

# EMERGENCY RESPONSE PLANNING EXERCISES FOR OIL SPILLS CAUSED BY NATURAL HAZARDS

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## ABSTRACT

*Emergency response exercises are designed to evaluate the operational readiness of responders to act consistently with plans, policies, and procedures. The design and execution of an exercise includes scenario development, exercise control and simulation, documentation, critiques, and after-action reports. Representatives of government agencies and private parties participate in exercises intended to ensure the successful implementation of oil spill response plans and contingency plans.*

*Exercise scenarios for oil spills associated with a natural hazard highlight unique problems, because natural hazards can cause spills in a number of different ways. For example, earthquakes, landslides, lightning strikes, tornados, hurricanes and other storms can affect vessels, pipelines, drilling platforms, and storage tanks. In addition, the cause of many large spills from vessels is often reported as "grounding" or "collision," but frequently a contributing cause of these accidents is severe weather.*

*This paper discusses the exercise objectives and special considerations for responding to oil spills caused by different types of natural hazards. Natural hazards present emergency planners with a variety of warning times, from little or no warning to days and weeks. Natural hazards have the potential to cause spills over a wide area, so coordination among several jurisdictions is particularly important. Some discharges may be even greater than an expected "worst case" spill, because an earthquake or flood can rupture multiple tanks and damage secondary containment structures. In addition, the conditions created by natural hazards can delay and hinder response efforts.*

## INTRODUCTION

Emergency management is based on a circular process through which emergency managers prepare for emergencies, respond to them when they occur, help people and organizations recover from them and mitigate their effects, and prevent future emergencies from occurring. Although natural hazards are usually uncontrollable and only moderately predictable, effective measures can be undertaken to prepare for such emergencies. Exercises play a critical role in this preparation for oil spills caused by future natural hazards.

Exercises are an instrument to train for and practice prevention, vulnerability reduction, response, and recovery capabilities in a risk-free environment. They also can be used to assess and improve performance. Strengths and weaknesses from exercise play or discussion are collected in an After Action Report, where areas for improvement are noted. As a result, many aspects of natural hazard response can be strengthened, including

communication issues, ineffective emergency response plans, and evacuation issues.

Owners and operators of vessels or facilities with response plans required by the Oil Pollution Act of 1990 may have participated in exercises under the National Preparedness for Response Exercise Program (PREP), developed by the U.S. Coast Guard and other agencies to address exercise needs for oil pollution response. In recent years, many State and local governments have implemented exercise and evaluation programs to assess domestic preparedness through the Homeland Security Exercise and Evaluation Program (HSEEP). Although the focus of an HSEEP exercise is often the response to a simulated terrorist threat, the range of exercise activities of varying degrees of complexity and interaction in HSEEP is also appropriate for responses to major oil spills caused by natural hazards.

## TYPES OF EXERCISES

Seminars, Workshops, Tabletops, Drills, Games, and Functional and Full-scale exercises shown in Figure 1 vary in their respective complexities, amount of planning and training needed, and overall costs.

- **Seminars** are primarily informational in nature. Their main goal is to provide a starting point for jurisdictions to understand relevant issues regarding plans and procedures to be updated and tested.
- **Workshops** differ from seminars in their main goal: attendees are often broken into working groups to focus primarily on the development of a product. Typically workshops have been effective at designing standard operating procedures, mutual aid agreements, and various exercise plans.
- **Tabletop** exercises allow for the discussion of simulated situations between senior staff and other key decision making personnel. Exercise play revolves around an exercise controller (moderator) who will introduce problems one at a time in the form of messages or "injects." Participants then discuss the issues related to the problem using existing plans and procedures, thereby testing their response capabilities.
- **Drills** are coordinated, supervised activities usually employed to test a single specific type of operation or function in a single agency.
- **Games** simulate operations that often involve teams, usually in a competitive environment, using rules, data, and procedures designed to depict an actual or assumed real-life situation.
- **Functional exercises** are designed to test and evaluate individual capabilities, multiple functions or activities

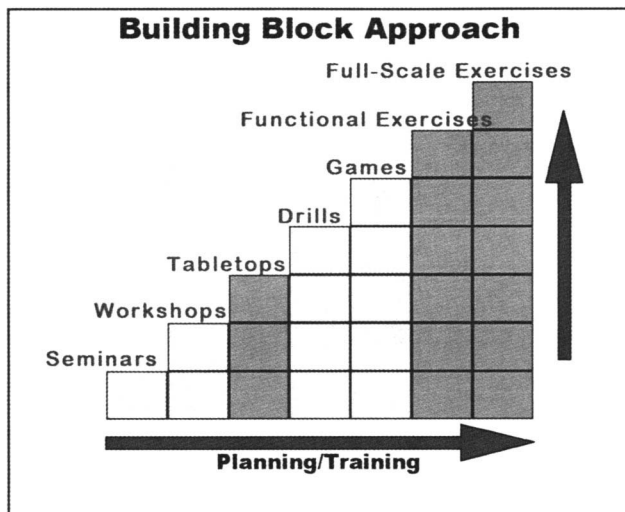


FIGURE 1: EXERCISE TYPES AS PART OF A MULTI-YEAR PROGRAM

Source: Homeland Security Exercise Evaluation Program (Department of Homeland Security)

within a function, or interdependent groups of functions. Functional exercises are led through simulated message injects, which will lead exercise players into situations where critical decisions regarding plans and procedures will be made and possible improvements discovered.

- **Full-scale exercises** are the most expensive, complex, and training- and planning-intensive exercises. Their primary goal is to test the actual mobilization and movement of personnel and resources in the real world, through simulated exercise scenario events. These exercises test a major portion of operation plans and organizations under field conditions.

Injects are simulated messages delivered by email, phone, fax, or in person communications that response agencies (911 call center, Emergency Operations Center, Local Emergency Planning Committee) might receive in the event of an emergency. Each individual inject relays a simulated real-world situation that would appropriately test the exercise objectives and lead to the respective anticipated response by the responsible agency. For example, an inject stating that a fire had started at an oil storage tank should push the local fire department and HAZMAT team to respond to this emergency, the fire house to extinguish the fire and the HAZMAT team to address the threat posed by burning oil, as their plans and procedures would state.

### EXERCISE PARTICIPANTS

A variety of individuals comprise an exercise team. Four major types of exercise participants are controllers, evaluators, simulators, and players.

- **Controllers** are responsible for ensuring that exercise activities progress as planned and coordinate overall exercise flow and safety. They confirm that message injects are delivered on time, ensure appropriate responses to these messages are received promptly, and gauge the overall pace of the exercise. If needed, controllers can speed up or slow down exercise play by removing or adding exercise messages and actions.

- **Players** are those individuals who would likely fulfill the response duties required in these exercises. They possess expertise in their respective practice areas, and their reactions to message injects and scenario events can provide important information regarding strengths, weaknesses and pertinent issues in operational guidelines and plans.
- **Evaluators** closely monitor player action and provide an unbiased lens for judging the events of the exercise. Through detailed observation and note-taking, they note every action taken by players, and also note important actions overlooked during exercise play. After exercise play, evaluators determine which activities had been performed correctly according to local procedures, and where improvements are needed in plans and procedures. These conclusions reached by evaluators can provide a great deal of information on weaknesses not recognized during typical daily operations.
- **Simulators'** main function are to act as federal, state, local and independent agencies during exercise play in order to relay appropriate message injects to exercise players for play. For example, a simulator may act as the Environmental Protection Agency to inject a particular message to an exercise player regarding drinking water contamination. Simulators thus add a base of substantial subject matter expertise and realism to the exercise.

### LESSONS FROM PREP EXERCISES

A study by Epler and Hunt (1999) compiled lessons learned from PREP exercises conducted by the U.S. Department of Transportation's Office of Pipeline Safety. These exercises use a tabletop format with a worst-case spill scenario to evaluate pipeline industry preparedness. One of the findings of several exercises was that the pipeline company's spill management team should include Unified Command procedures to include Federal, State, and local representatives to help resolve response issues with government officials. Another major lesson was that potential command posts and equipment staging must be identified in advance. In addition, drills and training are needed to provide for the identification of other localities and other pipeline operators that may be impacted. These lessons are particularly relevant for spills related to natural disasters, which may affect several jurisdictions over a wide area.

### EXAMPLES OF OIL SPILLS CAUSED BY NATURAL HAZARDS

Every year, oil spills are caused by natural hazards. The Oil Spill Intelligence Report (Cutter Information Corp. 2004) has published an annual report of major oil spills—those of 10,000 gallons or more—from around the world. The latest summary, with spills from 1999, shows several incidents with a cause attributed to natural hazards, as listed in Figure 2. Of the spills in the United States, only four were caused by natural hazards, and these were all lightning strikes. The Cutter summary of each spill, however, generally describes the cause of these U.S. spills by just a word or phrase, and a more detailed analysis would show that many spills attributed to collision, grounding, derailment, or traffic accident actually had a natural hazard component. For example, the cause of the February 1999 *New Carissa* spill was listed in the Cutter summary as "grounding on beach," but neglects to mention that rough seas were a contributing factor. For a few spills, the summary does indicate that the spill response was hindered by adverse weather.

More recently, an earthquake struck Washington State in 2001 and ruptured piping at a tank farm for gasoline and fuel oil on Seattle's Harbor Island. A tornado in Indiana in 2002 caused 15 oil spills when it damaged oil-filled electrical equipment in the

Date	Location	Spill Cause
May 13	Peru	Landslide during torrential rain crushed pipeline
May 30	Ecuador	Structural damage to pipeline during landslide
July 22	Philippines	Strong winds and heavy seas swamped barge
August 17	Turkey	Devastating earthquake damaged refinery
September 24	Japan	Freighter was grounded to escape Typhoon Bart
December 12	France	Tanker <i>Erika</i> broke in two during fierce storm
December 20	Turkey	Tanker broke apart during a storm while at anchor

FIGURE 2: MAJOR INTERNATIONAL OIL SPILLS CAUSED BY NATURAL HAZARDS IN 1999

Source: DeCola, E., 2000, International Oil Spill Statistics:1999, Cutter Information Corp.

town's electrical distribution system. That same year, Hurricane Lili damaged several drilling platforms and exploration rigs off the Louisiana coast. In 2003, Hurricane Isabel's high winds and storm surge dislodged home heating oil tanks at hundreds of properties in Maryland, spilling thousands of gallons of oil. Landslides in Ecuador in March 2004 broke a pipeline running from the Amazon jungle to a Pacific port, causing a large discharge of oil.

The 2004 hurricane season brought an atypical number of serious storms to the southeastern United States. Aside from expected damage to homes and businesses, the oil industry also experienced losses. For example, the recent hurricanes heavily saturated and flooded some areas of North Carolina. As a result, hundreds of chemical containers, including oil drums, were swept into the Pigeon and Swannanoa rivers. Almost 20,000 gallons of diesel oil were contained and prevented from polluting the Swannanoa. The Environmental Protection Agency typically assists State and local authorities with response to oil spills during a severe storm; EPA also receives additional support from the U.S. Coast Guard in coastal regions.

Hurricane Ivan (Figure 3) hit the Gulf Coast in September 2004 and demonstrated the impacts a natural disaster can have on the entire oil and natural gas sector of the economy. Ivan, which reached Category 5 magnitude before weakening in the Gulf prior to U.S. landfall, caused major disruptions to the oil infrastructure in Louisiana. Nearly 30 percent of the nation's energy supply travels through the state, and the storm caused numerous pipeline ruptures and significant damage to offshore oil rigs. As a result of the storm, at least four oil spills originated from the damaged pipeline system; a Shell oil pipeline discharged over 200,000 gallons of oil, and numerous other small spills resulted from cracked pipelines across the Mississippi delta. In addition to the environmental damage caused by oil slicks, the economic repercussions of the storm were felt by the country as a whole. Domestic oil production decreased by as much as 3 million barrels per week, and oil prices rose to historic highs.

#### UNIQUE PROBLEMS AND SPECIAL CONSIDERATIONS

*Advance warning.* As demonstrated by images of hurricane tracking and forecasting, we sometimes have advance warning of a

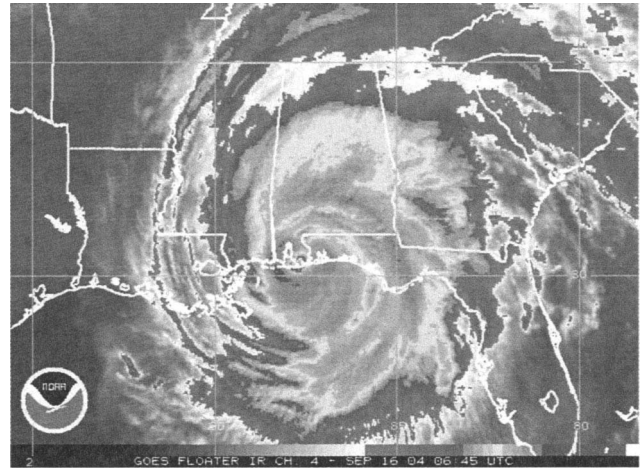


FIGURE 3: HURRICANE IVAN

Source: NOAA satellite image taken September 16, 2004

natural hazard that may strike vulnerable oil facilities. An exercise can simulate the flow of forecast information and monitor the decision-making for evacuation orders and other preparedness steps. Other types of natural hazards may present little or no advance warning, as illustrated in Figure 4.

*Geographic scope.* Natural hazards have the potential to cause spills over a wide area. For example, the same earthquake, flood, or tornado can affect several counties. As we saw in the fall of 2004, a hurricane can move through several States. Coordination among several State and local jurisdictions is particularly important, and representatives from those jurisdictions should participate in planning.

*Spill size.* Some discharges may be even greater than an expected "worst-case" spill. For onshore storage facilities having tanks with secondary containment, the regulatory calculation of a worst-case discharge includes the capacity of the largest single tank. In an earthquake, tornado, or flood, however, the event can rupture multiple tanks and damage secondary containment structures at more than one facility. The available response resources that a facility has planned for may be inadequate to handle facility's spill or may be unavailable if those resources are needed at another spill site.

*Adverse response conditions.* The conditions created by natural hazards can delay and hinder response efforts. Spill responders may have difficulty reaching the spill site because of weather conditions or damaged roads. When emergency workers must respond to life-threatening situations or try to restore power, communications, and other infrastructure, response to an oil spill may have a lower priority.

#### CONCLUSIONS

Many different groups and individuals would benefit from natural hazards exercises. First, those involved in exercise play would gain the experience of a simulated response to an exercise event. Through this process, plans and procedures can be tested and validated, gaps in resources can be identified, individual performance can be improved, and participants can receive useful training in their respective functional areas.

Communities as a whole would also benefit from exercises. Jurisdictions can gain an objective assessment of their capacity to

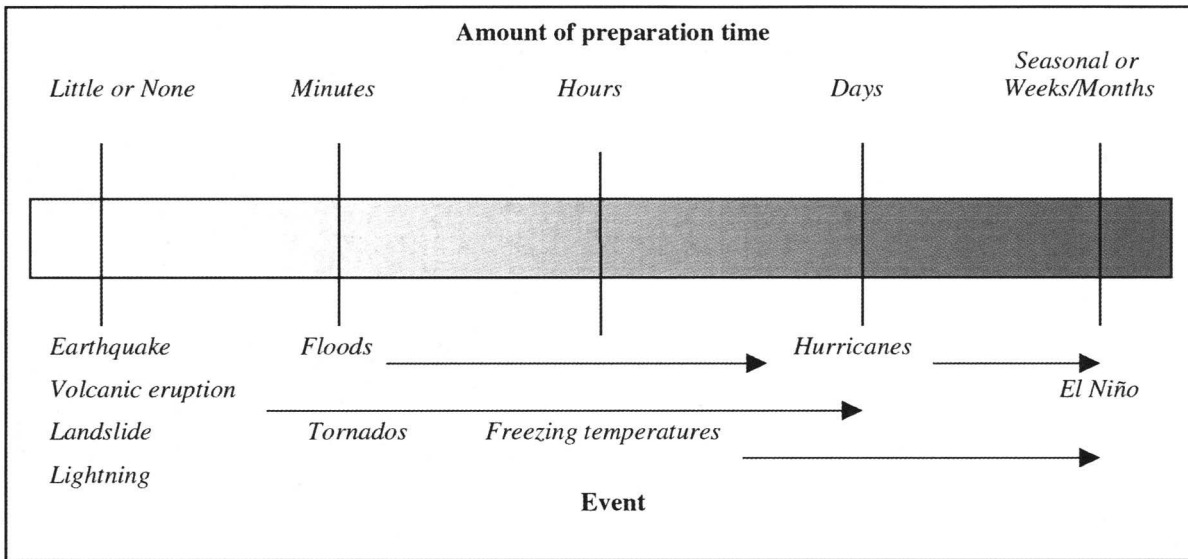


FIGURE 4: NATURAL HAZARD VARIATION TIME IN WARNING AND PREPARATION

respond to a disaster so that communities can implement modifications or improvements prior to the occurrence of a real incident.

Natural hazards exercises also have spillover benefits to other preparedness, response, and recovery plans and procedures. Natural disasters can create many different environmental consequences—a hurricane can cause high winds, storm surge, flooding, lightning, and tornadoes. The natural disaster as well as the array of environmental hazards posed by the disaster have the potential to create an oil discharge. By exercising a natural hazard scenario, responders and planners encounter a variety of challenges that strengthen an agency’s ability to respond to an event.

In addition, natural hazards exercises can help emergency management personnel respond to oil discharges caused by terrorism. For example, a bomb detonating at a dam causes high water and flooding downstream. Similarly, pipeline explosions

and sabotage like that seen in Iraq in 2004 caused the same type of discharges as those caused by Hurricane Ivan on the gulf coast of Louisiana the same year. If a jurisdiction has trained and exercised for responding to a natural disaster, it will be more capable of responding to the terrorist event that results in discharges and requires response planning and recovery operations.

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