DELAWARE ESTUARY SITUATION REPORTS

This series of reports is devoted to discussion of current issues relevant to conservation, use, and development of Delaware Estuary resources, and of concern to managers, decision makers, and the general public.

Emergency Response

How Do Emergency Management Officials Address Disasters in the Delaware Estuary?

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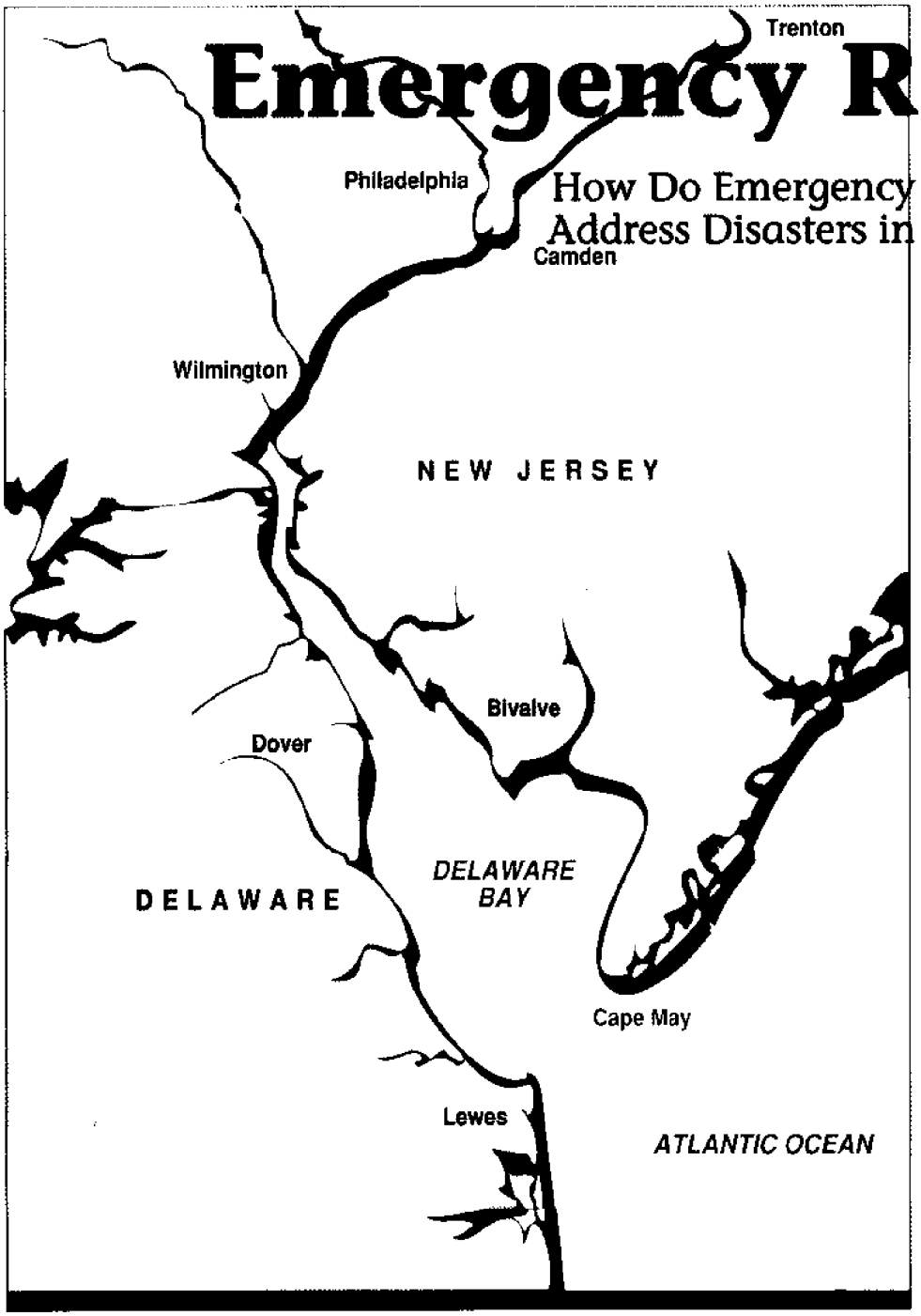

The Delaware Estuary, a multi-purpose bistate resource.

Not all disasters happen on land, they also happen on our waterways. The Delaware Estuary has experienced a variety of disasters over the years, from natural threats such as hurricanes and droughts, to "man-made" disasters such as oil and chemical spills. More remote disasters that could occur range from radiological emergencies at nearby nuclear reactors to war.

The toll that disasters take on the Delaware Estuary and those who live on its shores depends largely upon the degree of emergency preparedness, speed of response, and effectiveness of recovery operations. What happens when a disaster occurs? Who is in charge? How are decisions made? And what actions must be taken to overcome disaster, reducing as much as possible damage to the environment or human life?

In the Delaware Estuary, as in most major U.S. estuaries, three federal agencies play major roles in emergency preparedness and response: the Coast Guard, the Army Corps of Engineers, and the Environmental Protection Agency. This report will define emergency management, examine the [illegible] plays in an emergency, and highlight how each agency operated during an actual disaster—an oil spill in the Delaware Estuary.

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University of Delaware
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What Is Emergency Management?

Historically, emergency management has been viewed as a local function of law enforcement or fire departments, augmented by public health and civil defense units in times of major catastrophe. The impetus for national emergency management stemmed from World War I, World War II, and cold war civil defense. Over the past 20 years, however, emergency management has been redefined and expanded to address a wide variety of natural and man-made disasters besides war. Today, emergency management seeks to reduce human suffering and economic loss due to the unnecessary exposure of people and property to the risks associated with a complex, technological, urban society. Within the context of various laws, emergency management can be defined as the process of developing and implementing policies concerned with *mitigation, preparedness, response*, and *recovery*.

Mitigation, as it applies to emergency management, is deciding what to do to reduce an identified risk to the health, safety, and welfare of society, and then carrying out that risk-reducing action. Many of the problems of mitigation involve differences about how a hazard is perceived and what must be done to alleviate or reduce the hazard (i.e., inducing hurricane-vulnerable shore communities to adopt federal flood insurance for their homeowners contingent upon local compliance with federal codes of hurricane-resistant housing construction).

Preparedness entails developing a response plan and training first responders to save lives and reduce disaster damage. It includes identifying critical resources and developing agreements among responding agencies, both within the jurisdiction and with other jurisdictions. Also involved is planning of alert notification, public warnings, and education.

Response means providing emergency assistance, reducing the probability of secondary damage, and minimizing problems for recovery operations. Provisions for search-and-rescue, evacuation, and sheltering are all elements of response.

Recovery is providing immediate support after a disaster to quickly return life-support systems to minimum operating levels. This support should continue until the community returns to normal (see Petak, 1985). A key component of recovery is reconstruction and repair. In sound emergency management, recovery is linked to mitigation. For example, if a ship collides with a bridge, causing the bridge to collapse, mitigation is served by rebuilding the bridge to a higher clearance.

Emergency management embodies four simple assumptions: (1) emergencies or disasters will occur; (2) it's better to be prepared for these events than to be unprepared; (3) good preparation involves emergency preparedness and response planning; and (4) good emergency management is more than a paperwork exercise—it requires the participation and consultation of emergency responders; it entails pre-disaster inter-agency and intergovernmental understandings regarding who is to do what, who is in authority, and who is to provide labor and resources; and it calls for maintaining a state of readiness even in non-emergency periods.

Often, emergency management agencies operate with stages of mobilization based on the immediacy, probability, and magnitude of the threat. When disaster has a slow onset, that is, when there is some advance warning that a disaster is possible, emergency mobilization can more easily occur. For example, the location and path of a hurricane can be tracked so that probable affected areas can be prepared for emergencies. The Coast Guard's Hurricane Emergency Plan includes four hurricane-threat conditions: Condition Four is an alert that goes in effect from June 1–November 30, corresponding with the Atlantic hurricane season; Condition Three goes into effect when hurricane-force winds are possible within 48 hours; Condition Two when these winds are possible within 24 hours; and Condition One when they are possible within 12 hours.

Yet sometimes it may not be the magnitude of the threat so much as the infrequency and singularity of a problem that makes it an emergency. Part of the function of emergency management is to train responders so that their handling of incidents originally labeled emergencies eventually becomes routine and manageable.

Emergency Management Agencies And Their Disaster Preparedness

While state and local organizations play essential roles in emergency management in the Delaware Estuary, three federal agencies take the lead in responding to disasters: the Coast Guard, the Army Corps of Engineers (the Corps), and the Environmental Protection Agency (EPA) (see Table 1). The following highlights each agency and its disaster preparedness.

The U.S. Coast Guard

The Coast Guard's Marine Safety Office (MSO) near Penn's Landing in Philadelphia prepares and maintains plans for responding to virtually every type of disaster in the Delaware Estuary. The MSO employs about 100 people and maintains a 24-hour watch for incidents affecting the estuary and other local waterways. Commanding officer of the MSO is also Captain of the Port, a post that empowers him or her to direct law enforcement activities within a specified port area and to protect vessels, harbors, waterfront facilities, anchorages, bridges, ports, waterways, and the marine environment. The Coast Guard reduces the risk of disaster through vessel and port safety inspection and regulation.

Because of the Coast Guard's authority to respond to emergencies at sea or along waterways, it often takes the lead in preparedness and response to oil and chemical spills, marine fires, ship collisions, and of late, preparation for commercial aviation crashes. It maintains emergency response vessels and equipment on standby at the Port of Philadelphia and at Cape May (the base of its aerial operations for the estuary). It also maintains emergency communications systems and, on short notice, can mobilize a large work force of its own people by drawing on personnel inside and outside its zone.

The Coast Guard's most elaborate emergency plan is for oil and hazardous substance spills into or along the Delaware River and Bay. A Marine Emergency Response officer handles all spills and tries to insure that each is investigated under the law. The agency classifies a discharge of oil under 10,000 gallons a "minor spill," between 10,000 and 100,000 gallons a "medium spill," and greater than 100,000 gallons a "major spill" (see CG, *Sub-regional Area Oil and Hazardous Substance Pollution Contingency Plan*).

Major spills require the notification of the Multi-Agency Emergency Response Team (MALRT) and officials and agencies on the Major Spill Notification Checklist. MALRT comprises representatives from EPA Regions II and III, the Army Corps of Engineers, U.S. Fish and Wildlife Service, Delaware Department of Natural Resources and Environmental Control, Pennsylvania Department of Environmental Re-Resources, New Jersey Department of Environmental Protection, New Jersey State Police, and Philadelphia Fire Department.

The U.S. Army Corps of Engineers

The Army Corps of Engineers protects and regulates navigable waters; constructs, operates, and maintains navigation projects; operates a dredging fleet; has authority for emergency military construction; and plays a major role in controlling the water supply to the region. The agency's Emergency Operations Center in Philadelphia is prepared for disasters in the estuary. It employs 140 engineers and a staff

of 400. During an emergency in the estuary, the center has construction responsibilities, resources, and technical expertise to conduct salvage, channel clearance, and cleanup operations. It also has a strong contracting capability and can get private contractor help on an expedited basis.

The Corps plays three major roles in mitigating disaster. It has the authority, in cooperation with the Delaware River Basin Commission (DRBC), a four-state federal compact agency, to control water flow from dams or impoundments in the basin, restricting water release upriver if flooding from a major coastal storm is expected, or conversely, releasing more water if low water levels threaten to move the salt line of the Delaware River perilously close to Philadelphia's drinking water intakes. The Corps also keeps the navigable portion of the estuary dredged to a depth of 40 feet, reducing the likelihood of vessel groundings, sinkings, or pollution stemming from hull damage caused by submerged objects. And the Corps operates and maintains the Chesapeake and Delaware (C&D) Canal, a "lock-less" canal that connects Delaware and Chesapeake bays, cutting marine transit between Philadelphia and Baltimore by 300 miles. Blockage of the canal would yield serious economic consequences for water freight interests and complicate transit of naval vessels.

Although the Corps operates with a much smaller emergency response unit than does the Coast Guard, the Corps has detailed plans for natural disasters and oil and hazardous substance incidents and maintains a high degree of readiness.

In emergencies, the Corps Emergency Operations Center is activated and manned by six to seven people who maintain radio contact with officials in the field, zone offices, and Washington-Pentagon offices. Zone coordinators respond to emergencies on federal property in their areas and are expected to assist their county emergency managers. However, the Corps does not respond to chemical cleanups—this is the job of the Coast Guard and Environmental Protection Agency.

Federal Region III Emergency Response Team

Federal Agencies

U.S. Environmental Protection Agency, Hazardous Waste Management Division, Superfund Branch (Philadelphia, PA)

U.S. Coast Guard, Fifth Coast District (Portsmouth, VA)

U.S. Department of the Interior, Office of Environmental Project Review (Philadelphia, PA)

U.S. Fish and Wildlife Service (Newton Corner, MA)

U.S. Department of Commerce, National Oceanic and Atmospheric Administration (New York, NY)

U.S. Department of Health & Human Services, Public Health Service (Philadelphia, PA)

U.S. Federal Emergency Management Agency (Philadelphia, PA)

U.S. Department of Labor, Occupational Safety and Health Technical Support (Philadelphia, PA)

U.S. Department of Agriculture, Forest Service (Broomall, PA)

U.S. Department of Justice, Land and Natural Resources Division, Environmental Enforcement Section (Washington, DC)

U.S. Department of Energy, Brookhaven Lab Area Office (Upton, NY)

State Agencies

Operations Division (Delaware City, DE)

Maryland Department of the Environment, Hazardous Waste and Solid Waste Management Administration (Baltimore, MD)

Pennsylvania Department of Environmental Resources, Office of Environmental Protection (Harrisburg, PA)

Table 1. Federal Region III Emergency Response Team. *These agencies respond to disasters in the Delaware Estuary. Note that New Jersey is in standard Federal Region II and thus belongs to that region's response team. Virginia and West Virginia, both members of Region III, were omitted because they would have little, if any, role in responding to a disaster in the estuary.*

U.S. Environmental Protection Agency

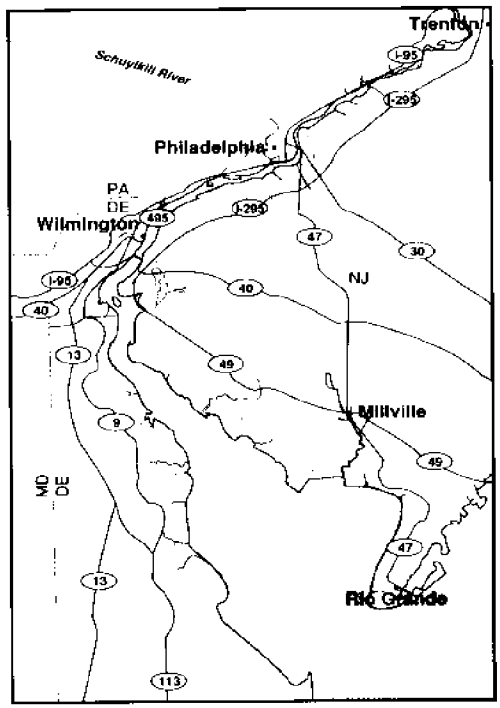
The Environmental Protection Agency Region III Emergency Response Section, headquartered in Philadelphia, prepares, maintains, and stores plans for emergencies on land and in non-navigable waters. Like the Coast Guard, it is on 24-hour watch for emergencies. The unit employs 30 and has an extramural budget for personnel, equipment, and travel of about $15 million a year. It assists state and local environmental agencies or independently takes action in the event of a threat to public health, safety, or welfare, or to natural resources. A major responsibility is emergency management of abandoned toxic and hazardous waste dumps under the federal Superfund program.

Of the three federal agencies addressed here, the EPA Emergency Response Office has the largest collection of oil and chemical emergency plans. To avoid confusion when spills occur in or near the estuary, the EPA and Coast Guard have worked out procedures for determining when each of the two agencies has lead responsibility.

Under the 1980 Superfund Law, the Coast Guard has the authority to respond to releases and threats of releases originating from facilities other than hazardous waste management facilities when such releases require "immediate removal" and are in an area of Coast Guard jurisdiction. In other words, if a toxic or hazardous substance is released in an area of Coast Guard territorial jurisdiction (see "A Lesson in Political Geography," p. 4) and if the substance is not emitted from a hazardous waste facility, the Coast Guard is in charge. The EPA is responsible for conducting a response "when the preliminary assessment indicates no need for immediate removal action, or when the immediate removal is completed and the remaining medial action." Thus, the EPA directs long-term cleanup of a remedial nature in areas of Coast Guard jurisdiction and assumes lead responsibility from the outset in areas directly under its jurisdiction.

The EPA stipulates that it will respond to discharges from industrial facilities, non-marine transportation casualties, and bulk-storage facilities, or at hazardous substance waste sites *(EPA Region III Contingency Plan, III-26)* even if these

Emergency Jurisdictions: A Political Geography Lesson



Why do federal agencies take the lead in emergency management? One major reason is *political geography*. The natural geography of an estuary rarely coincides with governmental boundaries. State lines may abut, span, or divide rivers and bays. County and municipal boundaries may checkerboard the river basins. Even the national government "carves up" estuaries to serve administrative purposes, and electoral districts such as congressional and state legislative districts never neatly conform to an estuary's natural contours. This complexity of boundaries and districts can muddle emergency decision making in an estuary. Consequently, lead responsibility for emergency response in most U.S. estuaries has gravitated to national agencies.

Environmental Protection Agency (EPA) and Coast Guard officials have set territorial dividing lines, based on highways, that determine which agency should respond first to emergencies in the Delaware Estuary and which agency has lead authority. Interstate-95 runs from north of Trenton to the Delaware state line, paralleling the west bank of the Delaware River. The area west of I-95 is the EPA's lead-response territory except for the area below Schuylkill River Dam in Philadelphia's Fairmount Park, which is assigned to the Coast Guard. The Coast Guard has lead response east of I-95, including the Delaware River. In Delaware, the Coast Guard's territory lies to the east of I-95 to Wilmington, to the east of US 40 to Delaware Route 9, and to the east of US 113 as far as the Maryland border.

On the east bank of the Delaware River in New Jersey, the dividing line between the Coast Guard and EPA is I-295, a route that parallels the river and extends from Trenton to the Delaware Memorial Bridge at Deepwater, New Jersey. The Coast Guard's jurisdiction is to the west of I-295 and the EPA's is to the east. Below the Delaware Memorial Bridge, the Coast Guard's jurisdiction is east of US 30 until it intersects New Jersey State Route 49. It remains east of Route 49 until it meets State Route 47 at Millville. It stays east all the way to the Garden State Parkway interchange at Rio Grande, New Jersey, close to the Atlantic Ocean.

Some awkwardness results because New Jersey is in Federal Region II and Pennsylvania, Delaware, and Maryland are part of Federal Region III. The Coast Guard 5th District Region III jurisdiction crosses the Delaware River and Bay and encompasses much of southern New Jersey. The EPA Region II and III jurisdiction is split along the border of New Jersey and Pennsylvania, a border that, in places, runs down the middle of the estuary. This has required memoranda of understanding (MOUs) between EPA Region II and III offices.

Note that the environmental incidents or emergencies that the EPA responds to usually occur inside specific state and local political jurisdictions. Sometimes these incidents can be handled by the political jurisdictions in which they occur; however, sometimes state and local governments cannot respond effectively to an environmental emergency, and the EPA is asked to take over.

The Army Corps of Engineers is not hampered by regional boundaries. The Philadelphia District has eight disaster zones in the Delaware River Basin. Zones 4 through 8 encompass the estuarine portion. From Zone 1 at the headwaters of the river to Zones 7 and 8 at the mouth of Delaware Bay, the Corps monitors rainfall, water levels, and water usage, and carries out navigation projects.

incidents have occurred within an area of Coast Guard lead-response jurisdiction. For example, the EPA assumed the lead role when a Delaware City chemical company accidentally leaked half a million gallons of dichlorobenzene into wetlands beside the Delaware River.

The EPA emergency response unit is called out to an incident, on average, every four or five days. The Philadelphia office's 14 on-scene coordinators (OSCs) manage about 30 emergency response projects most of the time. Consequently, most coordinators are running two to three projects simultaneously. (In Coast Guard parlance, an "OSC" is an "On-Scene Commander" under search-and-rescue conditions and in wartime, but an "On-Scene Coordinator" in environmental response. Sometimes the terms are used interchangeably. For the EPA, however, an "OSC" is always an "On-Scene Coordinator.")

In 1985, the EPA Region III Response Center received 3,000 notices of oil and hazardous substance spills and responded to over 400 incidents (interview, Stephen Jarvela, Director, Emergency Response Preparedness Section, August 16, 1988).

Disasters and Responding Agencies

The following details the responsibilities of the Coast Guard, Army Corps of Engineers, and Environmental Protection Agency during specific kinds of emergencies in the Delaware Estuary.

Military Mobilization. The U.S. Army, Navy, and Coast Guard share in developing and maintaining an elaborate set of naval and port security measures to protect and ensure marine passage to and from the Philadelphia Navy Yard. The Army Corps of Engineers has lead duties in war mitigation because what it builds serves the national defense—its fortifications are built to deter attackers. The Coast Guard also promotes national defense. From a civilian vantage point, the Corps and Coast Guard maintain waterways and aids to navigation that help prevent and mitigate maritime and port accidents.

As military organizations, the Coast Guard and Army Corps of Engineers both maintain elaborate systems of communications intended to supplement or replace civilian telecommunications. There are more than a half-dozen marine band radio frequencies, some reserved for emergencies, such as VHF-FM channel 16, used for distress calls and as a hailing frequency. This communications capability is much greater than that of the EPA, which, as a civilian agency, lacks elaborate back-up communications and is therefore extremely dependent on the telephone.

Oil & Chemical Spills. All three federal agencies have detailed oil and hazardous materials emergency response plans. The Coast Guard and EPA share in emergency response to oil or chemical spills. In recovery operations, the EPA may, under the conditions noted earlier, assume the lead federal agency role. The EPA has the greatest expertise in assessing the environmental effects of oil and chemical spills and in judging the use of solvents, dispersants, detergents, and other substances that might be employed in clean-up operations.

Marine Fires, Ship Collisions, Ship-Bridge Collisions. Maintenance of safe navigation is a top priority with both the Coast Guard and the Army Corps of Engineers. Together, the two agencies devise plans to address marine fires, collisions of ships, ship damage to bridges, and port security. The Coast Guard has a detailed marine fire fighting plan, and responding to ship collisions is part of the training and education of Coast Guard officers and enlisted personnel. The Coast Guard and Corps also work to protect, regulate, and maintain waterborne commerce, recreation, and transportation.

Nuclear Emergencies. Both the EPA and Coast Guard have prepared, with the Nuclear Regulatory Commission and the Federal Emergency Management Agency, detailed sets of nuclear power plant radiological emergency response plans. These plans emphasize emergency notification and alert more than any other aspect of emergency management. For example, in a nuclear emergency, a vessel from the Coast Guard's MSO in Philadelphia and another from Group Cape May would sortie to establish a safety zone at its upriver and downriver extremes. Vessel traffic would be restricted; only those vessels receiving permission from the Captain of the Port, Philadelphia, would be allowed to transit the safety zone. Helicopters from air stations at Cape May or Brooklyn would conduct a shore-to-shore search notifying boaters within the safety zone to evacuate (CG, *Radiological Emergency Response Plan*).

Natural Emergencies. The Army Corps of Engineers and Coast Guard maintain hurricane preparedness and response. Of the three agencies analyzed here, only the Corps formally addresses droughts and floods in its emergency planning although the EPA's duties in the aftermath of flooding would be substantial. An important element of the drought plan is the capacity to build alternate water pipelines, which the Corps has done in at least one Delaware River drought.

Integrated Emergency Management

All-hazard, integrated emergency management can be viewed systematically as mitigation, preparedness, response, and recovery (each considered interdependent and interrelated to the others), and can be applied to the management of all hazards. Experts believe this type of emergency management is superior because it promotes a high, coordinated level of emergency preparedness while reducing the duplication of effort and resources that invariably occurs when each threat is planned for separately.

All-hazard, integrated emergency management is not yet in place for the Delaware Estuary. However, there is extensive interagency and intergovernmental coordination in emergency planning, and there are many memorandums of understanding (MOUs) between the federal agencies and state, local, and private organizations. Additionally, mutual aid agreements are embodied in almost every emergency plan.

The Coast Guard's and Corps of Engineers' emergency plans are regularly updated and tested about twice a year through joint exercises or drills. The EPA's emergency response unit is a regular participant in these exercises, but it is burdened by regional hazardous materials dump clean-up operations. In Pennsylvania alone, there were 121 Superfund removal projects under way in June 1988; many were in the Delaware Valley (interview, Stephen Jarvela, Director, Emergency Response Preparedness Section, August 16, 1988).

The Coast Guard and Corps have peacetime duties; each agency also has essential responsibilities in readiness for military emergencies. Because they are on constant alert for war, each agency holds reserve resources that can be dedicated to peacetime emergencies, including personnel, special equipment, and spending authority.

As a civilian agency, the EPA has no military functions and thus has few resources in reserve. Moreover, the agency has been vulnerable to substantial federal budget cuts. Both the Coast Guard and the Corps of Engineers have faced recent budget cuts, but the EPA's funding cuts have been deeper and more sustained.

Responding to An Actual Disaster: The *Grand Eagle* Oil Spill

A good way to learn how emergency management is conducted in the Delaware Estuary is to review an emergency. The following is a chronology, based on Coast Guard accounts, of emergency response to the *Grand Eagle* oil spill in the lower Delaware River in September 1985. The comments in italics have been inserted by the author to clarify, or elaborate on, points in the original chronology. See the map on page 6 for all locations referred to in the chronology.

September 28, 1985

At 11:30 p.m., the master of the tanker vessel *Grand Eagle* informed the Captain of the Port, Philadelphia, via channel 16, that the vessel had lost power, run aground, and was leaking oil near buoy 6, Marcus Hook Range, Delaware River. The vessel was bound for the Sun Oil Refinery, in Marcus Hook, Pennsylvania. The master reported that an estimated 7,000 barrels of Ninian crude oil, API 36.6, had escaped from the No. 1 starboard cargo tank, which contained 56,000 barrels of oil. *[Since a single barrel contains 42 gallons, at least 294,000 gallons of oil had leaked into the river, far exceeding the 100,000 gallon threshold used by the Coast Guard to define a "major" oil spill. If the entire contents of the hold had flowed into the river, a spill of more than 2.3 million gallons of oil would have resulted.]*

September 29, 1985

About 12:40 a.m., the *Grand Eagle* was refloated with the aid of two tugs and proceeded to Sun Oil Refinery. After the vessel was docked, a boom was placed around it to contain the leaking oil. At 3 a.m., the vessel started pumping off the oil from the damaged cargo tank. The plan was to pump off the entire tank so the source of the leak could be secured. About 1½ hours into the discharge operation, the vessel's inert gas system failed and the oxygen content in the damaged cargo tank climbed to 8.5%, causing an automatic shutdown of the pumping system. About 20 minutes later, the problem with the inert gas system was located and repaired, and transfer operations were restarted. Cargo from the damaged tank was completely discharged by 11 a.m. *[In other words, 11½ hours after it was reported to the Coast Guard, the heavy leakage of oil from the hold was arrested. But the effects of the spill would be attacked for the next 16 days.]*

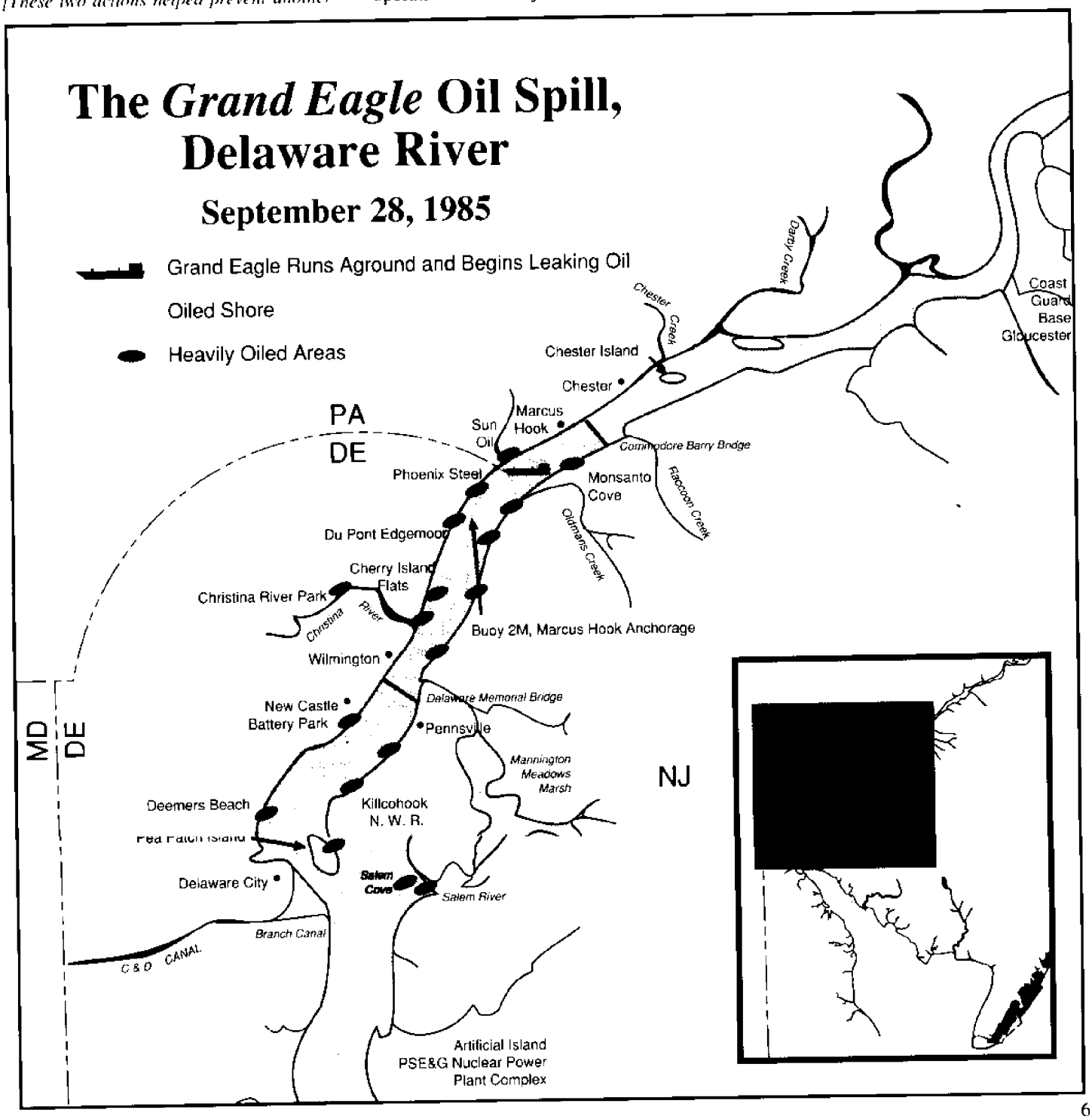
As lead responding agency, the Coast Guard directed its efforts at determining the extent, location, and amount of oil that had been spilled. Base Gloucester City small boat 32348 and Coast Guard cutter *Catenary* conducted an initial waterside investigation and remained close to Sun Oil to monitor operations and control traffic. *[This act made it possible to organize a response scaled to the magnitude of the spill and its effects.]* The On-Scene Coordinator established a safety zone in the Delaware River from buoy 2M, Marcus Hook Anchorage, north to the Commodore Barry

Bridge. No vessels were allowed in the safety zone without permission from the Captain of the Port, Philadelphia. *[This blocked commercial and recreational transit on the river between Chester, to the north, and Marcus Hook, to the south.]*

Shortly after the casualty, the aids to navigation were checked in the area of the grounding by the Coast Guard Red Oak Aids to Navigation team. All aids were reported on station and watching properly. The Corps conducted soundings of the area and found that the vessel grounded in a rocky, shallow spot about 19 feet deep. *[These two actions helped prevent another disaster. The first helped ascertain whether navigation equipment positioned in the river may have contributed to the night-time incident, and helped insure that the equipment was not damaged or displaced by the* Grand Eagle *or other forces. The second action was precautionary. It attempted to determine whether a submerged rock or object on the river bottom might have speared the* Grand Eagle. *If such a threat existed, the Coast Guard and Corps could issue vessel warnings and begin removing it.]*

The manager of the Delaware River and Bay Cooperative (DRBC), a non-profit cooperative funded by contributions from major oil companies operating in the estuary, was contacted and asked to have its members boom off environmentally sensitive Raccoon, Oldmans, and Darby creeks. In addition, the DRBC's open water oil recovery skimmer, *DELBAY*, was asked to begin operations at the leading edge of the slick and work north along the river. *[The* DELBAY *operates from Lewes, Delaware, a half-day's sail from the spill site.]*

The Multi-Agency Local Response Team (MALRT) was mobilized; a meeting at Base Gloucester City was scheduled for 8 a.m. The Coast Guard Atlantic Strike Team was alerted at 12:20 a.m. and



was asked to begin assembling equipment and personnel for the response effort. The U.S. Fish and Wildlife Service, New Jersey Department of Environmental Protection, Delaware Department of Natural Resources and Environmental Control, EPA Regions II and III, plus the National Oceanic and Atmospheric Administration (NOAA) Scientific Support Coordinator, were notified by 1:30 a.m. Federal Region II and III Response Teams were informed by message at 3:20 a.m. *[These actions show that the Coast Guard assumes major responsibilities in the alert notification stage of river spill emergency management.]*

At 7:30 a.m., the On-Scene Coordinator conducted an overflight to determine the extent of the oil slick and its effect. Heavy concentrations were reported around the vessel at Sun Oil. The oil extended from the Commodore Barry Bridge, 2.5 miles north of Sun Oil, south to the Delaware Memorial Bridge. *[The oil was slicked up- and downriver by tidal action.]* About 19 miles of shoreline had been affected in Pennsylvania, New Jersey, and Delaware. Protective booms that had been deployed at Raccoon Creek, Oldmans Creek, and the Christina River did not hold or were not placed quickly enough, and oil flowed past them and farther into the marsh. *[These and many other tributaries in the area are at the same general gradient as the Delaware and are subject to tidal flows.]*

An information exchange between the On-Scene Coordinator and the NOAA Scientific Support Coordinator began early. The Scientific Support Coordinator, Third Coast Guard District, gathered wind forecasts, (river) current, and weather information to develop a computer trajectory for the slick's path. Around 3 a.m., on September 29, 1985, the first trajectory was developed, predicting that the leading edge of the slick would reach the Delaware Memorial Bridge by the end of day. *[The first trajectory projection was completed only 3½ hours after the Coast Guard learned of the spill, in the middle of the night.]* Using existing and forecast weather and [river] current information, the Scientific Support Coordinator recommended that measures be taken to protect Salem River, Pea Patch Island, and southern marshes from possible oiling. Later that day, another trajectory projected that the leading edge of the slick would move 8–10 miles per day.

Members of the Atlantic Strike Team arrived at the Philadelphia base at about 9:45 a.m. *[Recall that they had been notified at 12:20 a.m. the same day.]* After a briefing, they left for Sun Oil Refinery to assist the On-Scene Coordinator. Other members of the Atlantic, Gulf, and Pacific Strike Teams were to arrive later.

Sun Oil Company initially assumed control of the cleanup until the owner's representatives arrived and could take over. One contractor, New Jersey Pollution Control, was at the scene and had started cleanup when the vessel docked. Sun Oil hired divers from Underwater Technics to conduct an underwater hull survey to determine the extent of the damage and the feasibility of placing a temporary patch on the *Grand Eagle* to prevent further cargo loss. *[Sun Oil's actions were purely voluntary because the company did not own the tanker.]* The divers were unable to find the damaged area because of poor underwater visibility and swift current. The On-Scene Coordinator reported that the Atlantic Strike dive team would attempt to find the hull damage.

At 4 p.m., the owners accepted financial responsibility and control of the cleanup and hired Captains Paul Preus and Norman DeWeir of Clean Water, Inc., to coordinate operations. Sun Oil had hired 13 contractors who were either performing cleanup at the site or were en route to the area. The initial emphasis by the owners was to contain and collect the large amount of oil at the Sun Oil dock. The owner's representatives set up a command post at Sun Oil to coordinate the cleanup. To satisfy requests for information, the On-Scene Coordinator held a press conference at Base Gloucester at 4:30 p.m. The Coast Guard Public Information Assist Team helped arrange the briefings. Coverage was reduced because of a strike that shut down Philadelphia's two major newspapers.

At 6:20 p.m., the On-Scene Coordinator and the Scientific Support Coordinator met with James Shirley of Haight, Gardner, Poor & Havens (attorneys representing the *Grand Eagle* owners), Capt. Paul Preus, and Sun Oil personnel. The On-Scene Coordinator raised the issue of boom deployment to protect the Salem Cove area and marshes farther south. Salem Cove leads into Mannington Meadows, a breeding ground and habitat for a reported 40,000 ducks. They reported that 21 contractors had been hired to conduct cleanup operations. The owner's representative assured the On-Scene Coordinator that a contractor was en route and would take care of booming off the Salem Cove area.

September 30, 1985

During a 7:30 a.m. overflight, the On-Scene Coordinator and Scientific Support Coordinator observed oil spreading out in ribbons from the Commodore Barry Bridge to about ¼ mile south of the Delaware Memorial Bridge. The Scientific Support Coordinator projected that by 8 p.m. the oil would travel south to the C&D Canal and Salem Cove. The On-Scene Coordinator again expressed concern to the *Grand Eagle* owner's representative about booming off Salem Cove and protecting Killcohook National Wildlife Refuge.

About 9 a.m., the Coast Guard Dive Team arrived and began diving to determine the location and extent of the *Grand Eagle's* damage. Divers initially were unable to locate any damage because of low visibility and swift currents. However, on later dives they were able to identify damage in the No. 1 starboard cargo tank.

At noon, the On-Scene Coordinator held a meeting with the Multi-Agency Local Response Team and the owner's representative to discuss a defensive strategy for the marshlands. The owner's representative maintained that a contractor was en route with 10,000 feet of boom that would be deployed by the end of the day at Salem Cove. Up to that point, the emphasis of the owner's cleanup operations continued to be at Sun Oil. No precautionary measures had been taken in environmentally sensitive areas south of Delaware Memorial Bridge. At 8 p.m., the On-Scene Coordinator again met with the owner's representative to discuss marsh protection. Prior assurances concerning booming off Salem Cove still had not been met and there was no indication that the booming would be performed soon. As a result, the On-Scene Coordinator declared a limited federally funded spill response south of the Delaware Memorial Bridge. *[Note that this action was a result of the responsible party's inability or unwillingness to undertake adequate response and recovery operations downriver. From here forward, the federal government began assigning, and paying for, its own cleanup contractors.]*

The On-Scene Coordinator immediately asked the Supervisor of Navy Salvage to respond with five Marco V skimmers and support personnel. A Navy official said they would be able to have the skimmers at the scene within 12 hours. The On-Scene Coordinator also hired New England Pollution Control as the primary cleanup contractor. *[Remember that this contractor is being paid from federal emergency reserve funding and the responsible party is supposed to reimburse the federal government for contractor costs the government has incurred in cleanup.]*

New England Pollution Control said 10,000 feet of containment boom could be delivered by 8 a.m. on October 1 to be deployed at Salem Cove. An additional 1,000 feet would arrive by noon the same day. The On-Scene Coordinator's strategy was to deploy a diversionary boom at Salem Cove and a containment boom across the entrance to the C&D Canal. The five

Volunteers at Tri-State Bird Rescue & Research, Inc., in Wilmington, prepare to bathe a duck oiled during the Grand Eagle *spill in the Delaware River in 1985. (Courtesy of Tri-State Bird Rescue & Research, Inc.)*

skimmers were to be used for collecting free-floating oil below Delaware Memorial Bridge. The On-Scene Coordinator also established the main command post at the Delaware Emergency Management Center in Delaware City. All operations were coordinated from this location. The Scientific Support Coordinator and all state representatives moved to this command post to plan strategies with the On-Scene Coordinator. *[Establishment of a command post is an essential element of sound emergency management.]* A representative was left at Sun Oil to monitor the cleanup north of Delaware Memorial Bridge and maintain liaison with the owner's representative.

Cleanup continued north of Delaware Memorial Bridge by 21 contractors hired by the owners. The cleanup remained centered at Sun Oil, but contractors were dispatched to heavily affected areas, such as Phoenix Steel, Naamans Creek, Du Pont Edgemoor, and the Christina River (Wilmington Harbor).

The U.S. Fish and Wildlife Service and Tri-State Bird Rescue & Research, Inc. established a wildlife rehabilitation center for oiled birds at Tri-State's facility in Wilmington. Coast Guard monitors reported a total of 75 oiled birds.

The On-Scene Coordinator requested additional staff from the Third District to be used for boat crews and pollution monitors. District officials announced that a voluntary call-up of reservists would be issued until approval was granted by the commandant for an involuntary call-up. The On-Scene Coordinator also requested district approval to raise the 311-K ceiling to $1 million dollars to pay for federal operations below the Delaware Memorial Bridge. *[Paragraph 311-K is in the Clean Water Act of 1972. Under this provision, the federal government is obligated to maintain budget authority that can be used to pay federal cleanup costs for oil spills or other types of water pollution.]*

The governors of New Jersey and Delaware contacted the On-Scene Coordinator and asked about the status of the oil spill. Congressional inquiries also were received from New Jersey, Pennsylvania, and Delaware. The On-Scene Coordinator addressed concerns about the oil's threat to sensitive marsh and wildlife areas.

October 1, 1985

An 8 a.m. overflight showed that the oil slick had landed along the shore from New Castle south to Deemers Beach, upriver from Delaware City, affecting an area about 2 miles long. Half-inch-thick oil was observed as far south as the Delaware City Branch Canal, adjacent to the C&D Canal. On the eastern bank, heavy oil concentrations were reported from Monsanto Cove, New Jersey, south to Pennsville. A slight sheen was reported in the Salem Cove area. On the western bank, the Christina River was heavily affected and oil was observed as far as 6 miles upriver.

The owner's representative shifted contractors to areas along the New Jersey shore and Christina River. Cleanup activity was undertaken south of the Delaware Memorial Bridge at Pennsville, and at New Castle and Deemers Beach. New England Pollution Control subcontracted with six other contractors to gain help in cleanup operations. Free-floating oil remained in the Delaware River as thin ribbons, which continued to pose a threat to environmentally sensitive Salem Cove. The On-Scene Coordinator directed deployment of a boom across the Salem River and Cove area. A 10-knot current in Salem River made it nearly impossible for contractors to deploy a containment boom. The boom continued to break, so the cleanup contractor placed additional securing devices on it. Once finally secured, the boom was effectively a permanent boom that could not be redeployed if taken down or broken. The contractors also began deploying some 10,000 feet of diversionary boom to protect the Salem Cove area.

About 12:30 p.m., the owner's representative requested that the *Grand Eagle* be allowed to depart Sun Oil to transit a few miles upriver to Pennsylvania Shipbuilding in Chester so that the damaged cargo tank could be repaired. The On-Scene Coordinator permitted the vessel to

move from to the shipyard, but required that all oil be properly boomed off before the vessel set out. The *DELBAY* skimmer was positioned to collect any oil that might escape. At approximately 4 p.m., the vessel departed without incident.

October 2, 1985

Beach cleanup continued north of Delaware Memorial Bridge, where a heavy sheen covered most of the river, interspersed with globs of heavy oil. The remaining floating oil continued to migrate south although by this time most of it was beached on the shore and in marsh fringes.

New England Pollution Control continued to gear up equipment and resources for a large-scale cleanup operation south of Delaware Memorial Bridge. Sorbent boom, a chain of connected, floating oil-absorbent barriers, was deployed at Salem Cove; tidal conditions would not allow long runs of containment boom to be deployed. Boom deployment at the C&D Canal was completed. Public Service Electric and Gas Company deployed a boom as a precautionary measure around water intakes to its Artificial Island nuclear power plant, 7 miles farther downriver.

Navy skimmers were recovering about 70 gallons of oil from the Christina River. The owner's representative reported that, to date, approximately 4,309 barrels of oil *[181,000 gallons]* had been collected, most by vacuum truck.

The On-Scene Coordinator held a press briefing at Tri-State Bird Rescue & Research, Inc., in Wilmington. The Scientific Support Coordinator and U.S. Fish and Wildlife representatives were involved. A total of 25 birds had been transported to the facility for treatment.

A representative from the Marine Safety Office in Baltimore arrived at the Delaware City command post to monitor the progress of the slick. Concern was raised that the oil might flow into the C&D Canal, which is under the jurisdiction of the Coast Guard, Baltimore District.

October 3, 1985

Overflights previously planned were canceled due to rain and low cloud-cover. Coast Guard boats and a Delaware marine police boat, conducting a survey south of Delaware Memorial Bridge, noted that a sheen remained on the river, with isolated patches of oil near Pea Patch Island. Most of the oil beached on the shore north of the Delaware Memorial Bridge.

The *DELBAY* was called in by the On-Scene Coordinator to conduct skimming operations near Pea Patch Island. When the vessel arrived, it reported that there was no oil in that location.

On recommendation of the On-Scene Coordinator, the owner's representative intensified cleanup at the Christina River. The On-Scene Coordinator was concerned that booms needed to be in place so that loose oil would not flow out of the river.

The Scientific Support Coordinator asked the Third Coast Guard Marine Safety Division to arrange, with the EPA, high-resolution aerial photography of the river.

October 4, 1985

An afternoon overflight revealed a remaining sheen in the river, with patches of oil in isolated areas, such as Cherry Island flats and the Christina River. Cleanup operations were emphasized at New Castle, Battery Park, and Christina River.

The five Navy skimmers were demobilized; two units remained on standby. Little oil had been collected; the Supervisor of Salvage representative reported that the skimmers were no longer effective. *[The Supervisor of Salvage representative works for Naval Sea Systems Command, an organization that maintains and stores elaborate pollution control equipment.]*

Coast Guard Public Information Assist Team members departed the Delaware City command post, having completed their duties. *[Here again, use of this unit, and positioning it in the command post, helped centralize and fulfill essential public relations functions during the incident.]*

October 5, 1985

The On-Scene Coordinator met with the owner's representative and expressed concern over goals not being met because of poor supervision. *[Apparently, the On-Scene Coordinator was dissatisfied with the owner's use and management of cleanup contractors.]* The On-Scene Coordinator considered declaring a federal spill for the remainder of the area. The owner's representative appointed two men to oversee and coordinate the cleanup above Delaware Memorial Bridge. *[Remember, once the cleanup is completed, the federal government seeks to recover money from the vessel owner to pay for federal contractor cleanup expenses. A threat to widen the area of federal declaration increases the cleanup costs the vessel owner may later be forced to pay. Note that the government's own internal costs, such as those for cleanup vessels and personnel, can be added to the government's claims under the Clean Water Act, Section 311 (B). However, if the claims are not fully reimbursed, the U.S. taxpayer must make up the difference.]*

A 4:30 p.m. overflight showed that the river below Delaware Memorial Bridge was clear except for a small sheen near Pea Patch Island and New Castle. Above Delaware Memorial Bridge, ribbons of oil were observed in the Christina River as a result of water-washing performed on the shore. *[Water-washing is a method by which oil is removed from solid items. It is also spraying water on grass to cleanse it of oil.]* The *DELBAY* skimmer was on-scene, collecting loose oil. The On-Scene Coordinator determined that the Salem main channel boom was to remain staged rather than removed even though this meant continued blockage of river traffic.

October 6, 1985

A morning overflight showed fewer areas of sheening. Major cleanup remained at Sun Oil, Christina River, and New Castle. The 10,500 feet of containment boom deployed in Salem Cove was removed. Sorbent boom remained at creek entrances to collect loose oil. The *DELBAY* was secured since there was little oil in the river that could be collected.

Heavy concentrations of oil collected in marsh and beach areas at New Castle's Battery Park. The Scientific Support Coordinator and strike team conducted a survey to evaluate alternative cleanup methods. *[This activity may not seem important, but it enables emergency responder crews to learn from experience, thus improving their expertise in handling future spills.]*

October 7, 1985

To improve cleanup operations, the On-Scene Coordinator permitted limited marsh grass cutting (300–400 yards) near Commodore Barry Bridge.

Using water-washing to clean marsh grass at New Castle's Battery Park was ineffective. Thus, the On-Scene Coordinator approved limited grass cutting to gain access to pooled oil. The Delaware Department of Natural Resources and Environmental Control concurred with the plan.

October 8, 1985

A morning overflight reported little sheen in the river. Isolated areas were detected in the Christina River and at Sun Oil. Cleanup activities continued at New Castle—350 feet of marsh grass was cut under the Scientific Support Coordinator's supervision. Pollution monitors observed a cleanup contractor using Aquamix, a water-soluble soap on the bulkhead at Christina Park. The On-Scene Coordinator directed the contractor to stop using the product until a determination could be made by the Scientific Support Coordinator about its safety to the environment.

The On-Scene Coordinator asked that a contracting officer or representative from the Third Coast Guard District be present on October 10 to review claims by the prime contractor and subcontractors.

October 9, 1985

Cleanup continued on the Christina River and along New Castle. The area south of Delaware Memorial Bridge was rapidly approaching completion, but awaited official judgment by the On-Scene Coordinator and state authorities. The On-Scene Coordinator developed plans to disestablish the Delaware City command post.

The Scientific Support Coordinator determined that Aquamix was not approved for use in the marine environment and thus recommended that it not be used to clean bulkheads at Christina Park. The On-Scene Coordinator concurred and asked the contractor to use an alternative method.

The owners requested permission to sail the *Grand Eagle* from Pennsylvania Shipbuilding in Chester on October 10. The On-Scene Coordinator required that it have a tug escort and a manned engine manual control station during its escort from Chester as far as Artificial Island, at the headwaters of Delaware Bay.

October 10, 1985

Cleanup continued at Christina River, New Castle, and the Sun Oil docks. The owners of the *Grand Eagle* changed the vessel's name to *Amersham. [Coast Guard officials claim this was of no particular advantage to the owner since parties filing suit would have no difficulty identifying and locating the owner of the former* Grand Eagle.*]* The On-Scene Coordinator requested that Customs clearance be reinstated so that the vessel could depart. The vessel's P&I attorney gave the On-Scene Coordinator verbal assurance that the vessel had a valid letter of financial responsibility under the new name. *[P&I refers to the protection and indemnity requirements vessel owners must meet.]* The vessel departed without incident.

Oily debris from the New Jersey shoreline was stored at a landfill in Chester, Pennsylvania. Oil is considered a hazardous waste under New Jersey law. An EPA manifest number was obtained and approval was granted for transport of the debris. It was trucked to a federally approved disposal site in Ohio.

October 11, 1985

At 4 p.m., the owner's representative reassumed responsibility for cleanup south of Delaware Memorial Bridge. The request, accompanied by a written plan for orderly transition, was accepted by the On-Scene Coordinator. The owners assigned a contractor to the area who was to work under third-party supervision. *[This transferred cleanup duties from public authorities and their contractors to the ship's owners and contractors. It meant that the On-Scene Coordinator was satisfied that the vessel owner's contractors could finish the cleanup.]*

New England Pollution Control continued to demobilize its equipment and resources. An On-Scene Coordinator representative remained at the scene to monitor close-out of the federally funded portion of spill cleanup. The Delaware City command post was temporarily shifted to the Quality Inn, New Castle.

October 12–November 8, 1985

Cleanup continued at New Castle and Christina River, Delaware, and Monsanto Cove, New Jersey. As areas were completed, they were inspected by the contractor and designated state and Coast Guard monitors who either recommended approval or identified further action needed.

New England Pollution Control completed demobilization on October 15. *[This marked the end of federally funded emergency cleanup activity in the incident.]* Federal cleanup expenditures now totaled $1,110,171. Coast Guard Fifth District and New England Pollution Control personnel continued to compile final contractor costs. *[Under federal law, the vessel owner was supposed to reimburse the government for these expenditures, but parties alleged to be responsible for environmental damage sometimes refuse to pay or they contest the amount they are asked to pay. As a result, a delay in reimbursement occurs, owing to backlogged court calendars and the time required by litigation. Sometimes alleged polluters win rulings absolving them of responsibility for the government's cleanup bills. Here, owners of the* Grand Eagle *contested liability for the federal damage claim and the case remains unresolved at this writing, nearly six years since the spill occurred. The federal suit against the* Grand Eagle *had escalated to $1,685,323.91, as of August 1, 1989, largely as the result of inflation costs (interview with CG Commander T. A. Patrick, July 26, 1989).]*

An estimated 200 birds, mostly cormorants, had been affected by oil. Ninety-two birds had been delivered to the Tri-State Bird Rescue facility in Wilmington, Delaware; 38 survived.

On October 18, remaining members of the Atlantic Strike Team departed, and the command post south of Delaware Memorial Bridge was disestablished. All Coast Guard activities were coordinated through their Philadelphia area offices.

An inspection of the shoreline of Monsanto Cove and New Castle, conducted on November 8, showed no need for further cleanup. These were the last areas to be inspected by the On-Scene Coordinator and state representatives before the pollution case was closed.

A total of 2,554 cubic yards of debris had been removed. An estimated 8,060 barrels of oil had been received at the Sun Oil Refinery from a combination of vacuum trucks, the *DELBAY* skimmer, and the five Navy skimmers. *[About 338,520 gallons were collected. Recall that the initial leak was estimated to be 7,000 barrels, but the punctured cargo hold contained 56,000 barrels, of which some escaped from the vessel during pump-out of the hold and during ship transit and repair operations.]*

Lessons of the *Grand Eagle* Oil Spill

Many principles of emergency management are evident in the *Grand Eagle* oil spill. The Coast Guard, along with private corporate and volunteer organizations, responded quickly, helping avert additional pollution damage. The Coast Guard closely monitored the path of the oil flow, the ensuing damage and damage threat, and the work of cleanup contractors, all in accord with its oil spill emergency response plan. The Coast Guard On-Scene Coordinator established a main command post close to threatened areas, which helped him coordinate the actions of federal, state, and local responders. The command post also served public information functions. The *DELBAY* oil skimmer, operated by a consortium of oil companies, took direction from the On-Scene Coordinator and was a critical resource throughout the cleanup. Volunteers from Tri-State Bird Rescue & Research, Inc., did much to help oiled waterfowl and typified the best aspects of volunteer emergency response.

A disturbing, yet illuminating aspect of the case was the exchanges between representatives of the vessel owner and the On-Scene Coordinator. As oil continued to flow south of Delaware Memorial Bridge, the On-Scene Coordinator became alarmed by delays in the response of the owner's cleanup contractors to threatened areas. Promises were made and not kept. Believing he could wait no longer, the On-Scene Coordinator declared the area south of the bridge a limited federal disaster area and assigned private contractors to the cleanup, who were paid from federal funds. Also disturbing is the as yet unresolved lawsuit by the government to reclaim from the *Grand Eagle*'s owner money spent to pay Coast Guard-assigned cleanup contractors. A lesson from this is that parties responsible for the spill cannot always be trusted to do the cleanup they promise and may use various legal ploys to forestall payment of federal oil spill cleanup costs.

The *Grand Eagle* case shows that constant monitoring of cleanup operations is

necessary. It helps ensure that methods of, or products used in, cleanup do not compound environmental damage, as might have happened if Aquamix use went unstopped. Supervision also precluded overcutting of wetlands vegetation during oil recovery and water-washing operations. Of more generalizable value was the constant evaluation of cleanup methods as they were being performed. This creates a knowledge base that advances learning and planning for future oil spill cleanup operations. Superior emergency recovery operations are those that improve disaster mitigation and emergency preparedness for future incidents and disasters.

Oil spill emergency preparedness must be constantly maintained, practiced, revised, by the responders themselves, not by outside consulting firms or administrative staff confined to their offices. Oil spill emergency response requires the availability of oil spill cleanup contractors and volunteer organizations. None of the federal agencies here—Coast Guard, Army Corps of Engineers, or Environmental Protection Agency—does an entire major spill cleanup with its own personnel. The EPA has some capacity to act, at least initially with its own resources and technical staff; however, the Corps of Engineers is almost completely contractor-dependent. The Coast Guard is prepared to act temporarily in the absence of contractors, but it cannot do without them, particularly in long-term post-disaster recovery operations.

Private contractors assume the role of emergency responders in oil and chemical spill cleanup, in many drought emergencies, and in flood threat circumstances. In effect, the *DELBAY* and selected contractors serve as a "rapid deployment force" called in on short notice for boom deployment, diking, and cleanup operations.

Oil spill recovery operations demand close monitoring by the On-Scene Coordinator and other officials. Recovery is almost always longer than the response phase and requires care to avoid causing more damage through inappropriate cleanup activities. It requires coordination of numerous public and private organizations and supervision of volunteers. Both response and recovery demand competent and regular consultation with the media, even to the point of arranging press tours and news conferences.

Oil spill emergency mitigation is no less difficult than preparedness, response, and recovery. One action that may advance mitigation is raising civil penalties for oil spill violations to levels that get the oil transport industry's attention (an action recommended by Coast Guard Commander T. A. Patrick, Compliance Branch, phone interview, July 26, 1989). Mitigation is also promoted by dredging river channels and deploying and servicing river navigation aids. Tighter regulation and supervision of water freight transporters would also yield mitigation benefits.

Frank Bryson

Workers remove oil from the shore near Marcus Hook, Pennsylvania, in the aftermath of the Presidente Rivera *spill in the Delaware River, June 1989. (Courtesy of Delaware National Guard)*

Closing Observations

There is considerable variation in the missions, personnel, expertise, and budget resources of the Coast Guard, Army Corps of Engineers, and Environmental Protection Agency. The Coast Guard and EPA shoulder day-to-day emergency response duties and are regularly mobilized. The Corps maintains a capacity for emergency response, but one Corps official noted that it had been so long since the agency had to confront a disaster in the estuary that many in his unit had serious reservations about how younger staff would perform. The EPA's emergency response personnel carry a heavy burden in managing Superfund cleanup, which impedes their ability to respond to new disasters. The Coast Guard also has considerable obligations in regulating maritime operations in the estuary. However, the agency seems to hold more reserve emergency resources, owing in part to its search-and-rescue responsibility. Neither the EPA nor the Corps is equipped to handle search-and-rescue as quickly or in the same way as the Coast Guard.

In closing, if one considers the general concept of "emergency" of the three federal agencies, the Coast Guard maintains the highest capacity for initial emergency response. Emergency planning has been best integrated into its work routine. The EPA emergency response unit is a repository of technical expertise that is stretched to the limit in workload. The EPA's emergency operations either augment, or work in place of, state or local emergency operations. The Corps is a secondary emergency response organization called in by the Coast Guard or asked to serve the purposes of the Delaware River Basin Commission. At the same time, the Corps contributes to disaster mitigation much more than the EPA or Coast Guard. Moreover, Corps engineers make essential contributions to long-term post-disaster recovery.

The Coast Guard, Army Corps of Engineers, and Environmental Protection Agency all maintain a high state of readiness for emergencies in the Delaware Estuary. As coordinating organizations, each makes possible a more rational, balanced emergency response by state, local, and private organizations. From a federal perspective, the Delaware Valley appears, from this study, to be better prepared for waterborne than land-based disaster, at least with respect to oil and hazardous substance spills.

Epilogue

On June 24, 1989, the 749-foot tanker *Presidente Rivera*, en route to the same refinery as the *Grand Eagle* had been some four years earlier, ran aground near buoy 1M, Marcus Hook Range. The Uruguayan-registered tanker was carrying 430,000 barrels of Number 6 oil. The river pilot aboard the vessel notified the Coast Guard that the ship was grounded and leaking oil into the river. The incident began at about 4:46 a.m., a night-time accident just as the *Grand Eagle* had been. Initial Coast Guard estimates were that at least 100,000 gallons had spilled into the river, but vessel owner representatives thought the amount could reach 800,000 gallons. The Coast Guard mobilized for a "worst case spill of 1.6 million gallons" (*Coast Guard News*, June 24, 1989, 9:30 p.m.).

The Coast Guard managed this spill much as it had the *Grand Eagle* incident: a safety zone was established in the river; the On-Scene Coordinator supervised cleanup operations conducted by the vessel's owners and contractors; the Regional Response Team was called out to coordinate federal, state, and local pollution response agencies; the Delaware River and Bay Cooperative and Tri-state Bird Rescue & Research, Inc., were alerted, as were EPA Region II and III and Interior Department officials, and experts from the National Oceanic and Atmospheric Administration. Creeks, shorelines, and environmentally sensitive areas were boomed off. Oil was pumped from the vessel's holds, and it was refloated. The Atlantic Strike Team arrived quickly. Bottom surveys were conducted.

However, there are some notable differences between the *Presidente Rivera* and *Grand Eagle* spills. Shortly after the *Presidente Rivera* accident, the vessel's master, river pilot, and crew submitted voluntarily to drug and alcohol testing. There is no evidence that the *Grand Eagle* crew underwent drug and alcohol testing. The *Grand Eagle* accident was attributed to a loss of propulsion—a mechanical failure. The *Presidente Rivera* investigation revealed that members of the crew mistakenly dropped the port anchor at the bow. The river pilot had asked the master to ready the anchor. That order was passed from the master, to the second officer, to the bow. Apparent miscommunication and anchor-mechanism malfunction resulted in the dropping of the anchor while the vessel was moving at a 6-knot speed, which forced the ship to turn out of the channel, causing it to ground, penetrating the hull.

Another notable difference between the two spills was the volume and heaviness of the oil. The *Presidente Rivera* carried oil so heavy it had to be heated before it could be pumped. This oil formed globules in the river that proved nearly impossible to pick up by skimmer but which could be picked up by pitchfork or shovel. Hundreds of workers picked up tar balls from the river and bank, among them 300 National Guardsmen mobilized by the governor of Delaware. Officials downgraded the volume of spilled oil and calculated at the end of the cleanup that 369,844 gallons of oil and oily debris had been recovered (an amount only slightly larger than that recovered in the *Grand Eagle* case). *Presidente Rivera* oil did not spread out as much as the more fluid *Grand Eagle* oil. Also, many more waterfowl died in the *Grand Eagle* spill than in the *Presidente Rivera* incident. Tri-State Bird Rescue & Research, Inc., cared for 128 birds during the *Presidente Rivera* incident, but only two died. There were no reports of significant waterfowl loss along the river.

Perhaps the greatest difference between the 1989 *Presidente Rivera* spill and the 1985 *Grand Eagle* spill is that the *Presidente Rivera* cleanup did not trigger an On-Scene Coordinator declaration of a limited federal emergency, as had the *Grand Eagle*. The Coast Guard On-Scene Coordinator supervised cleanup by the vessel owner's contractors and volunteers. Most oil contamination was north of Delaware Memorial Bridge; quantities flowing south of the bridge did not pose the threat to wildlife areas that the *Grand Eagle* spill had. Obviously, owners of the *Presidente Rivera* will face lawsuits for reimbursement of cleanup costs and claims filed by those who allege damage to their business or property. It does not appear that the *Presidente Rivera* litigation will be as protracted as that for the *Grand Eagle*. The environmental impact of the *Grand Eagle* spill was more destructive and more widespread than the environmental impact of the *Presidente Rivera* spill.

The management of each of these incidents did produce political fallout, much of it critical of oil spill emergency response. It may require new federal laws to reform government oil spill response and compel vessel owners and operators to exercise more caution, accident prevention, and vigilance for the protection of the Delaware Estuary and all our nation's waterways.

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