

# Oil Spill Response – Oil Spill Response Squad



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## ***Recommended for Grades:***

7<sup>th</sup> – 12<sup>th</sup> grades

## ***Alaskan Academic Standards***

English/Language Arts D1,2,4 Science D 1, 2, 3,4,5,6

## ***Nutshell***

Students will engage in a role-playing exercise to learn how organizations and individuals work together to respond effectively to an oil spill.

## ***Concepts***

- A number of organizations – local, state and federal – would be involved in any oil spill response.
- Different organizations and individuals take on different roles in a containment and/or clean-up effort.
- Groups working together need to share information and resources to effectively clean up an oil spill.
- Many factors (weather, oil type, proximity to land and resources, etc...) must be taken into consideration during an oil spill clean-up.

## ***Objectives***

Students will be able to:

- Name federal, state and local organizations that would be involved during oil spill monitoring, containment and clean-up operations.
- Work with other students to determine what each agency or person has to offer the group.

## ***Materials needed***

- Name Tags for Roles
- Table top easel pads for group notes
- Oil Spill Scenario Packet (attached at end of this document) prepared for each group

## ***Activity: Students will work together to:***

1. assess the current situation
2. identify immediate objectives (think before you act)
3. develop safe, practical strategies to meet spill containment & cleanup objectives while considering the effects on the local environment, animals and human residence in the area
4. select methods most appropriate to available resources and strategies

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5. establish a chain of command to carry out the objectives
6. once method is employed evaluate effectiveness

## ***Lesson Outline***

**5 min.** Divide students into groups of 6 and explain that this will be a role playing exercise. Each group will receive the oil spill scenario description. In addition, each individual will receive his/her role and in some cases may want to share only limited information with the group. They must work together to determine the best course of action for this spill.

### **5-7 min.**

Hand out the roles, oil spill scenario, and Oil Types chart. Have one student in each group distribute the role cards to all of the group members, and once the scenario is read aloud let students begin to determine what they should do to respond to the spill.

### **3-5 min.**

Hand out possible course of action for first scenario and give groups time to rethink their first ideas.

### **10 min.**

Call the groups together to see who was able to plot a course of action. Discuss progress so far being careful not to tell them what's coming.

### **5-7 min.**

Hand out Updated Oil Spill Scenario to each group.

### **3-5 min.**

Hand out possible course of action for the second scenario and give groups time to rethink their first ideas.

### **15 min.**

Have students share the course of action that their group took.

### **5 min.**

Wrap-up and conclusion

## ***Wrap up and Conclusion***

Ask students a few questions to see what they learned during the lesson.

1. Who in your group took on a lead role in directing the courses of action? Do you think this would be how a real response team would interact?
2. What were the big decisions your group needed to make? (ex. How to clean up before oil struck the shoreline, when/whether to remove captain and crew, how/if

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- to stop boat drift, which areas should get protection by boom first- or should/could boom be deployed around the spill to minimize oil getting to land).
3. What other roles do you think might be involved in a real oil spill?

## **Background**

Any good oil spill response operation involves the teamwork and knowledge of a number of agencies and individuals.

Appropriate and effective strategies must be put into play in order to contain and recover the spilled oil in a timely manner. These strategies must factor in safety, practicality, oil viscosity and volatility, environmental conditions such as wind speed and wave height, and the presence of any ice cover.

The objectives of the response team or squad are to limit the spread of the oil, to minimize the impact of a spill, and to facilitate natural recovery of the animals and habitat affected by the spill. An assessment of the benefits and consequences of any strategy must be weighted. Activities that cause additional damage, such as blasting oil off rocks with scalding water, or driving equipment into a spill site across a pristine tundra environment, should be carefully assessed to determine if the benefits outweigh the additional stress to the environment.

Finally, economic concerns should be evaluated - both the cost of an oil spill cleanup, and the potential loss of subsistence and income-generating resources to communities adjacent to the spill.

When oil spills from a tanker, its behavior and impact can depend on several factors, including the proximity of the spill to shore, tides and currents, weather conditions, and the type of fuel spilled. Understanding how these variables influence a spill allows scientists to develop dispersion models that can help them prepare appropriate response strategies.

If a spill occurs in the open ocean, little can be done to contain and remove the spilled oil. Getting cleanup crews and equipment to the spill site is logistically challenging. Left alone, all but the thickest grades of oil will evaporate. What doesn't evaporate will generally coalesce and sink to the sea floor, where it may remain in the sediment for years.

In near-shore environments, tides and currents have a major impact on the behavior of a spill. Oil tends to float on the denser seawater, and it behaves much like a wooden raft: it is carried in and out with the tides and is moved laterally along a coastline by currents. Weather conditions, especially temperature and wind, also affect spill behavior. Cold

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weather tends to slow evaporation, whereas wind influences the speed and direction of a moving surface slick.

## ***Resources***

### Oil Spills

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

<http://www.evostc.state.ak.us/>

<http://www.epa.gov/oilspill/>

Web address for time sequence on Exxon spill:

<http://library.thinkquest.org/10867/cleanup/timeline.shtml>

### On Oil Tankers

[http://www.oceansatlas.org/unatlas/uses/transportation\\_telecomm/maritime\\_trans/shipworld/tanker\\_pas/oil/oil.htm](http://www.oceansatlas.org/unatlas/uses/transportation_telecomm/maritime_trans/shipworld/tanker_pas/oil/oil.htm)

# Oil Spill Scenario Packet

## Teacher's Instructions

### Preparation for the Role Play Exercise:

Prepare one packet for each group as follows:

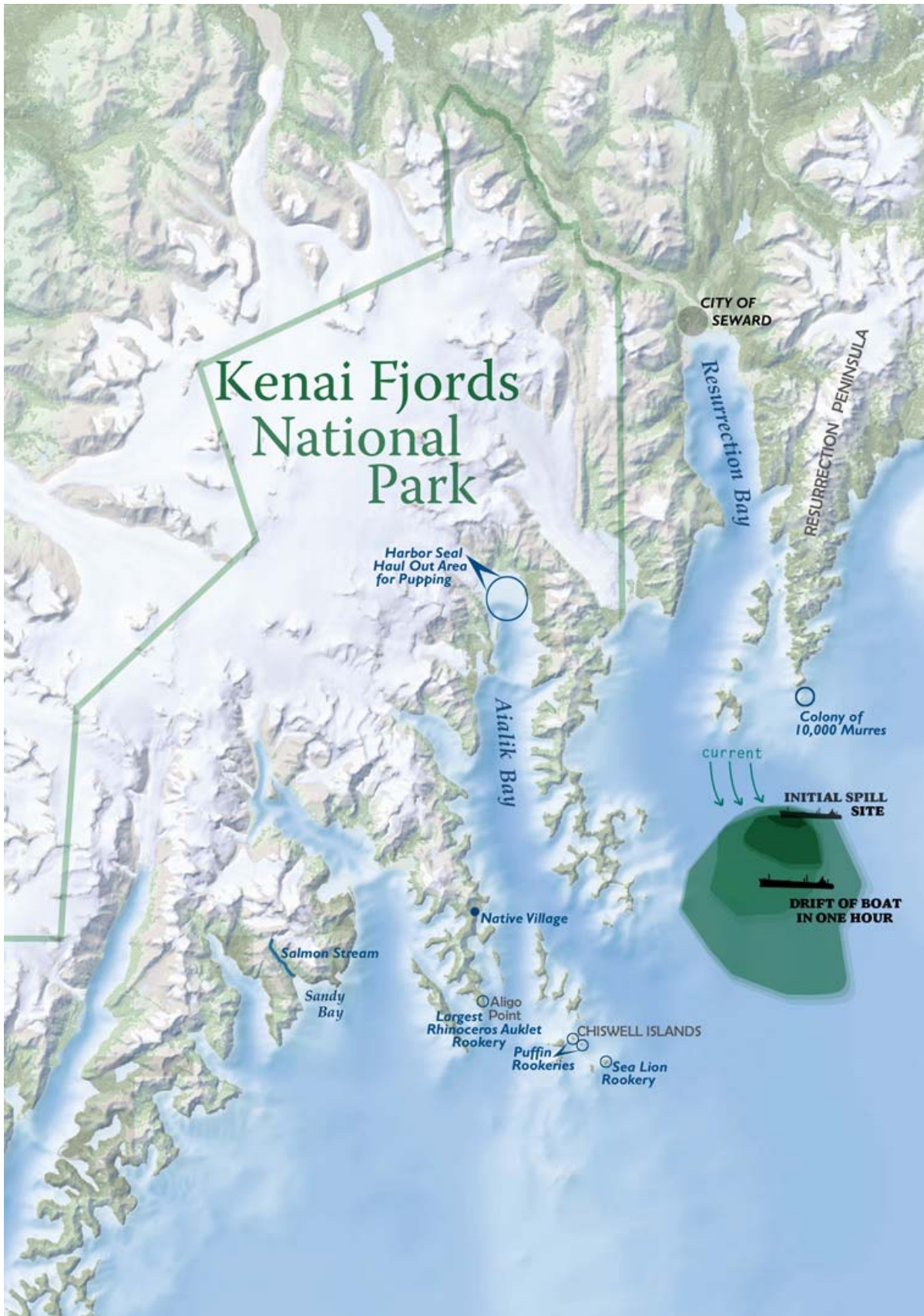
- Print pages 2-11 of this packet (note that pages 2 & 3 can be printed double sided to conserve paper – the oil spill scenario map and oil types chart will be back to back – but the remaining pages must be printed single-sided so they can be handed out individually)
- Cut along lines as indicated to separate student roles and scenario information. You will want to keep all of the “updated scenario” cards separate to be handed out mid-way through the exercise.
- Begin the exercise with the reading of the initial scenario. Remind students that they also have the oil types information chart for reference.
- After the scenario is read aloud, each group member will receive a description of his/her role in the scenario, then a few minutes into the exercise each student receives information about possible courses of action.
- After the students have had a while to discuss their options for spill response, have them discuss their responses with the class. Then hand out the updated spill scenario, and a few minutes later hand out the updated possible actions for each group member. Allow students to discuss the new information as they see fit.
- Finish the exercise with a presentation by each group to the class, describing how the group members interacted during the exercise and what actions the group decided to take. Have all groups discuss the pros & cons of the other groups' decisions.

### Final Thoughts:

The urgency in group discussions will hopefully change between the first and second scenario, as the updated scenario predicts only a 24-hour window of response time before weather complicates the spill.

The hope for this exercise is not to come to specific conclusions but to generate a discussion that helps students think about all that is involved in an oil spill and its clean up.

# Oil Spill Scenario Map



# Oil Types

## **Type 1: Very Light Oils (Jet Fuels, Gasoline)**

- Highly volatile (should evaporate within 1-2 days).
- High concentrations of toxic (soluble) compounds.
- Localized, severe impacts to water column and intertidal resources.
- No cleanup possible.

## **Type 2: Light Oils (Diesel, No. 2 Fuel Oil, Light Crudes)**

- Moderately volatile; will leave residue (up to one-third of spill amount) after a few days.
- Moderate concentrations of toxic (soluble) compounds.
- Will "oil" intertidal resources with long-term contamination potential.
- Cleanup can be very effective.

## **Type 3: Medium Oils (Most Crude Oils)**

- About one-third will evaporate within 24 hours.
- Oil contamination of intertidal areas can be severe and long-term.
- Oil impacts to waterfowl and fur-bearing mammals can be severe.
- Cleanup most effective if conducted quickly.

## **Type 4: Heavy Oils (Heavy Crude Oils, No. 6 Fuel Oil, Bunker C)**

- Heavy oils with little or no evaporation or dissolution.
- Heavy contamination of intertidal areas likely.
- Severe impacts to waterfowl and fur-bearing mammals (coating and ingestion).
- Long-term contamination of sediments possible.
- Weathers very slowly.
- Shoreline cleanup difficult under all conditions.

## Oil Spill Scenario

At 11:45 am on May 15<sup>th</sup> a call comes into the US Coast Guard that the Tanker “Crisco” has collided with an unidentified marine hazard about 6 miles South of Cape Resurrection. Several of the boat’s engines have been compromised in the accident but one engine is still working intermittently. With this engine the boat is able to reduce its drift but not completely stop it.

The vessel contains a medium crude oil in twelve separate compartments. The total amount of fuel is thought to be 8,000,000 gallons. At least one of the compartments has been ruptured. The captain estimates 600,000 gallons have been lost so far and oil is continuing to flow.

The seas are 1-2 feet coming from the Southeast. Winds are variable 5 knots, air temperature is 50 degrees and visibility is unrestricted.

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## Updated Oil Spill Scenario

At 12:45 pm you learn that the boat has drifted 3 miles to the south and is still leaking oil. The Captain now estimates that 1,200,000 gallons have been lost. The forecast for tomorrow is for winds out of the Southeast increasing to 20 knots and seas of 6 feet. There is an 80% chance of precipitation for tomorrow as well.

There are 15 crew members aboard the ship. If the boat continues its present drift it will not run aground until the weather shifts but the captain feels that it will be riskier for all concerned if the boat drifts farther out into the Gulf of Alaska.

## **Role: You are the Lieutenant Commander of the local area Coast Guard**

The United States Coast Guard is the nation's primary maritime operating agency. We protect life and property at sea, enforce federal laws and treaties, preserve marine natural resources, and promote national security interests. The Coast Guard hallmark is quality service to the public.

The Coast Guard carries out that mission statement in the performance of four main roles: maritime safety, maritime law enforcement, marine environmental protection, and national defense.

With a catastrophe at sea such as an oil spill the coast guard will take on the role of “incident commander” handling communications and issuing jobs.

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### **Lieutenant Commander of local area Coast Guard – Possible courses of action**

**Which actions would you take and in what order?**

- 1) Send a helicopter out to assess the spill
- 2) Rescue the Captain and Crew of the ship
- 3) Begin notifying agencies that you would want to coordinate with
- 4) Call the press to be sure people are alerted to the crisis
- 5) Communicate with the captain to obtain more information about the boat, oil, safety of the situation for human life.
- 6) Start an incident command sheet \_
- 7) Contact people who might be able to tell you about local concerns: wildlife patterns and seasons, fish streams, villages and towns.
- 8) Weigh your options for clean up, is it volatile? Should you burn it off? Are conditions right for Dispersants? Containment?

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### **Lieutenant Commander of local area Coast Guard – Updated Scenario**

**Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Find containment boom
- 2) Find dispersants
- 3) Rescue Captain and Crew
- 4) Send a tug or other boat out to stop the tanker from drifting further
- 5) Locate and deploy skimmers
- 6) Send containment boom out to surround the current spill

## **Role: You are a National Oceanic and Atmospheric Administration (NOAA) Biologist**

You are a biologist with NOAA's Ocean Service Office of Response and Restoration. You have helicopter over flight capabilities and software that can predict the oil spill's trajectory if you know the size of the spill, viscosity of the oil, local currents and sea conditions.

NOAA Mission Statement - To understand and predict changes in Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs.

### **Biological Factors:**

- \* Sea otters which are highly vulnerable to oil because they need clean fur to protect them from cold northern waters.
- \* Immature salmon which are beginning to enter the ocean and feed on oil sensitive plankton.
- \* Spawning herring which are moving toward beaches where oil could smother and kill their eggs.

A dispersant could help protect the otters and sea birds highly vulnerable to floating crude, but it could harm the juvenile salmon just beginning to enter the Sound from surrounding streams, and the herring headed for spawning grounds.

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### **NOAA Biologist – Possible courses of action**

#### **Which actions would you take and in what order?**

- 1) Talk with the Park Superintendent to determine which species are at risk.
- 2) Grant an interview to the Associated Press.
- 3) Weigh your options for clean up, is it volatile? Should you burn it off? Are conditions right for Dispersants? Containment?
- 4) Contact the Coast Guard to see what is known about the spill.
- 5) Work with the Coast Guard to make best use of resources.
- 6) Contact Marine Mammal Labs division of NOAA to determine populations and seasonal movements of local marine mammals.

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## NOAA Biologist – Updated Scenario

**Additional information you alone have with updated scenario:** You have calculated the trajectory of the oil and the drift of the tanker. If the winds pick up and become SE the tanker will likely come aground somewhere on the Kenai Peninsula. If the ship does run aground the spill could get much worse especially if the 2<sup>nd</sup> tank were to rupture. You have access to “Environmental sensitivity indexes” which tell you that this area is extremely sensitive at this time of year with Rhinoceros Auklets just returning to the largest colony they have in the Gulf region. There are also puffin and sea lion rookeries beginning to be active, a salmon stream, and harbor seals hauling out for pupping.

**Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Alert the local Alaska SeaLife Center that they should begin preparations for receiving oiled marine mammals and seabirds.
- 2) Contact sources that may have absorbent boom available. Contact the Coast Guard with trajectory and environmental sensitivity index information.
- 3) Talk to the Park Superintendent about species at risk in the park.

**Role: You are a local fisherman & Native subsistence user living near Seward**

Your village is located just 16 miles southwest of the spill. You live in and use the area potentially impacted by the spill for subsistence hunting and fishing. You have had bad experiences in the past with big oil companies who have never paid their debts. You are worried that some of the salmon streams as well as a harbor seal hunting area may be negatively impacted by the spill. You have been paying \$6/ gallon for gas this past year and are frustrated with oil companies.

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**Local fisherman/Native subsistence user – Possible courses of action  
Which actions would you take and in what order?**

- 1) Share your knowledge of local resources with people that are managing the spill response.
- 2) Grant an interview to the associated press.
- 3) Take your boat out to investigate the spill for yourself.
- 4) Pay close attention to the Coast Guard Lieutenant Commander to see if they are aware of your interests.

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**Local fisherman/Native subsistence user – Updated Scenario**

**Additional information you alone have with updated scenario:** Your village has 300 yards of boom and two barges that could be used in the spill containment and clean up efforts. You are worried that the interests of your village may not be represented if you just donate the equipment to the cause and you are considering whether you want to use the boom to protect the Harbor Seal haul out and/or your village beach.

**Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Offer your boom and barges to the Coast Guard for cleanup efforts.
- 2) Check in with the Coast Guard to see if they are aware of the salmon and seal areas.
- 3) Ask the Coast Guard what plans there are in place for protecting your village site.
- 4) Talk to the press about your concerns.
- 5) Take your own boom and put it in the places you want to protect.

## **Role: You are the superintendent of the local park service**

You are aware that this spill could potentially impact many of the park's wildlife resources. You have a staff of 35 year-round employees and about 45 new seasonal employees that have just returned for their summer jobs. You have three small boats and one medium-sized boat.

During the 1989 Exxon Valdez Spill your park faced a similar crisis and was able to avert damage within the park by management actions. You are hoping for this sort of outcome.

The mission of the U.S. National Park Service (NPS) is to conserve the scenery, the natural and historic objects, and the wildlife in United States' national parks, and to provide for the public's enjoyment of these features in a manner that will leave them unimpaired for the enjoyment of future generations.

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### **Superintendent of the local park service – Possible courses of action**

#### **Which actions would you take and in what order?**

- 1) Offer staff and boats to the clean-up efforts.
- 2) Consult with your resource management team to find out which species are the most vulnerable at this time of year and where the vulnerable species would be.
- 3) Try to ensure protection of beaches within the park, using booms or other methods.
- 4) Grant an interview to the associated press.

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### **Superintendent of the local park service – Updated Scenario**

**Additional information you alone have with updated scenario:** You have been alerted that there are 1000 yards of boom at the local, Alaska SeaLife Center in Seward.

#### **Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Send Staff out in the Park boat to keep an eye on things.
- 2) Send staff to the SeaLife Center to see if they will need help handling injured wildlife.
- 3) Meet with the Coast Guard Lieutenant Commander and discuss options.

**Role: You are an Associated Press reporter who has been sent to Alaska to get the news**

You are new to Alaska and uncertain where to start your news gathering efforts. You are a relative new comer to your job and this story could affect your entire future career.

The mission of your organization is that the associated press believes firmly in fair and objective news reporting.

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**Associated Press reporter – Possible courses of action**

**Which actions would you take and in what order?**

- 1) You head to the Coast Guard headquarters to try to get an interview with the incident commander.
- 2) You go to the Alaska SeaLife Center to get interviews at a facility designed to care for marine mammals and birds that might be impacted by this spill.
- 3) You talk with the local community to see what they know about the spill so far.
- 4) You call the CEO of the tanker's company to see if he will grant an interview.
- 5) You look into the record of the tanker captain.

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**Associated Press reporter – Updated Scenario**

**Additional information you alone have with updated scenario:** Your headquarters has hired a local pilot to fly you out over the spill for photographs.

**Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Talk with the Coast Guard before you fly to let them know you are going out and ask if you can assist by taking up to two passengers with you.
- 2) Ask the Native Subsistence user to come with you and point out areas of concern.
- 3) Tell no one, just go on the helicopter yourself and get the best pictures you can of the spill.

**Role: You are the CEO of “Sea Slick Shipping,” the company that owns the tanker Crisco**

Your company owns and operates 5 tankers carrying oil out of Alaska. You have had a clean record with regards to spills up to this time.

You have just learned about the accident and are prioritizing your moves.

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**CEO of “Sea Slick Shipping” – Possible courses of action**

**Which actions would you take and in what order?**

- 1) Make radio contact with the captain of the ship.
- 2) Offer unlimited help with the spill clean-up, whether it be people, money or boats let them know you have all of them and are willing to help in any way you can.
- 3) See to the safety of the captain and crew who are onboard the ship.
- 4) Issue a statement to the Associated Press

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**CEO of “Sea Slick Shipping” – Updated Scenario**

**Additional information you alone have with updated scenario:** You have just learned that the Bank that is your major creditor is concerned about financing a company that has just had an oil spill and wants to stop any advances of credit to Sea Slick Shipping. This would be a big blow to your company and reduce production.

**Possible courses of action for updated scenario: which actions would you take and in what order?**

- 1) Call the Bank and let them know you plan to do everything you can to clean up this spill before it becomes a problem, they shouldn't worry.
- 2) Get on a helicopter and fly out to the ship to be certain the Captain was not drinking.
- 3) Go to the Lieutenant Commander and offer to be of any assistance you can be in the headquarters of the clean up operation, this for appearances sake but also to learn of any new turns in the spill before they leak to the press.