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Emergency Spills Research Strategy 1980-1984

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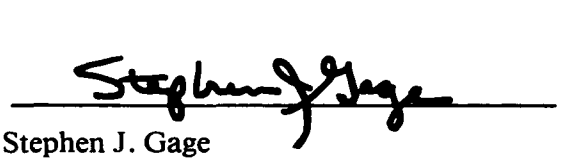
Prepared jointly by:
Office of Water and Waste Management
and
Office of Research and Development

U.S. Environmental Protection Agency
Washington, DC 20460

Preface

Beginning in 1977, the Environmental Protection Agency (EPA) undertook a comprehensive review of its research planning and management and reported its findings to the Congress, submitting *The Planning and Management of Research and Development* in June, 1978. To address some of the problems identified, a pilot project was initiated to examine the feasibility of planning research and development programs by committees representing the Agency's primary organizational elements. This project was the first attempt within EPA at a major joint planning effort between its research, regulatory, and operational components. Research committees were formed to plan programs in five areas—drinking water, industrial wastewater, pesticides, mobile source air pollution and particulate air pollution. Each committee was co-chaired by the Office of Research and Development (ORD) and the appropriate regulatory organization—the Office of Water and Waste Management; the Office of Air, Noise and Radiation; or the Office of Pesticides and Toxic Substances.

The Municipal Wastewater and Spills Prevention Research Committee was established in mid-1979 and charged with the responsibility, among others, to develop a research and development strategy for oil and hazardous materials spills and municipal wastewater. In view of the considerable differences between the technologies and Agency focus for municipal wastewater and spills, the committee decided to develop two strategies, one for Municipal Wastewater R&D and one for Spills Prevention R&D. This document deals only with the latter. The strategy reflects the current perspectives of Agency research requirements and research capabilities. The document will serve as the basis for detailed planning in those ORD laboratories implementing research on emergency spills prevention and control. To be properly responsive to evolving regulatory priorities and emerging scientific finding, however, the strategy will be subject to at least one annual revision, in concert with EPA's planning and budgeting cycle.



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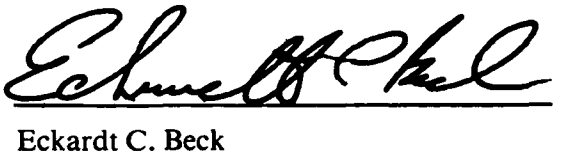

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1.0 Executive Summary

This paper presents the results of the planning efforts of the EPA Municipal Wastewater and Spill Prevention Research Committee on emergency spills research and development required by the Agency. In order to be responsive to the needs of the Agency, the committee includes representatives from the Office of Research and Development, Office of Water and Waste Management, Office of Enforcement, Office of Toxic Substances, Office of Planning and Management, EPA Regions I, II, and V, and the various ORD laboratories.

The research strategy addresses the prevention and control of the spillage of oils and hazardous substances. Coordination with the Solid Waste Research Committee has been maintained throughout this effort to establish areas of responsibility for R&D historically performed through the solid waste decision unit. Responsibility for uncontrolled waste site R&D is in the solid waste decision unit. A decision was made between these two committees, with program office concurrence, to place responsibility for risk assessment and incineration at sea R&D in the purview of the Solid Waste Committee also. This affects program planning for fiscal year 1982.

The purpose of the emergency spills R&D program is to provide technical information to prevent the release of oil and hazardous substances to the environment and to mitigate the environmental effects of such a release. Specifically, the program concentrates on the development of technology and techniques for preventing, controlling, removing, and ultimately disposing of oil and hazardous substances released to the environment. It also provides an assessment of the ecological and health impacts from such a release, and technology and techniques for the restoration of the environment.

The scientific activities needed by the program offices, as provided by their committee representatives, are described in three program areas: hazardous substances spills, oil spills, and monitoring systems and quality assurance.

The objective of the R&D performed under the monitoring systems and quality assurance program element is to provide specialized analytical support, overhead monitoring, chemical and biological laboratory field support, and quality assurance to the investigations of spills. These technical services will be available for emergency support, as well as cleanup and enforcement activities. The ORD activities in this area utilize a limited number of in-house experts, supported by contracts and interagency agreements, to offer unique capabilities to the program and regional offices.

The objectives of the R&D performed under the oil and hazardous substances spills areas are to develop, evaluate, and demonstrate new or improved equipment, devices, and systems for the prevention, detection, identification, containment, control, and removal of oil and hazardous substances released to the environment. The development of this hardware is carried beyond the prototype stage to the point where it is ready for field implementation by the commercial community. The program also defines techniques for the redevelopment and restoration of ecosystems that have been biologically damaged as a result of pollutant releases. The methodology for mitigating the effects of these releases is also identified.

The ORD resources allocated to the emergency spills R&D program were $2,472,000 and 16 PFT in fiscal year 1980. The resources requested in the fiscal year 1981 budget are $2,799,500 and 16 PFT. Present plans call for a small increase in funding for 1982 and subsequent years. The additional funding and personnel will be programmed primarily to hazardous substances spills R&D. This is in line with the established priorities of the Agency and the needs of the program offices.

2.0 Introduction

This paper presents the results of the planning efforts of the EPA Municipal Wastewater and Spill Prevention Research Committee on spills research and development required by the Agency. The committee includes representatives from the Office of Research and Development, Office of Water and Waste Management, Office of Enforcement, Office of Toxic Substances, Office of Planning and Management, EPA Regions I, II, and V, and the various ORD laboratories.

This research strategy addresses the spillage of hazardous substances and oils. The National Contingency Plan promulgated by the Council on Environmental Quality (CEQ) under the mandate of the Clean Water Act requires EPA and the U.S. Coast Guard to respond to spills as defined in the Act. EPA is responsible for the containment and cleanup of spills of oils or hazardous substances in or proximate to (so as to endanger) the waters of the U.S. in inland areas, while the Coast Guard has the responsibilities for coastal areas and the Great Lakes. The dividing line between agency jurisdictions is specifically defined in Regional Contingency Plans. Because of the broad applicability of the legislative definitions and the similarity of response, the EPA program offices have included the response to uncontrolled waste sites in their planning for oil and hazardous substances spills response. Uncontrolled waste sites containing hazardous materials which pose an immediate threat to the health and welfare of the public are not addressed in this strategy except to mention areas of possible technology transfer from the spills program.

The spill problem in the U.S. is enormous. The actual annual number of spills in the U.S. is difficult to assess, although it is estimated that it is well in excess of the 15,000 spills reported. Vast sums of money and manpower are being expended throughout government and industry in an effort to prevent spills and, when they occur, to minimize environmental degradation. A spill generally contaminates all three environmental media—the air, land, and water—whenever a spill occurs. The problems are extremely diverse, involving a multidimensional matrix of thousands of substances and mixtures, volume spilled, location and condition of the spill site, and weather. The number of spills requiring response action is expected to increase because of: 1) the increasing quantity of hazardous materials being handled, and 2) the recently promulgated regulations requiring that spills of hazardous substances be reported.

The Agency does not have sufficient manpower or equipment to respond to all these spills. It is anticipated that the use of contractors for spill removal will continue into the indefinite future. Also, state participation is expected to increase as public pressure demands immediate action at the scene of a spill and, in fact, state response personnel often arrive on the scene prior to EPA due to travel time. However, the Federal Water Pollution Control Act (FWPCA) requirement to provide an On-Scene Coordinator (OSC) at a spill site cannot be delegated. Therefore, qualified personnel must be available to perform this very necessary response function. In areas of EPA jurisdiction, it is the headquarters program office, in coordination with the EPA Regional Offices, that is required to pro vide this on-scene support.

In the past, the OSC has found that expertise in state-of-the-art spill technology is available at the ORD research laboratories. These laboratories have developed equipment and techniques specifically designed to assist the OSC at a spill. Much of this equipment has been thoroughly demonstrated and is now commercially available.

The task of this research committee is to recommend the direction of the future R&D program in the area of spill prevention, response, and assessment. This document analyzes each of these areas and recommends an allocation of Agency resources to perform the proposed R&D.

3.0 Organization

The Office of Research and Development (ORD) program for spills is administered primarily by two offices. The Office of Environmental Engineering and Technology (OEET) is responsible for the majority of spill response-related R&D, while the Office of Monitoring and Technical Support (OMTS) is responsible for aerial surveillance and quality assurance. Additional spill-related R&D is administered by the Office of Health Research (health effects) and the Office of Environmental Processes and Effects Research (ecological effects). Each program is described separately and all are necessary to ORD support of the program offices: the Office of Water and Waste Management (OWWM) and the Office of Enforcement (OE). The OEET administers the oil spill and hazardous substance spill program under two separate decision units. Under the research committee system of program planning, former decision units have been consolidated under the committees for fiscal year 1982. The oil spills and hazardous substances spills programs will remain in two decision units, energy and nonenergy, that include monitoring systems and quality assurance, and risk assessment R&D.

The third portion of the spills R&D program is administered by the Office of Monitoring and Technical Support (OMTS) and provides the program offices with aerial surveillance and support which they consider absolutely necessary in the performance of their obligations under Section 311 of the Federal Water Pollution Control Act (as amended). Additional monitoring systems and quality assurance R&D is not oriented toward spills at this time but rather is directed toward measurement of the consent decree pollutants. The benefit to the spill program is indirect in that 122 of the 299 designated hazardous substances are also consent decree toxic pollutants. Also, the quality assurance program is expected to expand in the future to analytical methods for industrial discharges.

Health effects R&D is currently administered by the Office of Health Research. No current work is specifically directed toward spills or emergency response. Current spills-related R&D is directed toward determining the health effects of contaminated drinking water and the health impacts of wastewater treatment and sludge management. Because spills can and do contaminate drinking water, this research is indirectly related to spills. The results of this type of research are available to the On-Scene Coordinator through the Office of Drinking Water's "Suggested No Adverse Response Level" (SNARL) System.

Ecological effects R&D is administered by the Ecological Effects Division of the Office of Environmental Processes and Effects Research under several decision units. None of these specifically address the effects of spills. However, several are indirectly related in a manner similar to the health effects R&D. The ecological effects program includes effects of toxic substances in fresh and marine water. Bioassay R&D for aquatic toxicity may be of assistance in decision making in the use of dispersants, determining the point of termination of cleanup efforts, or for designating substances as hazardous. This office is responsible for the ongoing aquatic monitoring program called "Mussel Watch." The data from this program may be useful as a baseline, prespill assessment of the spill environment.

Research and development efforts directed toward finding a solution to the problem of uncontrolled waste sites is administered from the solid waste decision unit. This decision unit includes all the Agency R&D efforts in solid waste: municipal, mining, and industrial. These efforts are in direct support of the program office requirements to meet the legislative mandates of the Resource Conservation and Recovery Act of 1976 (RCRA) and include a comprehensive health and ecological risk assessment R&D program. Because initial response to uncontrolled hazardous waste sites is similar to spills response, the Municipal Wastewater and Spill Prevention Committee is closely coordinating R&D planning efforts with the Solid Waste Research Committee.

4.0 Research Plan

This section presents the recommended research and development plan for oil spills and hazardous substance spills for the period fiscal year 1980 to 1984. The format of the section highlights specific problems that have been identified by the program offices and ORD and then presents the proposed ORD support in the problem area. The order of discussion of the program does not indicate priorities but rather follows a logical progression of analyzing a spill situation. The program presented here does not specifically address the problems at uncontrolled waste sites. This area is considered in the solid waste research strategy. The fact that the use of many of the techniques and guidelines being developed for spill response will be useful to the program offices and to the response personnel at these sites has been recognized by both research committees.

Background

EPA is required to perform three functions dealing with emergency spills under the mandate of the Federal Water Pollution Control Act (FWPCA), as amended, and the National Contingency Plan promulgated under its authority:

- promulgate regulations and guidelines for the prevention, designation, control, removal, and disposal of oil and hazardous substance spills
- provide enforcement of these regulations and the penalty provisions of FWPCA
- provide On-Scene Coordinators (OSCs), specially trained and equipped, to monitor and advise in the control, removal, and disposal of spilled materials and restoration of areas damaged by the release of oil or designated hazardous substances

ORD has provided support to the program offices to meet these legislative mandates since FY 70.

EPA has promulgated regulations under the authority of Section 311 of the FWPCA dealing with the spillage of oil or hazardous substances including the spill prevention, control and countermeasure (SPCC) requirements (40CFR112), the designation of hazardous polluting substances (40CFR116), the determination of reportable quantities of hazardous substances (40CFR117), and the penalty provisions for discharges (40CFR114). The Office of Research and Development (ORD) has supported the program offices in the past by providing data to substantiate these regulations. Examples of how ORD support is reflected in regulations include an historical analysis of spill accidents to determine where SPCC requirements would be most effective, and the use of aquatic toxicity data supplied by the ORD Environmental Research Laboratories at Narragansett, RI, and Gulf Breeze, FL, to determine what substances are to be designated as hazardous.

In addition to regulations, EPA has prepared guidelines to assist both industry and government to plan for and respond to spill situations. These guidelines are prepared by ORD at the Oil and Hazardous Materials Spills (OHMS) Branch (Edison, NJ) of the Municipal Environmental Research Laboratory (MERL) at Cincinnati, OH, as well as the Environmental Monitoring and Systems Laboratory at Las Vegas, NV. The guidelines provide suggested methods for responding to, clean up of, and mitigation of effects of spills. ORD also provides support at the scene of a spill by offering technical assistance personnel for on-site response, cleanup, aerial surveillance, analytical support, and mitigation.

The development of new techniques and equipment has traditionally been an ORD function in support of the program offices and industry in general. These developments enhance the solid technical data support for regulations by providing industry with newly developed technologies. Industry acceptance of these technologies for commercialization is one objective of the federal R&D program. The oil spill and hazardous substance spill program has an excellent record in this regard.

Past Successes

There are a number of technologies that have been developed by ORD for use in the event of a spill. Many of these technologies have been developed and demonstrated, some have been made commercially available by industry or private contractors. Table 1 lists the spills equipment developed by ORD, including equipment available for field use from industry or private contractors.

There are additional, one-of-a-kind devices that are ready for field use. This equipment has been developed by ORD but has not yet been commercialized by the private sector. All these devices are currently available to an OSC on request, often accompanied by technical assistance from the Environmental Emergency Response Unit (EERU). The EERU is a concept originated at the MERL that was designed to form a model nationwide spill response and control capability for situations where the use of complex cleanup equipment and techniques are involved. The EERU, a group of contractor and EPA personnel, has capabilities for the shakedown and field demonstration of prototype equipment and techniques that have been developed under EPA sponsorship and direction by various grantees and contractors. The following equipment, on standby and ready for field use, is in addition to the prototypes of the units available commercially. This equipment is also listed in Table 1.

Table 1
Spill Technology Developed by ORD

Commercially Available

- Mobile physical/chemical treatment system using granular activated carbon (built by O.H. Materials, Inc., Findlay, OH)
- Cyclic colorimeter for detection of heavy metals in water (marketed by Calspan Corp., Buffalo, NY)
- Hazardous materials detection kit to detect and monitor the location of chemical spills in water when the identity of the chemical is known (marketed by Hach Co., Ames, IA)
- Organo-phosphate pesticide detection and warning system (manufactured by Midwest Research Institute, Kansas City, MO)
- Foam dike system which provides an "instant dike" from a portable backpack apparatus for the emergency containment of spilled hazardous substances (marketed by MSA Research Corp., Evans City, PA)
- Acoustic emission earth dam spill alert device, a passive device for determining the stability of earthen dams containing hazardous chemicals (supplied by two U.S. firms and a British firm)
- Dynamic inclined plane skimming system—a vessel for removing spilled oil from choppy harbor waters at 2 knot currents (marketed by J.B.F. Scientific Corp., Burlington, MA)

Field-Tested Prototype

- Mobile Chemical Laboratory—consisting of a sophisticated complement of instruments (GC, IR, AA, etc.) for performing analyses at oil spills and chemical emergency situations in remote field locations
- Spill Assessment Laboratory—consisting of a self-propelled laboratory, equipped to perform in-field treatability studies for cleanup of hazardous material spills and industrial dumpsites
- Safety/Decontamination/Office Trailer—a mobile field office and safety station to provide office space for the EPA On-Scene Coordinator at a cleanup, a storage location for safety and communications equipment, and emergency shower for spill site personnel
- Mobile Stream Diversion System—a trailer-mounted pumping and piping system for the diversion (up to 3000 feet) of small (up to 12.5 CFS) streams that have been contaminated by spills for the purpose of isolating the contaminated segment of the stream to facilitate cleanup operations
- Mobile Froth Flotation System—a trailer-mounted froth flotation system to clean oil contaminated beach sand
- Pump/Collection Bag System—a pallet-mounted emergency collection bag and pumping system, consisting of a 7000-gallon furled teflon-coated urethane bag and battery-powered or explosion-proof gasoline motor-driven pumps, for temporarily storing spilled hazardous chemicals
- Gelling Agent System—a trailer-mounted multi-purpose gelling-agent system for solidifying and immobilizing spilled hazardous liquids and preventing their penetration through the soil into groundwater supplies
- Spill Alarm System—an in-stream warning system consisting of a number of individual probes and sensors (TOC, conductivity, UV absorption, etc.) for the continuous detection of a broad variety of spilled hazardous materials in water
- Enviro-pod Aerial Monitoring and Surveillance—a compact reconnaissance system designed to be secured to a widely available aircraft to provide vertical and forward-looking photographic images to high resolution
- Water Jet Boom System—a system capable of moving spilled oil horizontally relative to the water it floats on (even in the presense of waves) for either diverting the oil in high water currents or increasing the effective encounter width of skimming equipment
- Oil Dispersant Application System—a system of port and starboard spray booms and associated pumps, hoses, and fittings, designed to be installed on a vessel for the application of oil-dispersing chemicals to an oil spill at a rate of 268 acres per day
- Mobile Decontamination Station—a semitrailer van designed to support the personnel decontamination needs of cleanup activities involving highly toxic materials

Prototype Undergoing Operational Testing

- Powdered Activated Carbon System—a mobile physical/chemical treatment system designed to use powdered carbon, and including provision for flash mixing with chemical addition, flocculation, settling (with sludge dewatering), mixed-media filtration, and associated support equipment
- Mobile Carbon Regenerator—a mobile carbon reactivator system, designed for field use in reactivating carbons used on environmentally sensitive compounds such as Kepone, dioxin, or PCBs which cannot be either transported or commercially reactivated; system consists of kiln, fume incinerator, quench section, and scrubber section
- Mobile Soils Grouting/Detoxification System—a soil treatment system designed to inject grout, chemicals, or microbiological materials into soils for the purpose of reducing groundwater movement or in-place washing or detoxification of soils that have become contaminated with spilled hazardous materials or leachates from uncontrolled industrial waste sites

Under Development

- Mobile Incinerator—a system consisting of three semitrailers equipped with a rotary kiln, an afterburner and an air pollution control train for the incineration of toxic organic compounds
- Mobile Soils Washing System—a soils cleaning system designed to separate spilled PCBs or other compounds from soils on-site

In addition, there are three prototypes undergoing operational testing that will soon be ready for field use. These devices are listed in Table 1. These include a powdered activated carbon system, a mobile carbon regenerator, and a mobile soils grouting/detoxification system.

Finally, equipment for spill control, removal, and disposal that are currently under development include a mobile incinerator and a mobile soils washing system. The mobile incinerator is a prototype system for the incineration of compounds such as Kepone or dioxin at spills or uncontrolled hazardous waste sites; the system consists of three semitrailers equipped with a rotary kiln, an afterburner, and an air pollution control train. The mobile soils washing system is a prototype system designed to separate spilled PCBs or other compounds from soils at the scene of spills and at uncontrolled waste sites.

In addition to the field use equipment, procedures, and guidelines, there are two fixed facilities, administered by MERL, that have been proven to be successes: the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) and a highly sophisticated analytical laboratory facility. OHMSETT, located near Edison, NJ, is the major fixed facility of the spills program. It consists of a pile-supported concrete tank with surface dimensions of 667 feet long and 65 feet wide, filled with water to a depth of 8 feet. It provides an environmentally safe place to conduct testing and development of devices and techniques for the containment and cleanup of spilled oil and hazardous pollutants. The facility has been used by EPA, the Coast Guard, Navy, Army, Department of Energy and others, including the recent testing of Russian equipment.

The analytical laboratory provides an in-house capability for conducting studies to develop and evaluate methods and techniques for the identification, detection, and quantification of spilled oil and hazardous substances. The laboratory is also used to conduct pilot plant studies on small-scale models of full-scale field cleanup equipment. Examples of the past successes with this laboratory are the following new analytical methods and procedures developed to provide quick response to the immediate needs of response personnel in the field. These analytical methods are effective and essential during emergency incidents but are not official or approved EPA methods:

- a new technique for monitoring parts per million (ppm) levels of hazardous substances by nuclear magnetic resonance spectrometry
- an improved technique for polychlorinated biphenyl analysis by gas chromatography
- a new fluorescence spectroscopic method for the direct quantification of hazardous materials in water
- an analytical method for differentiating between synthetic and petroleum-derived automotive lubricating oils
- a new method for the rapid quantification of petroleum oils and hazardous materials in sediments by synchronous excitation fluorescence spectroscopy

The aerial surveillance program operated from the EPA Environmental Monitoring and Systems Laboratory (EMSL) in Las Vegas, NV, is also supported by the ORD spills program. This program provides on-scene personnel with aerial photographs and analyses from contractor aircraft and Environod support by the laboratories at Las Vegas, NV, and the Environmental Photographic Interpretation Center, Warrenton, VA, within 6 to 24 hours of a request. This assistance, particularly in the event of spills that preclude the entry of personnel because of hazardous conditions or terrain, is considered invaluable to the program offices and regions. In addition to the operational uses, this highly visible program is used to inform the media as well as Congress and other federal, state, and local authorities. It is used by the Office of Enforcement in case preparation and evidence as well as by the Office of Water and Waste Management for spill prevention, response, and analysis, and locating and evaluating uncontrolled waste sites. Aerial photography is also used by the Office of Environmental Review in reviewing impact statements. This very versatile tool in the ORD spill program requires additional refinement to improve its capabilities even further by developing a real-time television and a thermal infrared capability in addition to the present photographic capability.

There are numerous other pieces of equipment and laboratory procedures that have been developed for the EPA spills program. Each piece of equipment has been developed to serve a specific purpose for a particular problem, and when taken as a group, can provide the OSC with broad coverage at most spill events. This does not mean that the problems the program offices and Regional Offices face have been solved. There are many problems that require further analysis. The next portion of this background section describes the resources which have been used to develop this equipment and also outlines the current spills program.

Current Spills Program

The current R&D program for oil and hazardous substance spills was designed to develop, evaluate, and demonstrate new or improved equipment, devices, and systems for the prevention, detection, identification, containment, control, removal, cleanup, and recovery of spills or acute releases of oil and hazardous polluting substances. The development of hardware and techniques is carried beyond the prototype stage to the point where it is ready for field implementation by the commercial community. Techniques are being developed for the redevelopment and restoration of ecosystems that have been biologically damaged as a result of spills, and methods for mitigating the effects of discharges are being identified. The objective of the spill program is to demonstrate technology for protecting the water,

land, and air from accidental releases and for identifying environmentally sound methods for the disposal of contaminated wastes associated with cleanup operations.

The recent increased emphasis on spills of hazardous substances is reflected in the program budget by the relative funding in the oil spill and hazardous substance spill areas. The needs of the Agency are not reflected in the total spill program budget, however, since the FY 79/80 budget is at an all-time low at a time when the Agency has assigned the highest priority to emergency spill response activities. Table 2 shows the historical resource levels of the spill program separated into three parts: hazardous substance spills, oil spills, and surveillance and analysis. The program offices have expressed their requirements in these areas and they believe it is imperative that the program support be continued.

Hazardous Substance Spill Program

The Agency hazardous spills R&D program supports three functions of OWWM and OE:

- promulgation of regulations for the prevention, control, and removal of spilled oil and designated hazardous substances
- development of guidelines and technologies for the control and removal of spilled substances and demonstration of their effectiveness
- enforcement of the regulations

In addition, the efforts expended in support of the Oil and Special Materials Control Division (OSMCD) fill an important gap in technology and protocol that the Regional Offices and the states need for response and enforcement action in the event of a spill. The Office of Solid Waste (OSW) will also benefit from this program, as many of the technologies developed can be used in the Agency response to uncontrolled waste sites. Although the responsibility has been transferred to OSMCD from OSW, new techniques for sampling, monitoring, and preventing leaching will be required to substantiate the regulations promulgated by OSW under the authority of the Resource Conservation and Recovery Act of 1976. The areas of need in the hazardous substance spill program encompass: information transfer, prevention, prespill response planning, spill site safety, spill assessment, containment and confinement, separation and concentration, fate and effects, and restoration. Specific program office needs in each of these areas will be discussed in the following paragraphs.

Spill Information Transfer and Prevention of Hazardous Substance Spills

The OWWM has requested ORD assistance in the following areas of information handling and spill prevention, particularly in the pesticide application, chemical manufacturing, transportation, and waste disposal industries:

- determine the causes of past spills
- determine the feasibility and cost-effectiveness of spill prevention through risk analysis
- develop spill prevention techniques and equipment
- provide aggressive, credible information transfer through shakedown and demonstration of field usable R&D techniques and equipment

The best method of reducing the impact of hazardous substance spills on the environment is to prevent the spills from occurring. An historical examination of accidents can indicate operating procedures

Table 2
Spill Program History of Resources

	Fiscal Year							
	73	74	75	76	77	78	79	80
Oil Spills Program								
extramural[a]	1720	2054	616	1933	1305	833	563	310
in-house[b]	400	400	400	400	400	600	400	274
PFT[c]	8	8	6	6	6	4	4	4
Hazardous Substance Spills Program								
extramural[a]	1104	988	955	2065	1452	1092	1135	1150
in-house[b]	300	300	300	300	300	410	470	303
PFT[c]	4	5	5	6	6	7	7	7
Subtotal ($K)	3524	3742	2271	4698[e]	3457	2735	2568	2037
Surveillance and Analysis								
in-house[b,d]	not available				250	250	250	435
PFT[c]					3	3	3	5
Total ($K)	3524	3742	2271	4698[e]	3707	2985	2818	2472
PFT[c]	12	13	11	12	15	14	14	16

[a] *Dollars in thousands*

[b] *Estimate*

[c] *Professional, full-time personnel working directly on spill program*

[d] *No extramural budget. Anticipate support to be on reimbursable (Section 311k) basis*

[e] *Includes transition quarter (5 quarters in FY 76)*

and equipment that led to the accident and can be analyzed for the means of reducing the probability of having a similar accident in the future. A portion of the ORD spill program is dedicated to the development of technology to reduce the number and severity of hazardous spill incidents. The Department of Transportation has promulgated regulations directed toward the safe transportation of hazardous materials. The EPA program should develop technologies and protocols for increasing safety at impoundment areas, plants, loading sites, and storage facilities. The Agency also should maintain close coordination with the Department of Transportation to improve safety and reduce accidents during the transportation of hazardous substances.

The output of the prevention portion of the hazardous spill program will be used by manufacturers and users of hazardous chemicals to select and install fail-safe level gages, transfer lines, etc., and will allow government and industry to more readily recognize spill-prone situations. This research will also provide the basis for mandated federal regulations on spill prevention. The recommended program for FY 80-85 for the prevention of hazardous spills includes a progressive program to first statistically analyze historical spill data and then, utilizing the results of this analysis, develop and demonstrate fail-safe devices for the prevention of spills in the areas of greatest benefit. The analysis will take into consideration not only the probability of occurrence, but other aspects such as frequency, cause, volume, and cleanup cost as well.

A similar approach will be taken to analyze the chemical manufacturing, transportation, and waste disposal industries to ascertain the areas of greatest cost-effectiveness for chemical and waste handling technology. The results of this analysis will be used to establish priorities for the development of prototype spill prevention techniques and equipment for these industries.

In the area of pesticide application, ORD expects to complete a report on the prevention and control of spillage from aerial and ground applications of pesticides in FY 80. This report will provide the background information for establishing guidelines for industrial users of pesticides.

A unique feature of the hazardous spills program, and one designed to aggressively implement tranfer of technology from the R&D community to the commercial user community, is the shakedown and demonstration of new equipment and techniques developed for improved control of hazardous material spills. As mentioned above, the development of new technology is carried from the concept stage, through prototype or technique development, to the final stage of field use or commercialization. Frequently, devices and techniques are developed by research organizations with limited field experiences, but strong scientific and engineering backgrounds. Such new developments may require modifications to be actually "field-usable." A specific step is now being provided by the EERU, described above, to "shake down" prototype equipment and experimental techniques at actual spill situations. This shake down permits the Agency to gain firsthand experience in the new approach before EPA represents to the user community that an improvement is actually available. EERU represents a transition between a device undergoing development and one which is "operationally ready" or available for potential commercialization. The shakedown and demonstration activities of EERU, coupled with the extensive technical assistance activities of OHMS Branch personnel, provide OWWM with a continuous flow of credible new technologies. In addition, OWWM gains a technically sound basis for response to and control of unusual and nonroutine spill situations.

The above research and development has a goal of providing the program offices with technical information that will eventually lead to the promulgation of guidelines for establishing a "standard of care." This particular phrase encompasses not only spill prevention, but control, removal, and site restoration as well. The guidelines will provide the OSC with a scale to assess the efforts made by a spiller when the OSC must make a recommendation for enforcement action and the assessment of penalties. At the same time, these guidelines will provide an incentive for a potential spiller to expend his best efforts at using state-of-the-art measures to prevent spills, clean up after a spill, and restore the spill site.

Prespill Reponse Planning, Safety, and Spill Assessment

This portion of the hazardous spill program deals with the development of techniques for effective initial response to, and management of, spills. The program offices have requested ORD support in the following areas related to initial response and management:

- prespill response planning
- protection of response personnel
- spill identification and detection
- impact prediction: air, surface water, groundwater, and land

Past successes by ORD have resulted in commercially available detection and identification kits and a personal protective clothing ensemble. Additional work is required to ensure that rapid notification and proper response is made to any spill. The rapidity of effective response has a direct bearing on controlling the severity and extent of a spill incident. Effective response to hazardous material spills by personnel first-on-scene is most often the result of strong prespill planning and coordination. Further, at the time of the spill, responders need quick, accurate information on what was spilled and on the type of personal protection required. Experience shows that dependence on bills of lading and placards is frequently misleading and often dangerous. Firemen and emergency personnel who first respond to spills, officials who assess information and issue warnings and alerts, and cleanup and response crews will all make use of the equipment and procedures being

developed under this portion of the hazardous spill program. As a result, these individuals will be able to plan for maximum effective use of local resources, detect/identify the spilled material, track spill movement (especially in waterways), predict arrival times, assess countermeasures, and ensure the availability and use of appropriate protective clothing and other safety equipment. The spill movement prediction work is being closely coordinated with the Coast Guard Chemical Hazard Response Information System (CHRIS) and, particularly, the modeling system called Hazard-Assessment Computer System (HACS).

A recommended program of R&D to meet the needs of the program offices in this area of the hazardous spill problem will develop and demonstrate protective equipment, safety devices and safety techniques for spill response personnel. This effort is a continuation of the program that developed the protective clothing ensemble.

Another objective of the R&D program is the development of materials for use at the state and local level to assist with the preparation of effective contingency plans. Effective local-level first-on-scene response depends upon prior planning to take maximum advantage of resources available through police and fire organizations, civil defense organizations, and local industry. Such planning must be coordinated with area-wide mutual-aid arrangements, as well as with state and federal resources that can be applied to given spill situations. Supplementary to the development and organization of local resources is an assessment of local hazard potential to identify areas of high spillage probability, and local vulnerabilities where spills might have severe human health or environmental consequences. Current demand for guidance on the subject of prespill planning is very intense at the local level, as more municipalities find themselves inadequately prepared for situations that could have been reasonably forecasted as to likelihood, location and approximate effects.

The longer term requirements of the program offices will be supported by R&D in two other areas. The first of these will encompass the development of computer modeling of spill plume movement. This will provide response personnel with the capability of predicting the movement of hazardous substances in air, surface waters, and ground waters. This effort will be closely coordinated with the development of the Coast Guard HACS system which presently predicts the movement of substances in air and surface waters.

The other area of longer term support will be the development and demonstration of field kits and flow-through spill alarm systems. Previous efforts in this area have resulted in the commercially available test units discussed in Section 3. Future efforts will continue this work for spill identification and detection. These projects will also be useful to Agency response groups for initial assessments at uncontrolled waste sites, as well as at the site of a hazardous spill.

Spill Containment and Confinement, and Spill Separation and Concentration

The objective of this portion of the hazardous spill program is to develop technology to limit the extent of a spreading spill and to separate the spilled material from the air, water, soil and sediments that have been impacted. The program offices have requested support in the following areas:

- develop and demonstrate containment and confinement equipment and techniques
- develop and demonstrate technologies for on-site separation of spill materials from treatment agents and impacted environmental media, and concentration of dispersed spilled materials
- develop and demonstrate techniques for the control of volatile substances
- provide technical support for field use of spill control technologies

The Federal Water Pollution Control Act (FWPCA), as amended, clearly mandates that hazardous spills be removed or the effects mitigated and that the Agency specify approaches and equipment. The EPA hazardous substances designation regulations have been promulgated (FR 50766, Aug. 29, 1979, effective 28 September 1979), and the hardware and procedures are needed. There is considerable demand from federal, state, and local agencies, as well as from private cleanup contractors, for equipment which is being or has been developed by EPA. Previously commercialized equipment was discussed earlier. Within this portion of the spill program, additional equipment is being developed to clean up/remove spills of common organic chemicals, toxic heavy metal salts, pesticides, and complex industrial wastes.

The effectiveness and cost of spill cleanup activities is directly related to the intensity and areal extent of a spill situation. The number of individuals impacted and the severity of the impact from both human health and safety and from ecological viewpoints are also directly related to the physical extent of the spill. Thus, techniques to limit spill movement or spreading by containing or confining the spill are very cost-effective and environmentally beneficial.

In light of this, technology development for containment and confinement is progressing from a focus on spills of tank car capacity on land or in confined water bodies to spillage from barge or tanker accidents in unconfined waters, spills of vapors and gases in air, and spills into soils, sediments, and groundwaters. Some of these technologies have already been developed to the point of being accepted for commercialization by private contractors.

A second part of this technology development is the separation and concentration of spilled hazardous substances. The development of technologies for the on-site separation of all removed, spilled hazardous substances from the treatment agents and

cocollected materials (such as air, sediments, soils, and water) is sorely needed by field personnel. This technology serves two purposes in that it directly enhances the cost-effectiveness of cleanup operations, while decreasing the danger of secondary incidents by minimizing the volume of material that must be transported offsite to a suitable disposal location. An on-site capability of concentrating the (previously dispersed) spilled hazardous substance provides potential for reuse of the spilled material and its treatment agents. The ultimate user of these technologies will be government personnel and private contractors who are engaged in spill cleanup operations, as well as spillers that have cleanup capabilities in-house. The effort in this area will provide guidance and equipment for the recovery of cleanup agents and collected hazardous substances, and will result in the conservation of energy and resources by salvaging the hazardous substances and by preparing the collecting agents for reuse.

The third part of this portion of the R&D program for spill control deals with the problem of air pollution in the event of spills of gases or volatile hazardous substances. Mitigation of air pollution incidents involving hazardous substances is of major concern to public health and safety officials. The danger to the public health and welfare is acute and the effects of a spill are potentially catastrophic, particularly in urban areas on major transportation routes. ORD is primarily attempting to provide guidance and readily available equipment to the first-on-the-scene personnel. These response personnel need guidance in the use of available equipment in order to significantly retard the rate of transfer of the spilled material to the air column or effectively inhibit the flow of ground-hugging toxic and flammable vapors. This need will be met in part through the preparation of emergency response manuals. Although there are a number of emergency manuals available to response personnel already, these deal almost exclusively with the potential for fire and explosion. It is the intent of this portion of the R&D program to supplement these manuals with information on the best operational practices and the best available equipment and techniques for mitigation of hazardous substance spills and consequent danger to the public health and welfare due to additional hazard criteria.

Ultimate Disposal of Recovered Residues

The ultimate disposal of recovered residues from a hazardous substance spill is of great interest to the program offices. The OWWM has requested support from ORD in these areas:

- assessment of various ultimate disposal alternatives
- development or adaptation of technology for disposal of non-reusable contaminated waste and debris (emphasize on-site disposal)

Although recycling is the most desirable method of disposal for residues removed as a result of spill cleanup, this is not always feasible either technically or economically. The purpose of this part of the ORD spill program is, therefore, to develop or adapt technology for the disposal of all non-reusable contaminated waste and debris removed from hazardous substance spill sites. In-house experience and requests from federal, state, and local officials emphasize the need for methods to destroy or thoroughly deactivate or detoxify the residues from a hazardous spill cleanup. Often these requirements cannot be met by accepted disposal methods, such as incineration, encapsulation, and landfilling. This program is geared to the development of novel procedures for converting refractory organics to carbon dioxide, water, salts, etc.; immobilizing toxic constituents in such a form that they present no greater leaching hazard than they do in natural rock or mineral formations; and for sophisticated degradative application of microorganisms and nutrients.

The recommended direction of effort in this program area is based on a previously prepared assessment of various ultimate disposal alternatives for spills of designated hazardous substances. Candidate techniques identified by the assessment will be investigated at bench and pilot scales to develop new, innovative, transportable and mobile disposal systems for on-site detoxification/destruction of concentrated residuals from spill cleanup operations. The most promising techniques will then be developed and demonstrated as full-scale prototypes. Previous successes of this approach indicate that this is a valid method of planning a development program.

Fate and Effects of Spilled Material

The OWWM has requested that ORD provide support in the area of fate and effects of spilled hazardous substances, specifically to determine the ecological effects of acute discharges of hazardous substances.

All those who respond to, clean up, and dispose of spills of hazardous materials face the problem of determining what will happen to the environment if cleanup is imperfect and/or if nature alone takes its course, without active cleanup action. The purpose of ORD efforts in this portion of the hazardous spills R&D program is to determine the immediate and long-term damage to the environment resulting from acute discharges of hazardous substances. The thrust of these efforts is to determine when nature can cope with the spill and when degradation and by-products present short- or long-term hazards that must be addressed. This information is essential to those who must decide which spills must be cleaned up, how cleanup efforts should be prioritized and, eventually, when sufficient cleanup has been accomplished.

Restoration of Damaged Areas

The OWWM has requested ORD support to:

- evaluate currently available restoration practices
- develop techniques and equipment for accelerating recovery

- develop techniques and equipment for rapid determination of the level of restoration required

This area of the ORD hazardous spill program acknowledges that neither all spills, nor all portions of each spill, require the use of mechanical equipment for concentration and/or detoxification of the spilled substance. Accelerated natural restoration is both a complement to, and a substitute for, active spill control and removal operations. Damage assessment is particularly important in view of determining the impact of a spill on human health and welfare, as well as the environment. Every spill need not be cleaned up by men and machines; natural processes may be sufficient in many cases. Federal, state, and local officials need guidelines as to what procedures can be followed to assess the extent of and remedy the damage of a hazardous spill by aiding nature without major disruptions in the surrounding ecological milieu.

The recommended effort in this area deals first with this decision-making problem and, secondly, with the development and field testing of experimental techniques and prototype equipment designed to accelerate the recovery of spill-damaged waters and soils through accelerated microbial degradation.

Manuals

The program offices have requested ORD support in the development of manuals to assist response personnel in the event of a hazardous substance spill. Table 3 is a listing of the manuals that have been requested. Some of these have been completed (references are shown in the table), some are currently under development, and some will be developed in the future. When these manuals are completed, it is anticipated that their updating will be an ongoing effort.

Table 3
Hazardous Substance Spill Manuals

- Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills (EPA-Jun 72); PB 245 789)
- Guidelines for the Disposal of Small Quantities of Unused Pesticides (EPA-670/2-75-057; Jun 75)
- Manual for Control of Hazardous Material Spills:
  - Volume I: Spill Assessment and Water Treatment Techniques (EPA-600/2-77-227; Nov 77)
  - Volume II: A Guideline and Checklist for the Preparation of Contingency Plans (9/80)
- Emergency Action Manual for First-on-Scene Personnel (10/84)
- User manual of best available practices for on-site separation and concentration (6/85)
- User manual of best available practices for spill containment and confinement (10/84)
- User manual for mitigation of air polluting incidents (10/84)
- User manual of currently available practices for ultimate disposal (6/85)
- User manual of best available practices for accelerated recovery of the environment at spill-damage areas (6/85)

Note: ( ) dates indicate anticipated report availability date.

Resource Distribution

The ORD R&D plan specifies areas of effort that will be accomplished with available resources. A schedule of the subobjective outputs within the hazardous substances spills program is presented in Table 4. This table shows the subobjectives for R&D in spills information transfer, prevention, prespill response planning, safety, spill assessment, containment and confinement, separation and concentration, ultimate disposal, fate and effects, and restoration as discussed in the previous text. A time schedule for expected results, equipment, protocols, etc., is shown.

The resources required to perform these recommended projects in the hazardous spill program are estimated at $1,755,000 and 8 PFT annually. The distribution of this money and manpower within the program is shown in Table 5. It is obvious that the majority of the funding for this program is to be used in the area of on-site treatment and control of hazardous substance spills. It is in this area that the program offices have stated the greatest need. Moreover, the greatest potential for payback is to be realized in the form of commercially available equipment and of procedures for response personnel in federal, state, and local governments, as well as by private contractors and industry.

Oil Spill Program

The oil spill research and development program is directly related to the need for development of new energy sources for the U.S. The program supports the Agency requirement to ensure that the recovery of the nation's onshore and offshore oil and gas resources from existing, frontier, and ecologically sensitive sites is conducted in an environmentally acceptable fashion. It is inevitable that during the production, transport, and storage of oil, discharges will occur from accidental spills and operational releases. The impacts from these discharges range from contaminated water supplies to contaminated food supplies. Discharges to surface water and groundwater sources of drinking water or industrial water may make the water unfit for use. Likewise, contamination of shellfish or other coastal food sources may result from coastal spills. Unknown health and ecological hazards may yet be discovered as a result of experience gained after a release from advanced petroleum recovery practices currently being developed.

In order to meet this challenge, the oil spill R&D program supports the program offices (OWWM and OE) and the Regional Offices with the following objectives:

- develop methods, technology, and equipment to prevent, control, and abate oil spills and

Table 4
Schedule of Subobjective Outputs for Hazardous Substances Spills

	R&D Subobjectives	Fiscal Year 1980	1981	1982	1983	1984
Information Transfer and Prevention	• Statistical analysis of spills (frequency, cause, volume, cleanup cost) • Develop/demonstrate fail-safe devices (level gauge, transfer line) • Risk analysis of chemical manufacturing, transportation, and waste disposal industries • Develop spill prevention techniques and equipment • Develop background for guidelines on the prevention and control of pesticide spills • Shakedown and demonstrate new techniques at spill sites					
Prespill Response Planning, Safety, and Assessment	• Develop/demonstrate personnel safety devices (clothing, breathing apparatus) • Develop/demonstrate spills identification and detection kits (field kits and flow-through alarms) • Model spill plume movement in air, water, and soil • Prepare emergency action manual for hazards in addition to fire and explosion • Develop/update contingency planning guidelines			In-House		
Containment and Confinement Separation and Concentration	• Demonstrate systems for treating soils (soil washer) • Demonstrate second generation containment systems on land (dike pak, portable tank) • Develop second generation instream treatment systems (stream diverter) • Develop/demonstrate systems for separating substances from water (physical/chemical systems, reverse osmosis, steam stripping) • Develop/demonstrate systems for mitigation of air pollution • Prepare user manuals for spill control equipment and techniques • Organize National Conference on Control of Hazardous Material Spills					
Ultimate Disposal	• Investigate mobile disposal systems for on-site detoxification of residuals • Develop/demonstrate most promising disposal technqiues					
Fate and Effects	• Identify data gaps for hazardous substances • Determine effects and persistency data					
Restoration	• Identify gaps in knowledge on accelerated recovery of spill areas • Develop/demonstrate restoration techniques • Prepare and update restoration manual					

△ *Interim Report or Manual* ▲ *Final Report or Manual* ● *Prototype Equipment and Report* ✱ *Other; self explanatory*

Table 5
Hazardous Substance Spill Program Resource Allocation

Program	Fiscal Year 80 $K	81 $K	82 $K	83 $K	84 $K
Information Transfer and Prevention	377	320	320	325	500
Prespill Planning, Safety, and Assessment	288	480	480	250	350
Containment and Confinement, Concentration and Separation	428	516	516	700	650
Ultimate Disposal	284	263	263	400	550
Fate and Effects	—	—	—	150	200
Restoration	76	176	176	225	250
Total ($K)	1453	1755	1755	2050	2500
PFT	7	7	8	9	10

Total dollars (in thousands) including extramural and in-house funding (i.e., support for overhead, personnel and administration). Personnel resources (PFT) for the hazardous substances spill program in direct support only (i.e., no administrative or temporary personnel).

discharges of petroleum pollutants from oil and gas production, storage and transportation facilities
- provide standardized user manuals which encompass all environmental pollution control aspects of oil spills in a form that meets the operational needs of both regulatory control agencies and industry

Much work has already been done in this area. However, constant updating, development, and evaluation of new technology requires constant effort in the areas of spill prevention and control and removal. Efforts in the oil spill areas of ultimate disposal, fate and effects, and restoration have been expended in the past. Current efforts in this area are directed toward hazardous substances and, through the use of technology transfer, those technologies which also show particular promise for oil spill incidents will be examined at a future time.

The committee recommendations for future oil spill R&D are discussed in the following sections.

Prevention of Oil Spills

The program offices have requested the following support from ORD in the area of oil spill prevention:
- evaluate the effectiveness of the present oil spill prevention regulations in reducing spills
- develop a guide for improved spill prevention systems and practices
- continue aerial surveillance for SPCC monitoring and enforcement

Analysis of spill events in this country indicates that most spills occur in coastal and inland areas which are valuable ecological resources and are densely populated. The most effective means for protecting the ecology from spills is to prevent these events from occurring. This part of the ORD R&D program will provide the regulatory support for spill prevention, control, and countermeasure (SPCC) regulations. The program offices need manuals for interpreting the present regulations for their SPCC inspectors. The availability of such manuals will ensure uniform interpretation in the field when industrial SPCC plans are being inspected. ORD also intends to follow its current analysis of spill events with an evaluation of the effectiveness of the 1973 SPCC regulations (40CFR112). Both engineering and procedural aspects of the regulations will be considered in the evaluation which will result in recommendations for new oil spill prevention techniques and guidelines for improving current spill prevention practices. The results of this work will be used in the preparation of revised spill prevention regulations.

Oil Spill Control and Cleanup

The OWWM has requested the following support from ORD in the area of oil spill control and removal:
- operation of the Oil and Hazardous Materials Simulated Environmental Test Tank facility (OHMSETT)
- development of environmentally acceptable guidelines and techniques for cleanup operations
- development of guidelines and techniques for the protection and restoration of shorelines impacted by oil spills
- provision of technical support for spill control and removal

Oil spills occur all too frequently in the coastal zone, in spite of efforts directed at the prevention of spills. The technology and expertise for the control and removal of oil spills has made great strides, largely through the R&D efforts of EPA and the U.S. Coast Guard, among others. These two agencies continue to work very closely in an effort to assess, develop, and demonstrate the effectiveness and capabilities of equipment and techniques to control and clean up spills of oil on land and water. Of primary importance to this effort is the continued use of the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility to test

and evaluate new technologies as they are developed. This facility is used not only by EPA, but also by the Coast Guard, Navy, Army, Department of Energy, foreign governments, and private organizations (nonfederal). The continued availability of this facility is considered the top priority in this part of the program.

The operation of OHMSETT is only a portion of the program to assess and develop new technologies for oil spill control and removal. Under the National Contingency Plan, EPA is required to publish guidelines and techniques which are environmentally acceptable for cleanup operations. Of primary concern at this time are chemical and biological control agents which are intended for use primarily where mechanical cleanup would be more damaging to the environment than no cleanup, or under those situations where present technology is inadequate. (For example, the application of oil dispersing chemicals is probably the only technically feasible means of controlling major offshore oil spills in rough seas.) The use of these agents is controlled by regulation (40CFR1510). Evaluation of these agents must be performed as they are developed so that the program offices can make rational decisions in preparing new or revised regulations. It is important to develop the capability for choosing the most effective and least toxic chemical and biological agents and for applying them to oil spills in the most environmentally acceptable and efficient manner possible. This will assist federal, state, and local governments, as well as the spill response industry, in preparing contingency plans, purchasing equipment, and setting cleanup standards and guidelines.

Another portion of the oil spill control and cleanup program is directed toward shoreline protection and restoration. With the outer continental shelf areas now being developed for energy sources, any related oil spill can be expected to impact the shoreline of the U.S. These coastal and estuarine areas are inhabited by most marine species during the most vital portion of their life cycle and oil spills can be particularly devastating. In addition, the economic hardship that will be suffered by persons whose livelihood depends on the recreational use and food production of the area can be severe.

This program will also develop new and improved methods for identification and quantification of spilled oil as well as the technology to control oil spills which occur under cold climate (snow/ice) conditions.

The ORD efforts in the oil spill control and removal program will result in user manuals on: oil spill cleanup and control, chemical and biological agents, protection and restoration of contaminated shorelines, and the availability of equipment. The oil spill manuals that have been requested by the program offices are listed in Table 6. Those manuals which have been completed are indicated by a reference and those that are in a draft form are so designated. Additional manuals are currently under preparation. The updating of all manuals is expected to be an ongoing effort.

Resource Distribution

The ORD R&D plan specifies areas of effort that will be accomplished with available resources. A schedule of the subobjective outputs within the oil spills program is presented in Table 7. This table shows the subobjectives for R&D in oil spill prevention and control and cleanup as discussed in the previous text. A time schedule for expected results, equipment, protocols, etc., is shown. The ORD resources required to perform these subobjectives are estimated at $612,500 and 4 PFT annually. The distribution of these resources within the oil spills program is shown in Table 8.

Monitoring Systems and Quality Assurance

The objective of the monitoring systems and quality assurance program element is to provide specialized analytical support, overhead monitoring, chemical and biological laboratory field support and quality assurance to the investigations of spills. These technical services will be available for emergency support as well as cleanup and enforcement activities. The ORD activities in this area utilize a limited number of in-house experts, supported by contracts and interagency agreements, to offer unique capabilities to the program and regional offices.

In meeting the mandates of Section 311 of the Clean Water Act, the program offices have found a need for monitoring systems and quality assurance both in the prevention of spills and in response actions to spills. The program and regional offices have a strong role in the development of spill prevention, control and countermeasure (SPCC) contingency

Table 6
Oil Spill Manuals

- Manual on the Analysis of Spilled Hazardous and Toxic Chemicals and Petroleum Oils (available from ERL, Edison, NJ)
- Oil Spill: Decisions for Debris Disposal, Vol. I & II (EPA-600/2-77-153 a&b; Aug 77)
- Oil Pollution Abstracts (quarterly) (EPA-600/7-79-160; Jul 79)
- Field Manual for Cold-Climate Oil Spills (Draft) (6/83)
- Manual of Practice: Protection and Clean Up of Ocean, Estuarine, and Inland Shorelines (Draft) (12/80)
- Manual of Practice: Use of Chemical Treating Agents in Oil Spill Control (Draft) (6/81)
- User Manual for Oil Spill Protection and Clean Up Priorities (Draft) (12/80)
- User manual for the use of sorbents and biological agents (6/83)
- User manual for the use of oil analytical techniques (6/83)

Note: ( ) dates indicate anticipated report availability dates.

Table 7
Schedule of Subobjective Outputs for Oil Spills

	R&D Subobjectives	Fiscal Year				
		1980	1981	1982	1983	1984
Prevention	• Evaluate the effectiveness of current oil SPCC regulations • Develop guide for improved SPCC practices					
Control and Cleanup	• Demonstrate second generation containment systems in water courses (jet boom) • Operate OHMSETT test facility • Prepare user manuals for spill control equipment and techniques • Develop new technology for shoreline protection and restoration • Organize National Conference on Control of Oil Spills • Evaluate dispersants and other chemical and biological control agents • Develop technology for cleanup of oil spills under cold climate weather conditions					

△ *Interim report or manual*
▲ *Final report or manual*
● *Prototype equipment and report*
■ *Continuing effort*
✱ *Other; self explanatory*

Table 8
Oil Spill Program Resource Allocation

Program	Fiscal Year 80 $K	81 $K	82 $K	83 $K	84 $K
Prevention	—	—	120	300	350
Control and Cleanup	584	612.5	680	700	750
Total	584	612.5	800	1000	1100
PFT	4	4	4	4	4

Total dollars (in thousands) including extramural and in-house funding (i.e., support for overhead, personnel and administration). Personnel resources (PFT) for the hazardous oil spill program in direct support only (i.e., no administrative or temporary personnel).

plans for state and local government as well as industry. SPCC regulations have been promulgated in an effort to prevent and mitigate the damage done by oil spills. In addition to the prevention aspects of spill responsibilities are the actual response or cleanup aspects. Very often the regional offices are required to rapidly assess the nature and extent of a spill in a remote area. At times, the very nature of the material spilled can prevent sufficient access to the area to permit a reliable assessment.

In order to meet their responsibilities to the public, the program and regional offices have turned to ORD for assistance. ORD provides aerial surveillance, analysis and technical support for OWWM, OE, OER and the regions on request. Through the Enviro-pod program operated from the EPA Environmental Monitoring and Support Laboratory (EMSL) in Las Vegas, NV, on-scene personnel are provided with aerial photographs and analyses within 6 to 24 hours of a request. Enviro-pod is carried by contractor aircraft and is supported by the Environmental Monitoring Support Laboratory, Las Vegas, NV, and the Environmental Photographic Interpretation Center, Warrenton, VA. This assistance, particularly in the event of spills that preclude the entry of personnel because of hazardous conditions or terrain, is considered invaluable to the program offices and regions. In addition to the operational uses, this highly visible program is used to inform the media as well as Congress and other federal, state and local authorities. It is used by the Office of Enforcement in case preparation and evidence as well as by the Office of Water and Waste Management for spill prevention, response, and analysis, and locating and evaluating uncontrolled waste sites. Enviro-pod is also used by the Office of Environmental Review in reviewing impact statements.

The program offices have requested continuing support in three specific areas with respect to this ORD program:

- development of real-time aerial surveillance techniques
- development of thermal infrared capabilities
- continued technical support for surveillance and analysis

The ORD laboratories will continue to provide technical support when requested by the program or regional offices.

In addition to the direct support functions, a continuing R&D program is underway to upgrade the capabilities of the Enviro-pod program. Current expectations are to increase the capabilities of Enviro-pod to permit real-time television coverage by integrating a TV system and data transmission equipment into the present carrier. Engineering tests will then be performed at an actual response site. To ensure that the capabilities of Enviro-pod are widely disseminated, ORD will prepare a manual discussing the capabilities and suggesting possible uses in spill contingency planning as well as cleanup operations.

The ORD resources required to continue this technical support are estimated at $542,000 and 5 person-years annually. This level of effort will support the Enviro-pod program, SPCC reports, and emergency spill projects. Support for the Enviro-pod development is provided by the program office. In addition, much of the material and contractor cost is expected to be reimbursable because of the nature of this support in CWA Section 311 response. A summary of the R&D plan for monitoring systems and quality assurance for oil and hazardous substances spills is presented in Table 9.

Summary of Resurce Distribution

A final summary of all three programs within the ORD spill program is presented in Table 10. These resources will enable ORD to achieve the R&D subobjectives described in the previous text and tables. In addition to these subobjectives, this funding will permit the continuation of technical support provided to the program offices and regions through the EERU and aerial surveillance programs.

Table 9
Schedule of Subobjective Outputs for Monitoring Systems and Quality Assurance

R&D Subobjective	Fiscal Year				
	1980	1981	1982	1983	1984
• Spill Prevention Control and Countermeasures Studies					■
• Develop aerial surveillance and analysis manual			▲		
• Emergency oil and hazardous material spill response, on-scene analysis, briefings					■
• Alaska gas pipeline study			▲		
• Develop emergency response standard operating procedures manual			▲		

△ *Interim report or manual*
▲ *Final report or manual*
● *Prototype equipment and report*
■ *Continuing effort*
✱ *Other; self explanatory*

Table 10
Resource Summary for ORD Spill Program

	Fiscal Year									
	80		81		82		83		84	
Program	$K	PFT	$K	PFT	$K	PFT	$K	PFT	$K	PFT
Hazardous Substance Spill Program	1453	7	1755	7	1755	8	2050	9	2500	10
Oil Spill Program	584	4	612.5	4	800	4	1000	4	1100	4
Monitoring Systems and Quality Assurance	435	5	432	5	542	5	600	5	600	5
Total	2472	16	2799.5	16	3097	17	3650	18	4200	19

Dollar (in thousands) including extramural and in-house funding. Personnel resources (PFT) in direct support role only (excluding administration and temporary).

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