Pollution Control in the Coast Guard—Present and Near Future

COMMANDER WILLIAM E. LEHR USCG
Office of Research and Development
U. S. Coast Guard
Washington, D.C.

INTRODUCTION

HISTORICALLY, THE U.S. COAST GUARD has been involved in efforts to control water pollution for over 50 years. As the maritime law enforcement arm of the federal government, the Coast Guard is responsible for the enforcement of statutory regulations and international agreements governing maritime operations on the high seas and navigable waters of the United States. In this capacity it continues to enforce such antipollution legislation as the Refuse Act of 1899 and the Oil Pollution Acts of 1924 and 1961.

Other statutes under Coast Guard cognizance also have served to protect the water environment and benefit the public. These statutes are concerned with general vessel safety. Though they are not designed for pollution control, general vessel safety statutes such as the Dangerous Cargo and Tank Vessel Acts have resulted in fewer vessel casualties. Fewer vessel casualties have meant fewer polluting spills. Thus our performance under the safety statutes has reduced water pollution through prevention of spill incidents.

The TORREY CANYON catastrophe, off the coast of England in 1967, called attention to a needed new dimension in our antipollution activities. It caused a re-evaluation of the Nation's ability to cope with a massive pollution threat to our water environment. More recent major incidents such as the breakup of the SS OCEAN EAGLE in San Juan harbor and the oil well leakage at Santa Barbara have catalyzed our efforts as well as increased public and private awareness of the water pollution problem.

Following the TORREY CANYON incident, a joint Department of Interior and Department of Transportation study was undertaken to assess the national capability to deal with major pollution incidents. The results of the study focused on the problems involved in pollution control and recommended an action program to solve them. We have used this study as the primary planning base for the development of our maritime pollution control program.

The Coast Guard's pollution control program may be considered to consist of two phases. One phase is concerned with the chronic, small scale spills that occur during routine operations through personnel or equipment failure. The other phase deals with the problem of a massive accidental release of a pollutant.

Small scale spills

With regard to the chronic small scale spill problem, we recognize that the best method of control is to prevent the spill from occurring. We are studying causes of spills and will develop regulatory controls to reduce spillage to the minimum practical. Since an appreciable percentage of the discharges involve foreign vessels and since there are other multinational implications, interna-

tional coordination is required. International coordination is being accomplished through the efforts of the Intergovernmental Maritime Consultative Organization (IMCO). The Coast Guard is an active participant in IMCO as a United States representative. IMCO is studying the problems of casualty prevention, liability, control of released oil and pollution from industrial and other waste disposal sources. IMCO also has been assigned responsibility for revising the International Convention for the Prevention of Pollution of the Seas by Oil. A number of the IMCO resolutions have already been implemented by the Coast Guard and published as federal regulations.

The Coast Guard is continuing its emphasis on enforcement of the existing antipollution laws. Unfortunately, the existing antipollution laws have several deficiencies which make them difficult to enforce. However, legislation pending in the current session of Congress, and expected to be enacted in some form, will eliminate these deficiencies. The pending legislation would put teeth into the federal antipollution laws and more clearly define the role of the federal government in preventing and cleaning up spills of oil and other substances. Among important features of the legislation are: (1) provisions for the assessment of civil penalties against a spiller; (2) a requirement for an oil spiller to remove the spilled oil; (3) designating a spiller liable in large, but limited amounts, for the costs of government cleanup efforts, if he fails to remove a spill; (4) authority for the government, and probably the Coast Guard, to issue regulations concerning shipboard procedures and equipment to prevent oil spills and methods of cleaning up oil already spilled; (5) a requirement for a spiller to report spills to a designated federal agency with severe penalties for failures to comply and (6) authority for the government to take control of a vessel which presents an imminent and substantial pollution threat.

Also included in the proposed legislation is a section dealing with prevention of sewage pollution from vessel discharges. The Department of the Interior would set water quality standards for sewage discharges and the Coast Guard would certify shipboard sanitation devices which meet these standards.

Chronic spill research and development

In conjunction with the foregoing spill control efforts, two specific areas for research and development have been identified. These areas are concerned with the development of pollutant sensing devices and satisfactory shipboard sewage treatment equipment.

Research and development (R & D) in sensor systems and instrumentation has several objectives. The foremost of these is to improve Coast Guard law enforcement capability. Our first efforts are directed towards the development of an all weather, airborne oil detection system. At the present time we are limited to visual sighting of oil slicks, and are thus restricted to daylight, fairweather surveillance. An all weather, airborne system will permit full time detection and enforcement of antipollution statutes. Currently we are investigating the feasibility of various active and passive techniques that may be used to develop the remote sensor. As part of the investigation, we are conducting basic measurement programs in the ultraviolet, optical, infrared and microwave portions of the electromagnetic spectrum. Little fundamental data exists on the properties of oil films in regard to their response to these possible sensing techniques. Our studies will furnish the necessary fundamental data. When they are completed, the studies will be used to determine the most cost effective technique for subsequent prototype sensor equipment development.

We are also pursuing investigations into techniques for identifying the source of an oil spill. Too many oil spills are unreported by the spiller. Development of a viable identification method could eliminate the problem.

Over the past few years the Coast Guard has taken a special interest in the development of shipboard sewage treatment devices. Our shipboard sewage treatment R & D program is directed towards developing equipment which will eliminate unsanitary discharges as a possible source of pollution. Our objective is to provide lightweight, compact, simple to operate treatment devices for Coast Guard boats and ships.

We are now field testing an experimental 50-man sewage plant that represents several years of Coast Guard funded R & D. If it tests satisfactorily it may provide at least a partial solution to the sewage pollution problem. In addition we have undertaken R & D projects to provide treatment devices for small ships. These devices will be required to serve crews of 10 to 20 men. It is worth noting that the sewage treatment plants being developed for Coast Guard vessels are of a size that generally matches the crew requirements of several classes of commercial ships. Our work may thus have some applicability to industry.

Massive spill planning

Solution of the massive spill problem is being coordinated with other federal agencies through the National Multiagency Oil and Hazardous Material Contingency Plan, published in September 1968. The Departments of Interior, Transportation, Defense, Health, Education and Welfare and the Office of Emergency Preparedness are participants in the plan. The plan provides for the development of regional and local contingency plans, the designation of national and regional operating teams, and generally outlines the responsibilities of federal agencies. Under the plan the Coast Guard is designated to provide on-scene commanders in areas where most of the spills occur. This plan was in effect at the time of the Santa Barbara incident. As a result of our experiences in Santa Barbara it is now under revision. When promulgated, the revised national plan will give more detailed guidance concerning the responsibilities of the various response components, will include a detailed model plan on which the required regional plans can be based, and will institute a new reporting system. Under the revised plan the Coast Guard is still designated to take charge of operations as on-scene commander during the emergency phase of cleanup. However, a new response category will be defined to provide a logical point for transfer of on-scene command from the Coast Guard to another agency when cleanup activities shift from the water to the shoreline.

At this point it might seem as though the federal establishment will provide all of the resources to control a massive pollution incident. This is not the case however. Under the national plan, strong emphasis is placed upon utilization of local governmental and private capabilities. Procedures for the provision and coordination of state, municipal and industrial inputs to cleanup efforts will be contained in regional and local contingency planning. During the Santa Barbara spill the resources of the State of California, the City of Santa Barbara, and the oil industry as well as other federal agencies were coordinated by the Coast Guard on-scene commander. He was operating under the auspices of the regional contingency plan.

In general it is possible to state that the initial planning for the control and cleanup of massive pollutant spills has met some success. However, continued

effort is still needed to provide in depth, quality contingency plans throughout the country. The Coast Guard is helping to develop them.

Oil pollution R & D

Although we have had considerable success in some of our on-scene control operations, there are a number of problem areas associated with our pollution control efforts. Normally the on-scene commander fulfills a command, coordination and control function. However, during recent major spill incidents, the Coast Guard has become increasingly involved in the actual cleanup operation. This is a natural development in view of our involvement in federal maritime law enforcement and our general responsibility for the protection of life and property in the maritime region. Furthermore, we usually have a variety of personnel, vessels and aircraft immediately available for deployment at the spill site.

Unfortunately equipment presently available for oil spill cleanup is ineffective in the coastal high seas environment. We have therefore undertaken an extensive R & D program to solve the high seas cleanup equipment problem.

General guidance for our R & D efforts has been derived from the R & D recommendations contained in the report of the Secretary of Transportation and the Secretary of Interior to the President of February 1968.

The Coast Guard is coordinating its oil pollution R & D effort with other federal agencies so that duplication will be avoided. Coordination is being achieved through participation in a research and development task group established under the contingency plan previously mentioned. The Coast Guard's Office of Research and Development is a member of the task group. At this time a working level agreement concerning areas of endeavor has been achieved. Our research and development program is tailored to meet Coast Guard responsibilities under this agreement. In simplified form we have agreed to develop detection, cleanup and control equipment for use in the coastal high seas region.

We are also maintaining close liaison with various oil industry task groups set up under the auspices of the American Petroleum Institute. These task groups are concerned with industry wide contingency planning and the conduct of oil pollution control R & D. Through coordination with the R & D task group both of our efforts are complementary and mutually supporting.

We have developed a three-step multiyear program to meet our R & D objectives. The three steps are prevention, or minimization of the size of a spill, containment of spills in reasonably small areas and pickup devices to remove contained oil. Each of these steps is related to the others and when achieved will provide a total cleanup and control capability.

In our efforts we are being guided by several basic tenets. All equipment systems must provide maximum compatibility with existing Coast Guard equipment. They must also furnish maximum response capability. That is the systems must be quickly and easily deployable by aircraft and local Coast Guard units. Additionally, all new systems must be mutually supporting. In this way the required quantities of pollution control equipment will be minimized.

During the past year emphasis was placed on the first step—prevention or minimization of uncontrolled release of oil from damaged tank ships. The most advantageous means to eliminate a massive oil spill is to prevent its uncontrolled release. Therefore design and development of a prototype of a special air delivered transfer pumping and storage system was undertaken.

This system will permit unloading 20,000 tons of crude oil per day from a damaged tanker to temporary storage containers. For comparison purposes 20,000 tons of oil is roughly equivalent to the cargo capacity of a T-2 tanker, or a single cargo tank in present day super tankers. The system is self-sufficient containing pumps, pump prime movers, and transfer hose as well as temporary storage containers. Furthermore all system components are packaged and rigged for air delivery direct to a wreck site. The key components in the system are special 500-ton temporary storage containers. These containers are collapsible when empty and require only a 14-foot by 8-foot by 8-foot volume. When fully loaded, the containers will be 140 feet long, about 30 feet wide and 10 feet in height. The system will be capable of performing in 12-foot seas and 40-mph winds. Component equipment tests are now being completed and delivery of a reduced capacity prototype is scheduled for late November 1969. At that time full scale testing and evaluation of the prototype system will be carried out under adverse sea conditions. The feasibility of the system should be proven within the next few months.

Significant progress has also been made with regard to the second step of the R & D program. The second step concerns the development of oil spill containment devices for use on the high seas. Past experience with massive oil spills indicates that spilled oil must be confined to a small area as quickly as possible. If it is not confined, oil will rapidly spread, creating a thin film over a wide region. Once the oil forms a thin film, cleanup operations at sea are not feasible. Some kind of rapidly deployed containment system is therefore required.

During the past year necessary background work was undertaken to support subsequent prototype hardware design and development. In-house studies to develop performance criteria and operational requirements for high seas containment systems were completed. Another critical research effort is in its final stages. This effort is a contracted design study which will furnish theoretical data, verified by model test, of the stress levels that may be expected under various conditions of sea, wind and current. The results of the study will be used to form design criteria regarding required strength in containment system development.

We are currently negotiating for the award of contracts to carry out the preliminary design and development of the containment systems. Two types will be developed. One system will be lightweight and easily deployed. It will furnish the quick response capability needed in ship type accidents. Design goals for the lightweight system include: (1) deployment on-site within 4 hours of a potential spill incident, (2) perform as an efficient container device in seas of 5 feet and 20-mph winds and (3) maintain physical integrity in seas to 10 feet and winds to 40-mph though not necessarily effectively containing oil.

The other system will be a heavy duty, high seas system. Its primary utility will be for Santa Barbara type incidents. The design goals for the heavy duty system include: (1) capable of long term emplacement at sea, (2) perform efficiently as a containment device in seas of 10 feet and 40-mph winds and (3) maintain physical integrity in seas of 20 feet and winds to 60-mph though not necessarily effectively containing oil.

We will use a two stage development plan for both types of containment systems. The first stage will consist of a concept development and preliminary design competition. When stage one is completed, the best of the preliminary designs will be carried forward to stage two: detail design, prototype construc-

tion, test and evaluation. It should be noted that we are requiring each concept to be for a complete system. That is, each concept must provide for delivery on-site, emplacement, maintenance and ultimate retrieval as well as design of the basic containment device. Completion of stage one concept development is scheduled for early summer 1970. Completion of stage two, and establishment of the feasibility of the prototype systems, is scheduled for completion by the summer of 1971.

The third step in the oil pollution control R & D program is concerned with the development of oil recovery equipment suitable for high seas use. The provision of high capacity recovery equipment is a necessary adjunct to high seas containment systems. At the present time background studies concerning various types of pickup techniques, as well as the physics of oil films as it affects various pickup schemes, are underway. In addition investigations concerning the availability of vital ancillary recovery equipment components are in progress. To be successful, a high seas recovery system must contain adequate temporary storage facilities and high capacity oil water separators as well as pickup devices. We believe the containers developed for the air delivery transfer pumping and storage system will furnish needed temporary storage. The availability of suitable high capacity separators remains to be proven however. In any event, design and development of a high seas recovery system is scheduled to commence next spring. Delivery of a feasible prototype is scheduled for the spring of 1972.

We should then have developed a total cleanup capability to combat massive oil spills in the coastal high seas area.

Our R &D program also includes evaluation of other control techniques which have some potential for providing viable oil spill cleanup capability. These special techniques include sinking agents and special absorbents, coagulants or other chemicals. If they can be developed, and proven ecologically safe, these techniques may provide highly acceptable oil slick disposal methods under certain circumstances.

CONCLUSION

In summary the Coast Guard is carrying out a multifaceted attack on the maritime water pollution problem. Continued emphasis on law enforcement, international coordination and contingency planning will result in significant reductions in the number of maritime water pollution incidents. Further, successful completion of our R & D program will furnish the equipment necessary to combat the pollutant spills that do occur.