidesandcurrents.noaa.gov/cgi-bin/customview.pl?screen=hkMtMnzh>
- CO-OPS current meter and wind data in the Gulfport, Pascagoula, and Mobile Bay areas
<http://tidesandcurrents.noaa.gov/cgi-bin/customview.pl?screen= SX6IGbrh>

Communications & Public Affairs

- NOAA Oil Spill Response Fact Sheets
<http://www.noaa.gov/factsheets.html>
- 2010 News Archive
<http://www.noaa.gov/newsarchive.html>

Costal Response Research Center (CRRC)

Environmental Response Management Application
<http://www.crrc.unh.edu/>

Damage Assessment, Remediation & Restoration Program (DARRP)

Information about natural resource damage assessments conducted by NOAA's DARRP
<http://www.darrp.noaa.gov>

Ecosystem Data Assembly Center (EDAC)

IT infrastructure supporting ecosystem observations data and other related data collected in the Gulf Oil spill
http://edac.northerngulfinstitute.org/opensap_index.html

External and Public Engagement

Deepwater Horizon Oil Spill Information Resources
http://www.externalaffairs.noaa.gov/oilspill_information.html

Fishery Service - Regional Team

- NMFS – SE Regional Office
<http://sero.nmfs.noaa.gov/>
- SE Federal Fisheries Closure and Other Information
http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm
- SE Regional Office – Press Releases
<http://sero.nmfs.noaa.gov/media/media.htm>
- SE Fishery Bulletins
http://sero.nmfs.noaa.gov/bulletins/fishery_bulletins.htm

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GeoPlatform.gov

<http://www.geoplatform.gov>

Gulf of Mexico Sea Grant Programs

- Regional DWH Sea Grant website
<http://gulfseagrant.tamu.edu/index.html>

Legislative & Intergovernmental Affairs

- News and Updates
<http://www.legislative.noaa.gov/>
- News and Updates Archive
<http://www.legislative.noaa.gov/newsarchive.html>
- Congressional Testimony
<http://www.legislative.noaa.gov/111testimony.html>
- Upcoming Hearings and Markups
<http://www.legislative.noaa.gov/schedule.html>

National Coastal Data Development Center (NCDDC)

- **Coastal Eco Systems Map**
GIS tool for the visualization of data sets on bathymetry, managed species, essential fish habitat (EFH), oyster reef locations, etc.
<http://www.ncddc.noaa.gov/website/CHP/viewer.htm>
- **Joint Analysis Group (JAG)**
The Joint Analysis Group (JAG) for Surface and Sub-Surface Oceanography, Oil and Dispersant Data is a working group with membership from NOAA, EPA, USGS, and OSTP.
<http://ecowatch.ncddc.noaa.gov/JAG>

National Marine Sanctuaries

Updates on the Deepwater Horizon incident as it pertains to sanctuaries

http://sanctuaries.noaa.gov/news/features/0410_deepwater.html

National Oceanographic Data Center (NODC)

- NODC Gulf of Mexico data and information
http://www.nodc.noaa.gov/General/deepwater_support.html
- *Walton Smith* Cruise Data
http://www.nodc.noaa.gov/General/deepwater_ocean_profile.html#walton

National Ocean Service (NOS)

- NOS response activities related to the spill
<http://oceanservice.noaa.gov/deepwaterhorizon/nosposupport.html>
- NOAA images related to the oil spill
<http://oceanservice.noaa.gov/deepwaterhorizon/images.html>
- NOAA video related to the oil spill
<http://oceanservice.noaa.gov/deepwaterhorizon/video.html>

National Weather Service (NWS)

Advanced Hydrologic Prediction Service Deepwater Horizon Incident Support

<http://water.weather.gov/dwh/>

Mesonet Observations

WS Mesonet Observations

<http://www.wrh.noaa.gov/mesowest/gmap.php?zoom=8&xtents=28.22213,-91.83>

National Centers for Coastal Ocean Science (NCCOS)

GIS Regional Data

Imagery acquired by the NOAA Remote Sensing Division of the Gulf Coast following the DeepWater Horizon Incident

<http://ccma.nos.noaa.gov/stressors/pollution/bioeffects/welcome.html>

NOAA Ship Tracker

The NOS Special Projects office hosts and maintains OMAO's Ship Tracker

http://shiptracker.noaa.gov/default.aspx?mapservice=st_charts_dwh&XMIN=-

Office of Response and Restoration (OR&R)

Daily updates on status of Deepwater Horizon response

<http://response.restoration.noaa.gov/>

Daily incident response status

<http://www.incidentnews.gov/incident/8220>

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

NOAA's Oil Spill Response

Shorelines and Coastal Habitats in the Gulf of Mexico

The effects of the Deepwater Horizon oil spill on natural resources are dependent on multiple factors including oil composition, oil quantity, dispersal techniques, and contact with organisms.

Broadly speaking, when offshore, impacts may occur in the upper meter or so of the water column, mid-level mixing layer (through dispersal of oil and toxic components) and at the sea floor. When onshore, impacts may occur to shorelines, nearshore waters, and coastal habitat.

To help quantify the magnitude of impact and injuries, modeling efforts will be supported through data collected during the spill.

Shorelines and coastal wetlands in the Gulf of Mexico

The Gulf of Mexico coastal areas have more than half of the coastal wetlands within the lower 48 states; Louisiana alone has approximately 40 percent of the total. Although coastal areas are vital for fish species and protection of human life and property ashore, the Gulf of Mexico has been losing coastal land at a very high rate over the last 50 years.

Each year, we lose 25 square miles of coastal wetlands. In the past century, we have lost more than 1 million acres. Approximately 90 percent of the nation's coastal wetland losses occur in Louisiana. If the current

rate of erosion continues, Louisiana alone could lose an additional 800,000 acres of wetlands by 2040, moving the shoreline inland by as much as 33 miles in some areas.

The effect of the Deepwater Horizon oil spill on coastal erosion will be determined by how much oil reaches these habitats, and how long it stays there.

A lot of oil resting on vegetated coastal shorelines could cause the vegetation to become stressed and die. This could cause the roots to die- weakening marsh soils. Weakened marsh soils would then be at risk of accelerated erosion from waves and storms.

Habitat in the Gulf of Mexico

Ninety-seven percent (by weight) of the commercial fish and shellfish landings from the Gulf of Mexico are species that depend on estuaries and their wetlands at some point in their life cycle. Landings from the coastal zone in Louisiana alone make up nearly one-third (by weight) of the fish harvested in the entire continental United States.

In such an incredibly productive area, important habitat in the Gulf covers nearly every part of the ecosystem. Some examples include the open water column, floating sargassum mats, deep-sea soft corals, hard coral reefs, rocky hard-bottom substrates, ledges and



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caves, limestone outcroppings, artificial reefs, mangroves, sandy bottom, muddy bottom, marshes, submerged aquatic vegetation,

bays, lagoons and even the sandy beach, which turtles use for laying eggs.

In federal waters, species that use the surface would be most impacted by the early stages of the oil spill. As the crude oil sinks, the bottom-oriented fish community may be impacted.

In general, the 42 reef fish species managed in the Gulf of Mexico are often found in bottom areas with high relief, such as coral reefs, artificial reefs, and rocky hard-bottom surfaces. These areas are usually deeper than 100 meters. As long as the oil spill remains on the surface and offshore, the impacts to reef fish habitat should be minor.

If the oil slick reaches the bottom or nearshore/inshore areas, the majority of the reef fish species could be affected. However, some reef fish spawn in spring, and their eggs and larvae are usually planktonic, carried by currents rather than through their own control.

These larvae would not be able to avoid or escape the oil if currents brought them together. Sargassum mats are nursery habitat for some species, including gray triggerfish and amberjacks. Sargassum mats that intersect the oil could affect these species.

In state waters, all coastal species could be affected if the oil spill reaches nearshore waters. In addition, shrimp larvae usually spend the early months of their life in inshore waters before migrating toward the ocean. Brown shrimp postlarvae migrate from February to April, and white shrimp being their migration from May through November.



During spring and summer months, several Gulf shark species use coastal habitats as nursery areas, so if oil reaches coastal areas they use, they would be affected.

How Oil Affects Habitats and Species

Dispersed and dissolved oil (comprised of polycyclic aromatic hydrocarbons, (PAHs)) in the water can result in exposure of aquatic resources to the toxicological effects of PAHs. This contact in the water column may be exacerbated by use of surfactants, weather conditions and other dispersal methods that increase mixing.

PAHs can cause direct toxicity (mortality) to marine mammals, fish, and aquatic invertebrates through smothering and other physical and chemical mechanisms.

Besides direct mortality, PAHs can also cause sublethal effects such as: DNA damage, liver disease, cancer, and reproductive, developmental, and immune system impairment in fish and other organisms. PAHs can accumulate in invertebrates, which may be unable to efficiently metabolize the compounds. PAHs can then be passed to higher trophic levels, such as fish and marine mammals, when they consume prey.

The presence of discharged oil in the environment may cause decreased habitat use in the area, altered migration patterns, altered food availability, and disrupted life cycles.

During past oil spills in the Gulf of Mexico, NOAA has documented direct toxic impacts to commercially important aquatic fauna, including blue crabs, squid, shrimp and different finfish species.

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

NOAA's Oil Spill Response

Effects of Oil on Marine Mammals and Sea Turtles

Oil is a mixture of chemicals, all of which may have different effects on marine animals and the combination may be even more hazardous. In addition, some of the chemicals and methods used to clean up oil spills may also have effects on marine animals. Toxicity or harmful effects are dependent upon:

- ▶ The mixture and types of chemicals that make up the oil or are used to clean up the oil.
- ▶ The amount of exposure (dose for internal exposures or time for external exposures).
- ▶ The route of exposure (inhaled, ingested, absorbed, or external).
- ▶ The biomedical risk factors of the animal (age, sex, reproductive stage, and health status). For turtles this will include differing impacts and vulnerabilities at the different life stages such as eggs, post-hatchlings, juveniles and adults. For cetaceans this will include neonates, calves, juveniles and adults.

Research on dolphins in human care has shown that the animals avoid oil on the surface of the water, however observations of wild dolphins have documented the animals swimming in, feeding in and socializing in oiled water during previous oil spills in the Gulf of Mexico.

Several aspects of sea turtles put them at risk, including the lack of avoidance behavior of oiled waters and indiscriminate feeding in convergence zones.



Whales, dolphins, manatees and sea turtles are air breathers and all must come to the surface frequently to take a breath of air. In a large oil spill, these animals may be exposed to volatile chemicals during inhalation.

Depending on the size of a particular spill, marine mammals and sea turtles could be exposed to these chemicals for a fairly long time.

General Types of Effects on Marine Mammals and Sea Turtles

The following are generalities and would need to be specifically applied to the situation or event.



Cetaceans, manatees and sea turtles may be exposed to chemicals in oil (or used to treat oil spills like dispersants) in two ways: internally (eating or swallowing oil, consuming prey containing oil based chemicals, or inhaling of volatile oil related compounds) and externally (swimming in oil or dispersants, or oil or dispersants on skin and body).

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Additionally sea turtles may experience oiling impacts on nesting beaches and eggs through chemical exposures resulting in decreased survival to hatching and developmental defects in hatchlings.

External Effects

- ▶ Cetaceans and manatees have no fur which can be oiled and do not depend on fur for insulation. Therefore they are not susceptible to the insulation effects (hypothermia) that often puts haired marine mammals (such as fur seals or sea otters) at risk.
- ▶ Oil and other chemicals on skin and body may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection. For large whales, oil can foul the baleen they use to filter-feed, thereby potentially decreasing their ability to eat.

Internal Effects

- ▶ Inhalation of volatile organics from oil or dispersants may result in respiratory irritation, inflammation, emphysema, or pneumonia.
- ▶ Ingesting oil or dispersants may result in gastrointestinal inflammation, ulcers, bleeding, diarrhea, and maldigestion.
- ▶ Absorption of inhaled and ingested chemicals may damage organs such as the liver or kidney, result in anemia and immune suppression, or lead to reproductive failure or death.

Summary

- ▶ Direct contact with of petroleum compounds or dispersants with skin may cause skin irritation, chemical burns, and infections.



- ▶ Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which may lead to inflammation or pneumonia.
- ▶ Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which may affect the animals' ability to absorb or digest foods.
- ▶ Absorption of petroleum compounds or dispersants may damage liver, kidney, and brain function as well as causing anemia and immune suppression.
- ▶ Long term chronic effects such as decreased survival and lowered reproductive success may occur.
- ▶ The Marine Mammal and Sea Turtle Stranding Networks have protocols and procedures in place for responding to live animals that are exposed to oil spills, and animals brought into rehabilitation facilities are provided veterinary care to remove oil and treat any related health effects.

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 🌐



Gulf Seafood Safety & The BP Deepwater Horizon Oil Spill



The Obama administration is carrying out an aggressive, comprehensive, coordinated, multi-agency program to ensure the safety of Gulf seafood – working across federal agencies and with state and local officials, and the seafood industry, to closely monitor the effects of the BP Deepwater Horizon oil spill and its potential impact on seafood safety. This includes rigorous testing throughout the process of bringing Gulf seafood to market – from active monitoring of the fisheries where seafood is caught to the inspection of companies that catch and sell Gulf seafood to the frequent testing of seafood caught in the Gulf to ensure that all seafood that goes to market is safe.

Seafood from open waters is safe to eat. Extensive steps are being taken to ensure that remains the case.



When waters were impacted by oil, or at the risk of being impacted, they were closed to fishing. Closing oiled areas to fishing is the primary tool for preventing the entry of tainted fish and fishery products into the marketplace. The federal government has taken a precautionary approach – closing areas where there is oil on the surface or sub-surface, and areas that do not currently have oil but where NOAA projects there will be oil.

To ensure safety, a five-mile buffer around these areas is included around any area that meets one of these criteria as an extra precaution. The Coast Guard and NOAA are monitoring the closed federal areas to ensure

there is no fishing within those areas, and will take enforcement action against vessels that violate closure boundaries.

1. Areas are considered for reopening only once they are free of oil.

The administration, working with the health and fisheries authorities from the Gulf States, has developed a protocol to ensure any area that has been closed to fishing is safe prior to being reopened. That process starts once an area is free of oil.

Following such a determination, samples from the area must pass sensory and chemical testing conducted by the FDA and NOAA.



2. Every seafood sample from reopened waters has undergone rigorous testing for oil and dispersants – and every sample from reopened waters has passed those tests.

Federal seafood safety experts have implemented a rigorous, risk-based sampling regime.

Sampling from Areas Considered for Reopening: Samples are collected from closed fishing areas and are brought to shore for immediate testing before those areas are reopened. NOAA has also collected baseline specimens and has sampled outside the closure.

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Sensory Testing: Seafood samples undergo rigorous sensory testing by expert panels at NOAA's seafood testing laboratory in Pascagoula, Miss. These experts can detect down to one part oil in 1 million parts seafood. Once the samples pass the sensory test, they are sent for chemical testing.

Chemical Analysis: Both NOAA and the FDA are performing chemical testing on seafood products from the Gulf at labs across the country. This analysis tests for hydrocarbon compounds and ensures that seafood products caught in the Gulf are safe for the consumer.

Dockside Sampling: In an effort to add an additional level of screening, NOAA has implemented a targeted sampling program that tests fish as they are brought into the docks from commercial fishing vessels.

Risk-Based Seafood Processor Monitoring: FDA has implemented a risk-based surveillance sampling program targeting seafood products at Gulf Coast

seafood processors – targeting oysters, crabs and shrimp, which could retain contaminants longer than finfish. This sampling provides verification that seafood on the market is safe.



4. Dispersants have not been used in the Gulf since July 19, were not applied in areas that have been opened for fishing, and tests of reopened waters do not show the presence of any dispersants.

To date, every seafood sample from reopened waters has passed sensory testing for contamination by oil and dispersants. Scientific data indicate that the dispersants used to combat the oil spill break down rapidly and become highly dispersed in Gulf waters.

Scientific data to date also indicate that dispersants do not accumulate in seafood. Of the thousands of water samples tested by NOAA and EPA, to date only two have shown the presence of dispersant. Robust testing on any sample that was initially believed to contain low levels of dispersant has indicated that they do not show the presence of dispersant.



Visit www.NOAA.gov or www.FDA.gov for more information about the federal government's seafood sampling programs. Call 1-888-INFO-FDA with questions or concerns about seafood or to report any seafood that you suspect of being contaminated.

NOAA's Oil Spill Response

Links Between Gulf Hypoxia and the Oil Spill

Where is the hypoxic zone (dead zone) found?

Hypoxia, or low oxygen, develops near the mouth of the Mississippi River every summer as a result of excess nutrients that are introduced principally via the Mississippi River. These excess nutrients trigger algal blooms that are eventually decomposed by oxygen-consuming bacteria. As a result, oxygen in the bottom waters of the Gulf, below about 25-30 feet, drops to stressful and sometimes lethal levels.

Low oxygen waters have already been recorded this year but the full geographic extent of the affected area will not be known until later in the summer. In addition to the hypoxia that develops to the west of the Mississippi Delta, hypoxia has also developed periodically to the east of the delta in the Mississippi Bight. Winds, currents and storms also affect oxygen conditions in Gulf waters. The area affected can spread from the mouth of the Mississippi west towards Texas covering, on average for past five years, about 7,000 square miles of the continental shelf.

What are the repercussions of the oil spill on Dead Zone development this year; and ultimately how will the combination of these environmental threats affect the Gulf ecosystem?

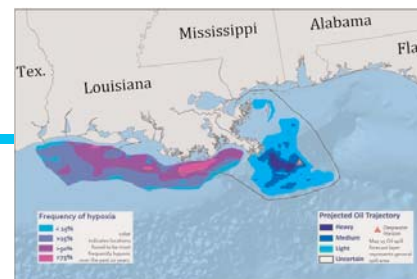
NOAA-supported monitoring cruises conducted by the Louisiana Universities Marine Consortium have already detected some low-oxygen zones. Recent oil flow trajectories have oil approaching sites where Mississippi

River outflow occurs. It is likely that water containing oil will intersect with this outflow and influence the dead zone formation. Heavy use of dispersants means that much of the oil is probably in the water column and may be moving closer to the region where the hypoxic zone typically forms than the surface accumulation might suggest.

According to researchers who have been studying hypoxia for decades, oil could exacerbate this year's dead zone. For example, oil on the surface of the water could restrict the normal process of atmospheric oxygen mixing into and replenishing the water column concentrations. In addition, microbes in the water that break down oil and dispersant also consume oxygen; this could lead to further oxygen depletion. It is also possible that the microscopic animal grazers of algae, or zooplankton, could be affected, thus allowing more of the hypoxia-fueling algae to grow.


There are factors related to the oil spill that could lessen the severity or extent of the hypoxic zone. For example, the large, near-surface algal blooms that ultimately fuel the bottom water decomposition that produces hypoxic conditions could be reduced if the oil or dispersant are toxic to the algae or reduce the light penetration required for algal growth. If such a reduction in algal growth occurs on a large enough scale, it is possible that this process could reduce the size and/or

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Map of spill trajectory and frequency of Gulf hypoxia over the past 20 years.





severity of the hypoxic zone. It is important to recognize that oil-related impacts could, in many cases, exacerbate the effects of hypoxia. For example, hypoxia can damage the health of organisms such as shrimp and fish, affecting their growth and reproductive potential.

Oil also can have sublethal effects on the eggs, larva, and early life stages of fish, so there is the potential that these stressors can be additive, and each stressor may increase the susceptibility to the harmful effects of the other. In fact, brown shrimp exposed to polycyclic aromatic hydrocarbons (PAHs), a common pollutant associated with oil, has been shown to induce stress at a higher level of dissolved oxygen relative to clean environments.

As part of NOAA's longstanding and ongoing research into the causes and effect of the Northern Gulf of Mexico Hypoxic Zone, efforts will be made this year to further evaluate the complex interactions between hypoxia and the oil spill.

Has the annual occurrence and expansion of the dead zone weakened the health of the food web over time, and has this made the ecosystem more susceptible to the harmful effects of the oil spill?

Hypoxia has clearly stressed or killed some organisms in the Gulf off Louisiana. This existing stress, therefore, likely makes the food web more susceptible to impacts from other stresses such as the oil spill. Some examples of this are provided in the prior question. However, since these food web effects may be subtle, even though potentially widespread and damaging, it is difficult to address this question definitively without substantial additional research.

Have NOAA sponsored research studies on the Dead Zone helped in the understanding of how the oil spill might affect the ecosystem?

Through NOAA research funding directed at the hypoxic zone and other NOAA programs over the past 30 years, a significant data base has been established that includes the benthic community, phytoplankton, zooplankton, shrimp, fish, and chemical constituents. These data can be used as a baseline to address impacts related to the oil spill. The hypoxia research programs

also have recently supported the development of sophisticated biogeochemical mathematical models that could be used, with certain modifications, to understand and quantify the impacts from the oil spill and help to definitively link causes and effects.

How will hypoxia research efforts be affected by the oil spill?

NOAA is funding (through the NGOMEX hypoxia program) a number of research cruises this spring and summer that are designed to collect data on essential physical, chemical, and biological properties in the waters west of the Mississippi River.

There is a possibility that oil residues in the area of the hypoxic zone will disrupt this sampling of near-surface and deeper waters. Researchers studying hypoxia need to deploy expensive sampling equipment. Water column sampling equipment has very sensitive probes that could be ruined if deployed in oil contaminated water. It is not clear how to avoid complications posed by the presence of the oil if studies of hypoxia are to be conducted this year. Water also is collected for experiments to determine the role of nutrients and other factors in causing algal blooms that lead to hypoxia. How the presence of the oil will affect these experiments is unclear.

In recent years, NOAA has issued a late spring forecast of the hypoxic zone size and later in the summer releases the measured size. Given the many complexities and uncertainties surrounding the impact of the oil spill on processes that affect hypoxia, NOAA will not be able to account for the effects of the oil spill in the models used to forecast the size of this year's hypoxic zone. However, a summary of the latest understanding on potential influences will be provided along with the model forecasts.

NGOMEX Program:

<http://www.cop.noaa.gov/stressors/pollution/current/gomex-factsheet.aspx>

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

NOAA's Oil Spill Response

Oil Spill Dispersant Application and Monitoring

Once oil has spilled, responders use a variety of oil spill countermeasures to reduce the adverse effects of spilled oil on the environment. Dispersants are one kind of countermeasure.

Oil spill dispersants are chemicals applied directly to the spilled oil in order to remove it from the water surface. Surface oil can be especially harmful to birds, mammals and other organisms that come in contact with the water surface.

Oil on the surface is often cohesive and natural degradation processes are slow. When dispersants are applied to surface oil slicks, tiny dispersant-oil droplets then separate from the slick and mix into the water column, reducing the size and volume of the surface slick.

The tiny droplets are too small to refloat to the surface. Bacteria and other microscopic organisms then act to quickly degrade the oil. Dispersants are commonly applied through specialized equipment mounted on an airplane, helicopter or ship.

Monitoring

Special Monitoring of Applied Response Technologies (SMART) is a cooperatively designed monitoring program for dispersant use. SMART relies on small, highly mobile teams that collect real-time data using portable, rugged and easy-to-use instruments.

The SMART program is designed to address critical questions:

Are dispersants effective in dispersing the oil? How quickly are dispersants working? Having monitoring data can assist the Unified Command with decision-making for operational use of dispersants.

Dispersants

To monitor the efficacy of dispersant application, SMART recommends three options, or Tiers.

Tier I

A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy and reports back to the Unified Command.

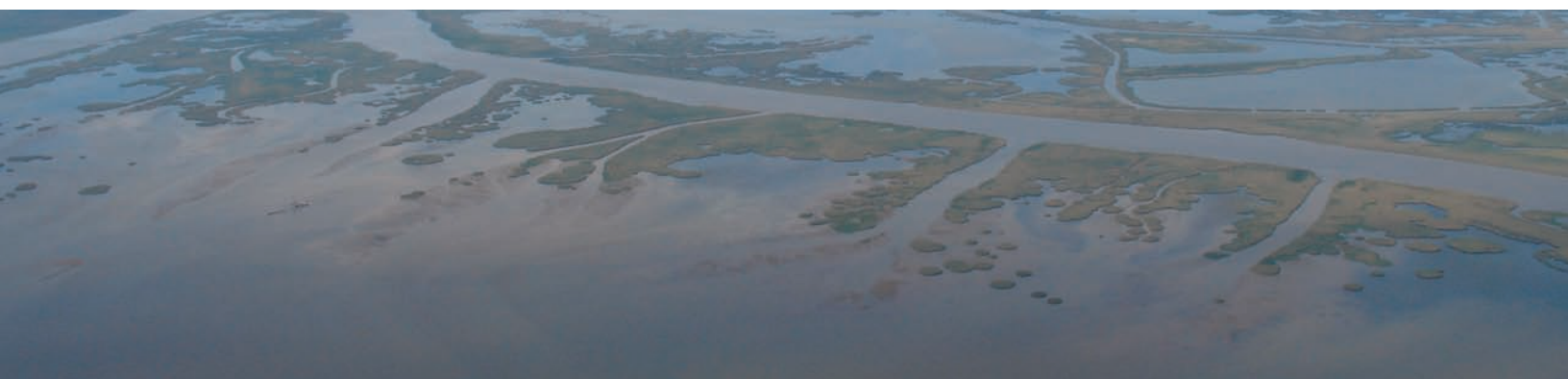
Tier II

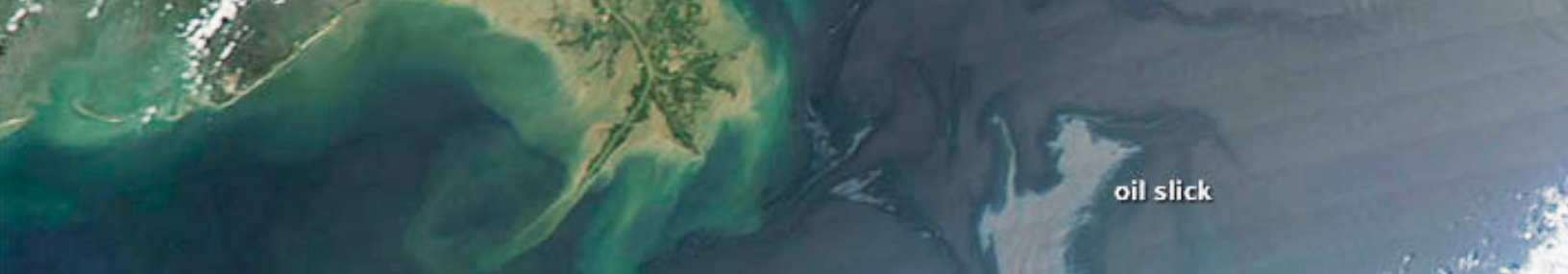
Tier II provides real-time data from the treated slick. A sampling team on a boat uses a fluorometer to continuously monitor for dispersed oil one meter under the dispersant-treated oil slick.

The team records and conveys fluorometer data to the scientific support team, which forwards it with recommendations to the Unified Command. Water samples are also taken for later analysis at a laboratory.



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Tier III

By expanding the monitoring efforts in several ways, Tier III provides information on where the dispersed oil goes and what happens to it: (1) two fluorometers are used on the same vessel to monitor at two water depths; (2) monitoring is conducted in the center of the treated slick at several water depths, from one to ten meters; and (3) a portable water laboratory provides data on water temperature, pH, conductivity, dissolved oxygen, and turbidity.

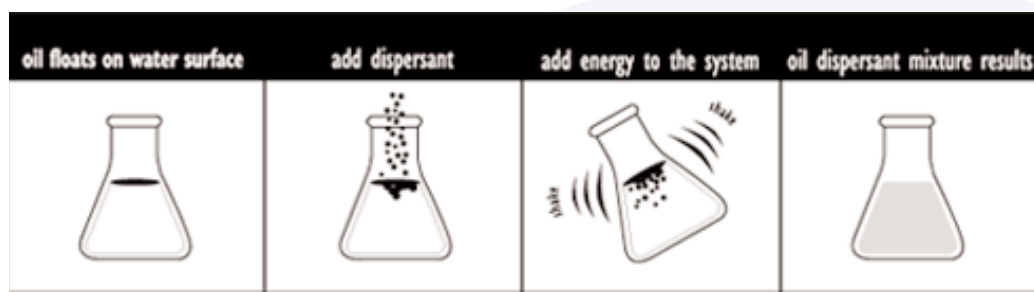
Field Experience

SMART has already been successfully tested in the field during exercises and spills. SMART has been used to monitor dispersant applications in the Gulf of Mexico. Practical usage help us to enhance SMART protocols and equipment.

For online information on SMART, visit <http://response.restoration.noaa.gov/smart>

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 



First, the dispersant is applied to the water surface. Next, molecules of the dispersant attach to the oil, causing it to break into droplets. Wave action and turbulence then force the oil-dispersant mixture into the water column, so that the oil that had been concentrated at the surface is diluted within the water column.

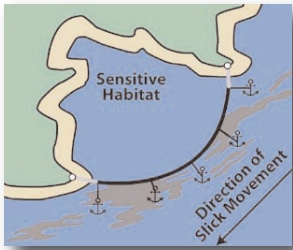
NOAA's Oil Spill Response

Using Boom in Response to Oil Spills

Boom is a common type of oil spill response equipment. It is used to protect shorelines or sensitive locations by acting as a barrier to oil, and to corral oil on the water to enhance the recovery effectiveness of skimmers or other response operations.

How Boom is Used

Boom is used in many ways during an oil spill response, including the following:



Boom can be placed to exclude oil from a sensitive stretch of shoreline, such as a coastal marsh, marina, seabird nesting area, or location where marine mammals congregate. This diagram shows how boom would be placed across

the mouth of a small inlet to prevent oil from entering the inlet, with anchors used to keep the boom in place. Boom placed to protect an area deflects oil; it does not collect it.

Boom can be placed around a vessel or tank that is leaking oil. The boom confines the oil within a small space so it can be collected.

Boom may be towed behind boats to collect oil, as in the photo at right. Oil that collects in the apex of a towed U-shaped boom



(below) Hard Boom.

can either be skimmed from the water surface, or towed away from the main slick to a location where it is safe to burn it.



Fire Boom.

Types of Boom

Four main types of boom are used for oil spill response. **Hard boom** is typically made of PVC or similar durable material. It consists of an inflated chamber that rides above the water, and an attached skirt that hangs down into the water. The two main types of hard boom are ocean boom, designed for use in high seas, and harbor boom, designed for sheltered waters. The primary difference between ocean and harbor boom is the strength of the material, size of the flotation chamber, and depth of the skirt.

Hard boom is used to contain oil. It may be placed around a leaking vessel to corral oil, or anchored offshore of a sensitive area to exclude oil from that area. Hard boom also can be towed behind boats to concentrate oil so that skimmers can recover it.

Fire boom is similar in design to hard boom, but is made of material that can withstand the heat generated by burning oil, which can exceed 2,000° F. Fire boom is used to corral oil to be burned in an on site (in situ) burn operation.

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Sorbent boom looks like a long sausage. It is constructed of a long fabric sock enclosing material that attracts oil but repels water.

Unlike hard boom, sorbent boom does not have an attached skirt. Once saturated with oil, sorbent boom must be removed and properly disposed of. It is used to both contain and absorb oil on the water surface.



Snare boom looks like cheerleaders' pompoms tied to a long line. It is placed along shorelines, anchored by stanchions. The "pompom" strands catch tarballs and

small quantities of oil brought by tides and waves.



Effective Use of Boom

For several reasons, NOAA recommends that boom be deployed and maintained in a coordinated strategy with other response equipment. For one thing, not all areas can be protected by boom; other response measures must be adopted in those locations. And because there typically aren't enough resources to protect all sensitive locations with boom, it is usually necessary to make tradeoffs when deciding where and when to place boom. For example, choosing to deploy boom to protect the entrance to an ecologically important coastal marsh rather than a recreational beach.

Because boom, once placed in the water, is difficult and time consuming to move, an effective strategy is to stage boom so that it is ready for deployment, but waiting to deploy until oil approaches the area. By using this strategy, responders can ensure that the boom is placed at the optimal location to protect against the oil, whether that location proves to be the originally envisioned site or a different location.

When boom is used to protect a shoreline, it must be tethered securely so that it will not be dislodged. Currents



faster than 1.5 knots or even wakes from passing ships can dislodge boom. Rough seas and winds can tear, capsize, and shred boom. An effective method is to deploy concentric rings of boom to protect highly sensitive areas in exposed areas. In estimating the amount of boom needed to protect a given length of shoreline, responders then need to consider whether multiple rings of boom will be deployed.

Boom should never be set out and forgotten; deployed boom must be monitored to ensure that it remains in place. Untended boom can be a barricade to wildlife. For example, dislodged boom can strand on shorelines and prevent sea turtle adults and hatchlings from transiting between shore and water. Dislodged boom anchors can damage corals and sea grass beds. Untended boom also can become a barrier and hazard to ship traffic. Marinas and navigation channels must remain open for response vessels and commercial traffic.

Sorbent boom designed for oil spill response should be used whenever possible for most spill response uses, because it is specifically designed to collect spilled oil from the water surface. NOAA's years of experience in oil spill response and field testing indicate that sorbent boom is much more effective than alternatives such as recycled nylon stockings stuffed with straw and hair.

In a February 2010 NOAA field test, commercial sorbent boom absorbed more oil and much less water than hair boom, which became waterlogged and sank within an hour. NOAA foresees a risk that widespread deployment of hair boom could exacerbate the marine debris problem in the Gulf of Mexico, in that waterlogged hair boom would be especially difficult to retrieve and more likely to break apart. It is possible that hair sorbents (absorbent pads) would be useful for collecting oil from drier areas such as rocks and artificial structures.

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

NOAA's Oil Spill Response

Understanding Tar Balls

What are Tar Balls and How Do They Form?

Tar balls, the little, dark-colored pieces of oil that stick to our feet when we go to the beach, are actually remnants of oil spills. When crude oil (or a heavier refined product) floats on the ocean surface, its physical characteristics change.

During the first few hours of a spill, the oil spreads into a thin slick. Winds and waves tear the slick into smaller patches that are scattered over a much wider area. Various physical, chemical, and biological processes change the appearance of the oil. These processes are generally called “weathering.”

Initially, the lighter components of the oil evaporate much like a small gasoline spill. In the cases of heavier types of oil, such as crude oil or home heating oil, much of the oil remains behind. At the same time, some crude oils mix with water to form an emulsion that often looks like chocolate pudding.

This emulsion is much thicker and stickier than the original oil. Winds and waves continue to stretch and tear the oil patches into smaller pieces, or tar balls. While some tar balls may be as large as pancakes, most are coin-sized. Tar balls are very persistent in the marine environment and can travel hundreds of miles.



How Long Will Tar Balls Remain Sticky?

Weathering processes eventually create a tar ball that is hard and crusty on the outside and soft and gooey on the inside, not unlike a toasted marshmallow. Turbulence in the water or beach activity from people or animals may break open tar balls, exposing their softer, more fluid centers.

Scientists have not been very successful at creating weathered tar balls in the laboratory and measuring the thickness of the crusty outer layer. Therefore, we don't know how much energy is needed to rupture a tar ball.

We do know that temperature has an important effect on the stickiness of tar balls. As air and water temperatures increase, tar balls become more fluid and, therefore, sticky — similar to an asphalt road warmed by the summer sun.

Another factor influencing stickiness is the amount of particulates and sediments present in the water or on the shoreline, which can adhere to tar balls. The more sand and debris attached to a tar ball, the more difficult it is to break the tar ball open. These factors make it extremely difficult to predict how long a tar ball will remain sticky.



(continued on back)





Are Tar Balls Hazardous to Your Health?

For most people, an occasional brief contact with a small amount of oil, while not recommended, will do no harm. However, some people are especially sensitive to chemicals, including

the hydrocarbons found in crude oil and petroleum products. They may have an allergic reaction or develop rashes even from brief contact with oil. In general, we recommend that contact with oil be avoided.

If contact occurs, wash the area with soap and water, baby oil, or a widely used, safe cleaning compound such as the cleaning paste sold at auto parts stores. Avoid using solvents, gasoline, kerosene, diesel fuel, or similar products on the skin. These products, when applied to skin, present a greater health hazard than the smeared tar ball itself.

Tar Ball Bits and Pieces

Beach Cleanup

There is no magic trick to making tar balls disappear. Once tar balls hit the beaches, they may be picked up by hand or by beach-cleaning machinery. If the impact is severe, the top layer of sand containing the tar balls may be removed and replaced with clean sand.

Are there more tar balls on beaches along the East Coast than on the West Coast?

The number of tar balls found on the beach depends on several factors: tanker traffic, wind patterns, sea currents, whether an oil spill occurred recently, and how often the beach is cleaned.



Obviously, some beaches may have more tar balls than others, but to our knowledge, East Coast beaches are not necessarily more polluted with tar balls than beaches along the West Coast of the United States.

Reporting

New tar balls appearing on a beach may indicate an oil spill. If you notice unusual numbers of tar balls on the beaches, call the U. S. Coast Guard any time at 800-424-8802.

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For additional information:

<http://response.restoration.noaa.gov>

<http://response.restoration.noaa.gov/adios>

NOAA's Office of Response and Restoration Emergency Response Division: 206-526-6317

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

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