OPEN WATER OIL IDENTIFICATION JOB AID
for aerial observation

NOAA / Office of Response and Restoration / Hazardous Materials Response Division
Seattle, Washington

U.S. Coast Guard Marine Safety Office Puget Sound, Port Operations Department
Seattle, Washington

Second Edition
September 2000

NOAA's Hazardous Materials Response Division works to reduce risks to coastal habitats and resources from oil and hazardous chemical spills and hazardous waste sites. HAZMAT draws on two decades of experience in responding with the U.S. Coast Guard to spill emergencies and resolving the often longer-term problems presented by hazardous waste sites. HAZMAT's response to spill emergencies and waste site problems has gained us a reputation for rapid, yet carefully considered and cost-effective environmental protection decisions.

This aid is a joint project of NOAA/HAZMAT and the U.S. Coast Guard Marine Safety Office Puget Sound, Port Operations Department. NOAA, Coast Guard-Astoria, Washington Department of Ecology, and industry contributed photographs.

OPEN WATER OIL SPILL ASSESSMENT JOB AID

Introduction

An important step in oil spill response is assessing character and extent of the oil spilled on the water. This information is used by the Incident Command to prioritize response and direct cleanup resources. This aid was created to help you perform efficient assessments and communicate your findings effectively.

When oil enters the water from a source (e.g., a vessel, pipeline, or facility), it initially spreads out and forms a continuous or cohesive patch on the water's surface. This layer or patch of oil absorbs energy and dampens out the surface waves making the area appear smoother or "slick" compared to the surrounding water. As the oil layer becomes thinner, it is more susceptible to being broken up by wave, wind, and current movement into smaller patches and narrow bands, or "windrows," oriented in the direction of the wind or current. Light oils, such as diesel and gasoline, may evaporate and disappear completely. Heavy oils, such as bunker fuels and crude oil, eventually spread out to form smaller, discrete patches or streaks, ultimately becoming tarballs.

The color, distribution, and consistency of the oil gives an indication of the type of oil spilled, how long the oil has been on the water and our ability to contain and/or recover it. You are being asked to observe these properties and report them to the Incident Command. This aid is designed to help you characterize the oil and describe what you see in standard terms. The observations on which you should concentrate are the on-scene weather, the location of the spill, and the color and distribution of the oil. In addition, you might be requested to report on other ancillary observations that pertain to the response that you notice while on-scene (e.g., location of response equipment, presence of wildlife).

The platform from which you make your observations — a helicopter, a fixed-wing aircraft or a vessel — will be determined by a number of different factors. Each platform has advantages and disadvantages. An aircraft, both helicopter and fixed-wing, allow you a greater overview of the area impacted by an oil spill. They allow you to reach the scene quicker and investigate the outer edges impacted by a large oil spill. A helo can generally fly slower and at a lower altitude, allowing you a better view of the spill. A vessel, on the other hand, allows you a very close look at

the oil itself, giving you a better feel for its thickness and consistency. A vessel will also allow you a closer look to verify whether the spill reported is actually oil or a natural occurrence that resembles an oil spill. Herring spawning, algae blooms, and jellyfish are often mistaken for oil. Lastly, a vessel will allow you to sight tarballs formed during a spill, as these are not often visible from an aircraft.

This aid is organized in the following format:

- *A glossary of standard terms frequently used by the pollution response community.*
- *Pictures illustrating different types and distributions of oil on water and common response activities. Each picture includes examples of how to use standard terminology to describe the scene.*
- *A chart to help you visually calculate percent coverage of an oil spill.*
- *A checklist to organize and record information.*

GLOSSARY OF STANDARD OIL SPILL OBSERVATION TERMS

Black oil: A black or very dark brown-colored layer of oil. Depending on the quantity spilled, oil tends to quickly spread out over the water surface to a thickness of about one millimeter. However, from the air it is impossible to tell how thick a black oil layer is.

Convergence lines: A line on the surface of the water that can collect floating objects and oil. A convergence can be caused by the interface between two different types or bodies of water, a significant depth change, tidal changes, or other common phenomena. Convergences are very common occurence in the marine environment.

Dispersion: The breaking up of an oil slick into small droplets which are mixed into the water column as a result of breaking waves and other sea surface turbulence.

Emulsification: The formation of a water-in-oil mixture. The tendency for emulsification to occur varies with different oils and is much more likely to occur under high energy conditions (winds and waves). This mixture is frequently referred to as mousse and indicates a spill which has been on the water for a while.

Entrainment: The loss of oil from containment when it is pulled under a boom by a strong current. Entrainment typically occurs from booms deployed perpendicular to currents greater than 1 knot.

Mousse: A water-in-oil emulsification. Mousse can range in color from dark brown to almost red or tan and typically has a "thickened" or "pudding-like" consistency compared to freshly spilled oil. The incorporation of up to 75% water into the oil will cause the apparent volume of a given quantity of oil to increase four times.

Pancakes: Isolated patches of roughly circular-shaped oil that range in size from a few feet across to hundreds of yards in diameter. Sheen may or may not be present.

Recoverable Oil: Oil that is in a thick enough layer on the water to be recovered by conventional techniques and equipment. Only black or dark brown oil, mousse, and heavy sheens (dull brown) are generally considered thick enough to be effectively recovered by skimmers.

Sheen: Sheen is a very thin layer of oil (less than 0.0001 inches or 0.003 mm) floating on the water surface and is the most common form of oil seen in the later stages of a spill. According to their thickness, sheens vary in color ranging from dull brown for the thicker layers to rainbows, grays, silvers, and almost transparent for the thinnest layers.

Slick: Oil spilled on the water which absorbs energy and dampens out the surface waves making the oil appear smoother or "slicker" than the surrounding water.

Streamers: A narrow line of oil, mousse, or sheen with clean water on either side of it. Streamers form in a spill as a result of the combined effect of wind, currents, and/or natural convergence zones. Frequently, heavier concentrations of mousse or sheen will be present in the center of the streamer, with progressively lighter sheen on the edges. Streamers are also commonly referred to as "fingers" or "ribbons."

Tarballs: Weathered oil that has formed pliable balls or patches that float on the water. Tarballs may vary in size from millimeters to foot across. Depending on exactly how "weathered," or hardened, the outer layer of the tarball is, sheen may or may not be present.

Weathering: Combination of physical and environmental processes such as evaporation, dissolution, dispersion, and emulsification which act on oil and change its physical properties and composition.

Windrows: Streaks of oil that line up in the direction of the wind. Windrows tend to form very early in a spill where the wind is 10 knots or greater. Sheens are the most common form of spill which that windrows.

LIST OF PHOTOGRAPHS

1. BLACK OIL LEAKING FROM BARGE

Black oil streaming to the southwest of the barge.

Observation altitude:
400 ft.

Platform:
Helo

Total slick dimension:
15 yds. x 500 yds.

2. BLACK OIL COLLECTED ALONG SHORELINE

Black oil collected in shoreline pocket in shallow bay. Patches of black oil and silver and gray sheens nearshore.

Observation altitude:
600 ft.

Platform:
Helo

Total slick dimension:
10 yds. x 50 yds.

3. STREAMERS OF BLACK OIL

Two distinct areas of black oil separated by mostly clean water. Lower streamer is breaking up into windrows.

Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
15 - 20%

4. SHEEN SURFACING FROM SUNKEN VESSEL

Patches of gray, rainbow, and dull brown sheens.

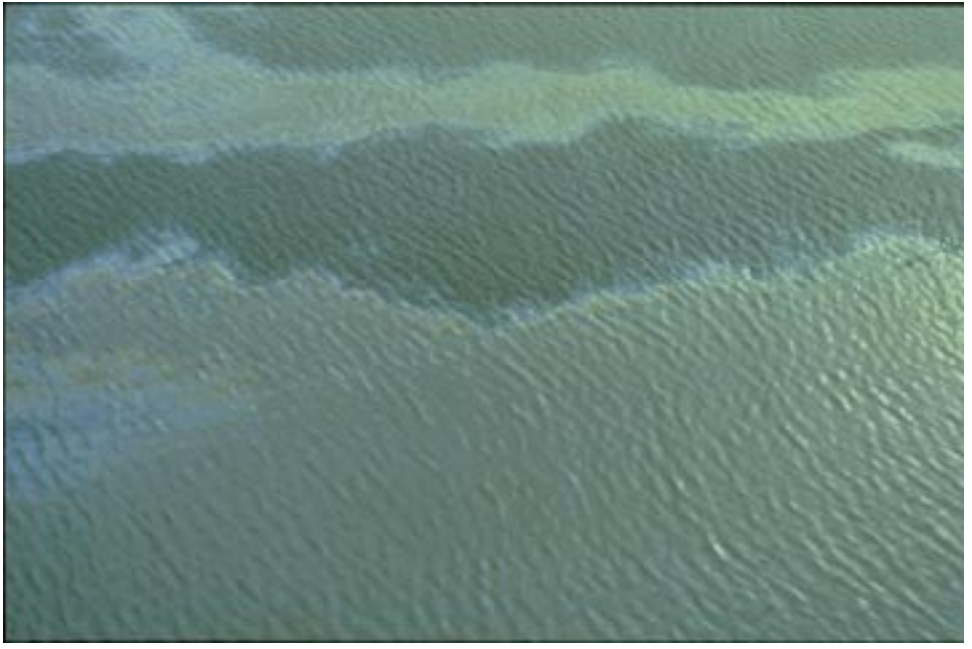
Observation altitude:
50 - 100 ft.

Platform:
Helo

Oil coverage:
60%

5. PATCH OF DULL BROWN SHEEN

Streamer of dull brown sheen at top of picture separated from patch by clean water. Note lighter gray sheen along edges.



Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
60 - 70%

6. FRESH DIESEL SLICK

Dull brown sheens in center fading to rainbow (blue) and gray along the edges.

Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
70%

7. LIGHT RAINBOW SHEEN

Light rainbow and gray sheens. Note very light wind and sea conditions.

Observation altitude:
100 ft.

Platform:
Helo

Oil coverage:
90 - 100%

8. DIESEL SPILL IN MARINA

Oil spreading out into dull brown and gray sheens in and around piers. Very light wind and currents.

Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
50%

9. TRANSPARENT SHEEN

Widely scattered transparent sheen. Very calm conditions.

Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
Cannot estimate from oblique view.

10. WINDROWS OF SILVER AND GRAY SHEEN

Note heavier dull brown sheens with small patches of emulsified oil in center of windrows.

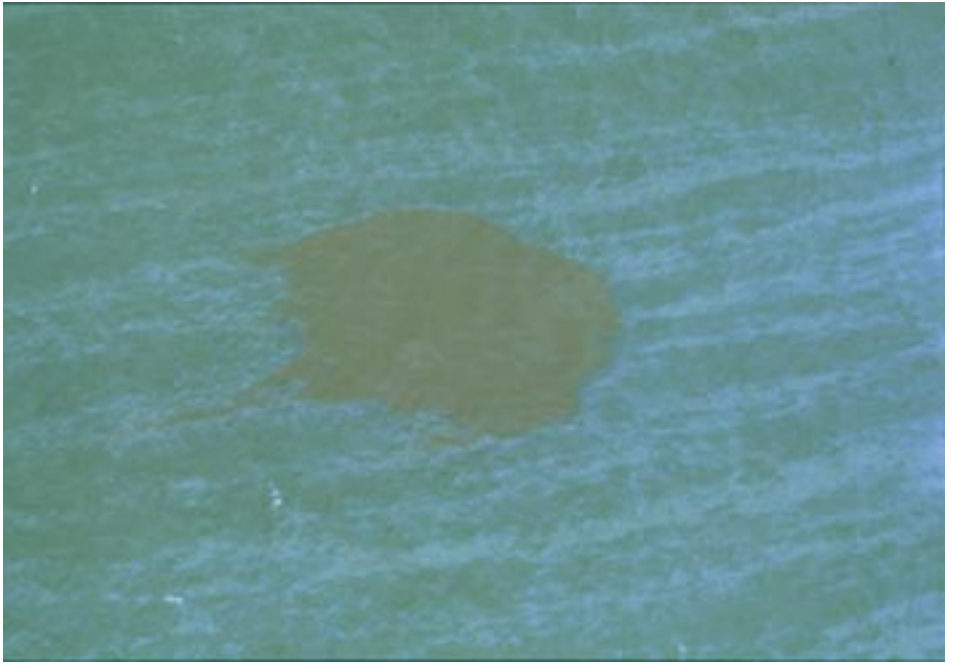
Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
Sheens 50%
Emulsified 1%

11. PANCAKE OF EMULSIFIED OIL

Isolated pancake of emulsified oil surrounded by windrows of gray sheen.



Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
40% total

Pancake 65 ft. in diameter.

12. STREAMER OF BROWN EMULSIFIED OIL

Streamer of brown emulsified oil with silver and gray sheen along edges. Note clear water on either side of streamer.

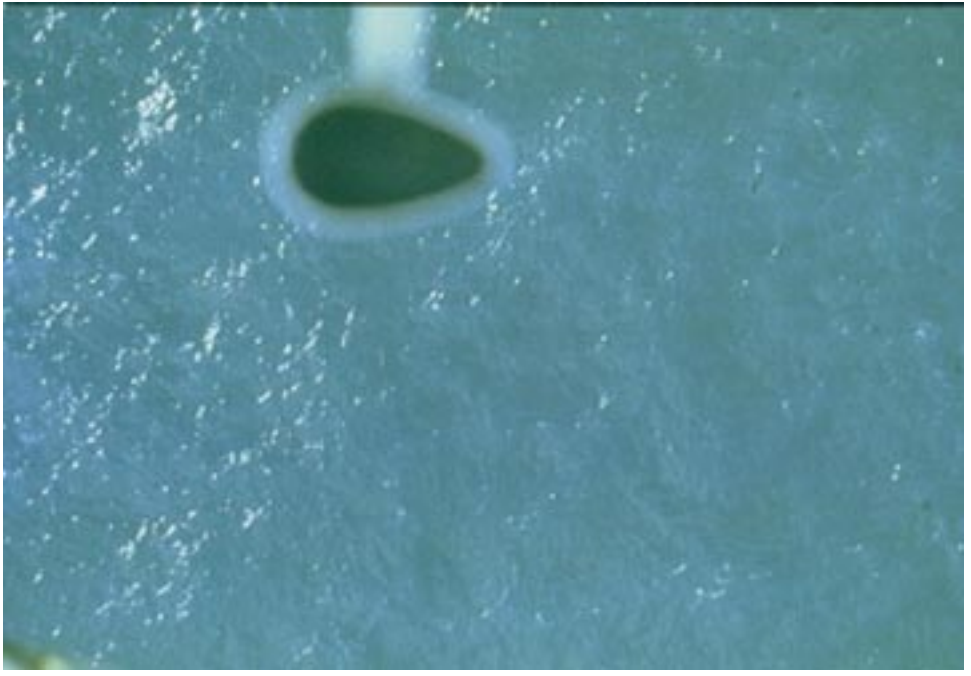
Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
50%

13. TARBALLS VIEWED FROM HELICOPTER

Fist-sized tarballs floating in upper righthand corner are hard to spot in overflight due to altitude and speed normally flown.



Observation altitude:
25 - 50 ft.

Platform:
Helo

Oil coverage:
n/a

14. TARBALLS VIEWED FROM BOAT

Dime to silver dollar-sized tarballs surrounded by dull brown and gray sheen.

Observation altitude:
Surface

Platform:
Boat

Oil coverage:
4 - 6 tarballs/sq. yd.

15. CONVERGENCE LINE

Note apparent sheening off convergence line. Need to take closer look (100 to 200 feet) to determine whether convergence line contains oil.

Observation altitude:
1000 ft.

Platform:
Helo

Total dimension:
Convergence line
1 mi. x 10 - 30 ft.

16. KELP BED

Kelp beds are frequently mistaken for oil. If in doubt, inspect more closely at lower altitude.

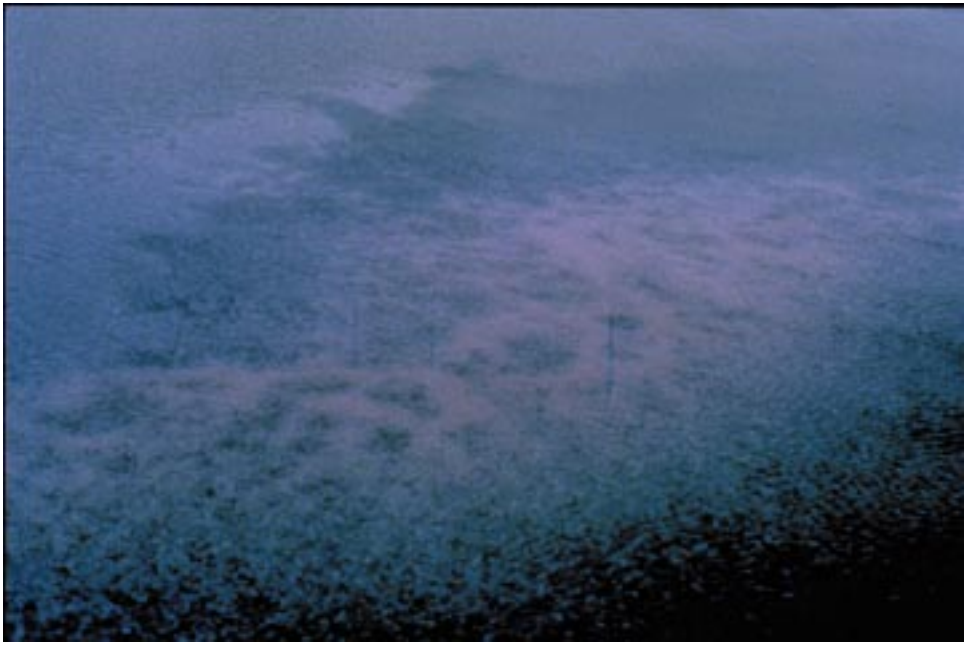
Observation altitude:
800 ft. at very oblique angle.

Platform:
Helo

Oil coverage:
n/a

17. JELLYFISH

Large accumulations of jellyfish (spring/summer) are frequently mistaken for oil
If in doubt, take a closer look.



Observation altitude:
50 ft.

Platform:
Helo

Oil coverage:
n/a

18. RED TIDE

Red tide blooms are sometimes reported as oil.

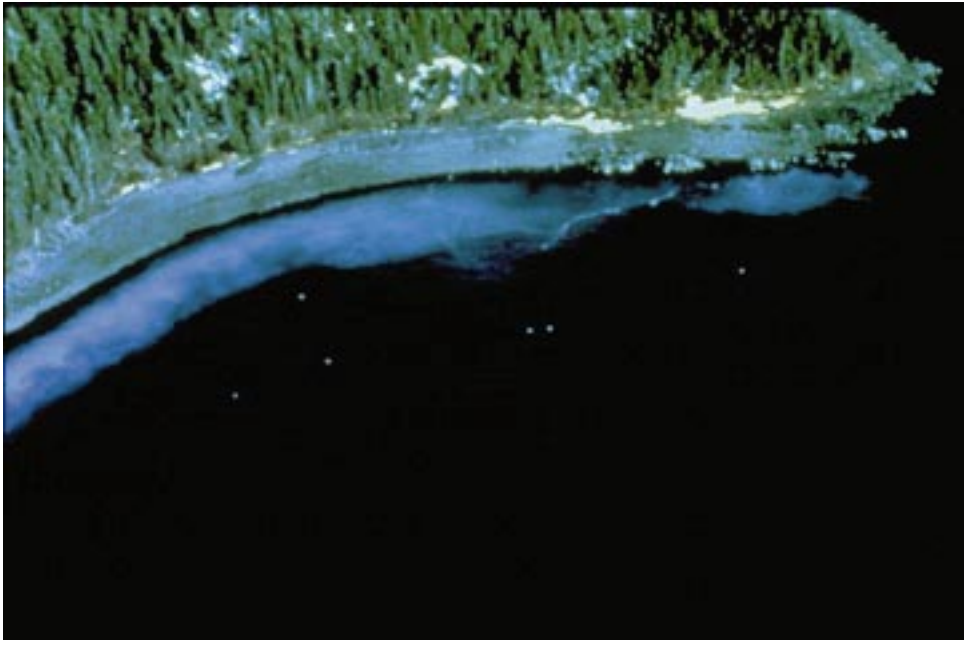
Observation altitude:
1500 ft.

Platform:
Helo

Oil coverage:
n/a

19. HERRING SPAWN

Herring spawn along shoreline can easily be mistaken for silver sheen.



Observation altitude:
1200 ft.

Platform:
Helo

Oil coverage:
n/a

20. EFFECTIVE BOOMING AROUND DRY DOCK

Properly deployed boom containing sheens and loose sorbent pads.

Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
n/a

21. ENTRAINMENT OF GRAY AND DULL BROWN SHEENS

Entrainment of oil under boom deployed in high current.

Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
60%

22. EFFECTIVE CONTAINMENT OF BLACK OIL

Black oil contained between boom and shoreline under very calm wind and current conditions.

Observation altitude:
300 ft.

Platform:
Helo

Oil coverage:
n/a

23. INEFFECTIVE BOOMING OF BLACK OIL

Black oil escaping under boom at point of attachment to shoreline. Note second boom deployed trying to trap escaping oil.

Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
n/a

24. ENHANCED SKIMMING

Boom towed in front of skimmer funneling oil into skimmer. Note how thin silver sheen “passes through” skimming vessel.

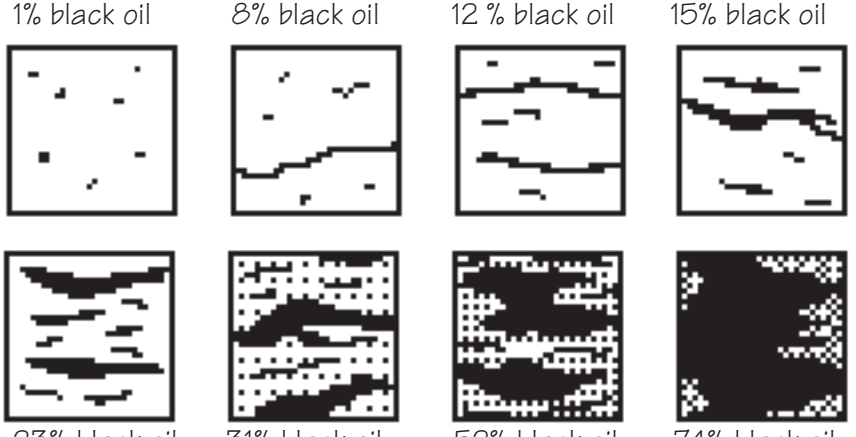
Observation altitude:
500 ft.

Platform:
Helo

Oil coverage:
n/a

PERCENT COVERAGE CHART

This chart is an aid to help you determine the percent of oil coverage in the area you are observing. When determining the coverage of an oil spill on the water, estimate the percentage of clean water and subtract from 100 to calculate the percentage of oil. Try to picture all the oil in one "corner" of the area you are observing and determine the clean water remaining.



OIL SPILL OBSERVATION CHECKLIST

Record information on chartlet of area being observed

General Information

___ Date
___ Time (start/end)
___ Case Name
___ Observers' names
___ Observers' affiliations
___ Location of source (if known)
___ Percent coverage
___ Stage of tide (flood, ebb, slack)
___ On-scene weather (wind, sea state, visibility)
___ Platform (helo, fixed-wing, boat)
___ Flight path/trackline
___ Altitude observations made from
___ Areas not observed (fog, restricted air space, shallow water)

In planning flight path/trackline, go beyond impacted areas to ensure that there is not more oil beyond this area and minimize observations into the sun.

Information filled out by (name/phone number)

OIL SPILL OBSERVATION CHECKLIST

Record information on chartlet of area being observed

Oil Observations

___ Slick location(s)
___ Slick dimension(s)
___ Orientation of slick(s)
___ Distribution of oil (windrows, streamers, pancakes, patches)
___ Color and appearance (rainbow, dull or silver sheen, black, brown, or mousse)
___ Percent coverage (estimate of area with oil. See Percentage Coverage Chart.)
___ Is oil recoverable? (black oil, mousse, heavy sheens - dull or dark colored)

Clearly describe where oil is observed. Also identify where no oil is observed.

OIL SPILL OBSERVATION CHECKLIST

Record information on chartlet of area being observed

Other Observations

Response Operations...

___ Skimmer deployment (General locations. Are skimmers in highest concentration of oil?)

___ Boom deployment (General locations. Does boom contain oil? Is oil entraining under boom?)

___ Source (Status of source. Is oil still being released?)

Environmental Observations...

___ Location of convergence lines, rip tides, sediment plumes

___ Location of kelp beds, seagrass (anything which might trap oil or be mistaken for oil)

___ Wildlife present in area
(give location and approximate numbers of birds and marine mammals)