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IXTOC I OIL SPILL

DAMAGE ASSESSMENT PLAN

**A COOPERATIVE FEDERAL AND STATE
PROGRAM**

AUGUST 29, 1979

JUNE 3
19° 20' / 92° 25'

LAGUNA
DE TERMINOS



IXTOC-I OIL SPILL
DAMAGE ASSESSMENT PROGRAM
A Cooperative Federal and State Program

August 29, 1979

Prepared by:

National Oceanic and Atmospheric Administration
and
U. S. Environmental Protection Agency Region 6

In cooperation with the following
Federal and State agencies:

U. S. Department of the Interior

Bureau of Land Management
Fish and Wildlife Service
National Park Service
U. S. Geological Survey

State of Texas

Department of Water Resources
Bureau of Economic Geology
Parks and Wildlife Department
General Land Office
Corpus Christi State University
Texas A & I University
Texas A & M University
University of Texas

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- ACKNOWLEDGEMENTS -

The contributions made to this plan by individuals and organizations are greatly appreciated and acknowledged. A complete list of participants in this effort is included in Appendix 2.

Special appreciation is extended to Corpus Christi State University for support facilities and to the IXTOC I Damage Assessment Team who actively participated by dedicating endless days and nights to this effort.

This plan is dedicated to the one individual who worked her fingers to the bone — Dolly Ulna.

EXECUTIVE SUMMARY

This program is proposed for assessment of damages to northwest Gulf of Mexico resources resulting from the IXTOC I oil spill. Oil has been impacting the barrier beaches of the Texas coast since 6 August 1979 and is expected to continue to come ashore through at least late winter. The most likely scenario of impact includes moderate oiling of bays and estuaries of Texas and Louisiana, with major impacts in the offshore and coastal systems of these states. The impact is expected to extend over at least a two-year period.

State and Federal agencies responsibility for assessment of damages from pollution incidents of this type stems from legal mandates which designate agencies as public trustees and protectors of the Nation's natural resources. The damage assessment program coordinates the Federal/State/Non-Government response to the environmental and socioeconomic impacts of the IXTOC I oil spill.

The goal of the Damage Assessment Program is to:

EVALUATE THE DAMAGE TO NORTHWEST GULF OF MEXICO RESOURCES RESULTING FROM THE IXTOC I OIL SPILL.

To achieve the program goal, it is necessary to assess the impacts on specific components of the ecosystem. The following six objectives are formulated to meet the responsibilities of Federal and State Governments:

- Assess potential impacts on human health
- Assess impacts on commercial and recreational fishery resources
- Assess impacts on marine mammals, birds, and endangered species
- Assess socioeconomic impacts
- Assess impacts on selected marine and coastal environments
- Develop an improved management and scientific approach to damage assessment

Successful completion of the program objectives will provide the first comprehensive evaluation and quantification of the total impact of a major oil spill on national resources. As such it will provide the basis for improved policy and management actions within both government and private sectors.

The proposed approach focuses on resources which have been identified as being important by legislative mandate or economic use. Emphasis is also placed on habitats and food resources required to maintain these important resources. Damage assessment studies have been divided into those which would be conducted in best case, worst case, and most likely situations. A monitoring phase will be established to track oil

I

INTRODUCTION

On 3 June 1979, a blowout on the drilling rig IXTOC I in the Bay of Campeche resulted in a massive release of oil into the Gulf of Mexico. Since then, oil has been escaping at the reported rate of 15,000 to 30,000 barrels per day. Drilling of a relief well or capping of the well is not expected until early October, which would make this the largest spill into the marine environment ever documented (potentially more than 2.7 million barrels). In comparison, the Amoco Cadiz spill, which caused significant environmental and economic damage along the French coast in 1978, released 1.5 million barrels.

The released oil has been carried northward by Gulf currents and now threatens coastal environments in Texas and Louisiana. The resources in this area include a \$2 billion tourist industry and a \$0.5 billion fishing industry. In addition, several threatened and endangered species (marine mammals, birds and turtles) regularly inhabit the area. At this time, the overall impact of the spill is subject to some uncertainty, although the quantity of oil involved suggests that damage to coastal resources could be catastrophic.

Oil from the IXTOC I spill is affecting a large geographical area and a multitude of local and regional interests. Given the extent and diversity of these interests, a cooperative damage assessment effort that recognizes as many interests as possible is the only practical means by which to develop a comprehensive and accurate evaluation of total damage. Lacking such an evaluation, it is difficult to separate fact from conjecture. Many questions will go unanswered and future planning will be seriously hampered. The damage assessment plan presented here is designed to focus on economic loss to resources along the northwest Gulf Coast as a result of this spill, to yield specific kinds of information by employing State and Federal multiagency capabilities under unified direction, and to assure that important questions are not overlooked. Products of the investigation should aid resource managers in formulating risk analysis and tradeoffs between competing needs.

- to give scientific advice to the Federal On-Scene Coordinator
- to provide a framework for damage assessment
- to take advantage of the research opportunities afforded by the spill.

The outcome of a damage assessment of the Zoe Colocotroni spill off the southwestern coast of Puerto Rico in 1976 set legal precedent for the use of scientific data to compensate for environmental damage. District Judge Juan Torruella calculated the monetary value of the damage by multiplying the number of organisms killed by a per-organism replacement cost (taking the low end of a range between 6¢ and over \$1.00 from a biological supply catalog). A judgement of \$6.2 million was entered against the plaintiff for damage to 23 acres of mangrove swamp habitat. Although assessment data were insufficient to support claims for all the associated losses, this decision established a basis in Federal common law for assessing natural resource damage from a spill of oil or other toxic substance.

Scientific support coordinators named by NOAA for the Gulf of Mexico and Southeast Atlantic, Alaska, and the Pacific Northwest have been responding to spills for the last 18 months. Spillage of oil from the barge Peck Slip off northeastern Puerto Rico in 1978 provided the first test of the resources and planning of the scientific teams. Ongoing research by EPA and NOAA contractors is seeking biological information that may be used to support resource damage claims.

THE CURRENT SITUATION

Although progress has been made in the techniques of managing damage assessment, a quantum jump is called for within the context of the massive threat to resources posed by the IXTOC I spill. Due to the distance of the spill from the study area, more lead time has been available for planning and implementation than in past incidents. This has made it possible to involve numerous Federal and State agencies in the planning process and to adopt an integrated approach which is aimed toward defined objectives and which will make optimum use of program funds. Additionally, in view of the fact that oil spill damage assessment is still in a formative stage, the IXTOC I spill should be exploited fully for all opportunities to develop realistic ways of quantifying ecological damage. Among the returns from the proposed program, whose costs are estimated at less than 1% of the annual value of currently threatened resources, will be the creation of a permanent program plan that can be activated quickly in future spills, and a data base of factual information on which resource managers can base decisions concerning offshore oil and gas development.

II

GOALS, OBJECTIVES, AND BENEFITS

The ultimate goal of the proposed damage assessment program is to evaluate damage to the resources of the northwest Gulf of Mexico resulting from the IXTOC I oil spill. Accomplishing the objectives of this program will result in a number of benefits (examples of these benefits are presented in Figure II-1). It is these benefits that dictate the need for the damage assessment program. Specifically, program objectives are to:

- Assess potential impacts on human health
- Assess impacts on commercial and recreational fishing resources
- Assess impacts on marine mammals, birds, and endangered species
- Assess socioeconomic impacts
- Assess impacts on selected marine and coastal environments
- Develop an improved management and scientific approach to damage assessment

The benefits that result from accomplishing each of these objectives are presented below.

(1) Protect consumer health by assuring quality products. While there are a number of important resources in the northwest Gulf, man is ultimately the most important. By law, State and Federal agencies are mandated to ensure the health and safety of the populations within their jurisdictions. The health of the general public can be threatened by oil-contaminated foodstuffs reaching the commercial or recreational fishery markets. Damage assessment provides a means by which the problem can be evaluated, and by which mitigative and preventive measures maybe taken in this and future spill incidents.

(2) Maintain consumer confidence in seafood products. Commercial fisheries account for approximately a half billion dollars in the local and regional economies of the northwest Gulf of Mexico. For a large segment of the population of this region, this commercial resource represents the sole source of income. Widespread knowledge that public health is potentially endangered by the presence of contaminated fishery products in the marketplace results in a loss of confidence in the fishery market. Without the damage assessment program, it will be difficult to counteract the negative publicity and emotionalism that accompanies oil spills.

(3) Support fishery and wildlife management decisions. Fish and wildlife populations are among the most important natural resources.

Users Benefits	LOCAL			STATE		FEDERAL								PRIVATE
	Municipalities (City/Chamber of Commerce)	County Agencies	Local Citizens	Regulatory Agencies (Environmental Quality)	State Citizens	EPA	BLM/USGS	FWS	NPS	NOAA/NMFS	NOAA/CZM	Citizens of the United States	FDA	Commercial Groups
Protect Consumer Health	■	■	■	■	■	■						■	■	■
Maintain Consumer Confidence	■	■	■	■	■							■	■	■
Fishery and Wildlife Management			■	■	■			■	■	■	■	■		■
Coastal Use Management			■	■	■				■		■	■		■
Support Regulatory and Legislative Processes	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Basis of Compensation for Damages	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Prevent and Mitigate Resource Damages	■	■	■	■	■	■	■	■	■	■	■	■		■
Information Transfer		■	■	■	■	■						■		■
Awareness of Risk Associated with OCS Development	■	■	■	■	■	■	■	■	■			■		■

Figure 11-2. Benefits and Selected Users

III

TECHNICAL APPROACH

The damage resulting from the IXTOC I oil spill will ultimately be reflected in impacts to man. Impacts may include loss of income from decreases in fisheries, tourism, and/or recreation; impaired health; and damage to esthetic resources such as birds and endangered species. The purpose of this program is to assess these impacts, recognizing that a viable program must be limited to resources that are easily identifiable and can be related by both decision makers and the general public to measureable values. By this means, the study elements of the program can be focused on a coherent endpoint defined by losses to human values. The program elements required to achieve these objectives are briefly defined below.

1. The potential impacts to human health.

Crude oil contains many components known to be toxic to man. Acute toxicity to humans will probably not be encountered since objectionable taste and odor will virtually eliminate the consumption of foodstuffs grossly contaminated with oil residues. At the same time, the IXTOC I oil contains components that may be carcinogenic. These carcinogenic hydrocarbons may be accumulated and retained in the edible tissue of harvested fish and shellfish and represent a pathological threat at contamination levels which would probably not be detected by consumers. It is not feasible to institute the extensive and long-term human epidemiological studies which would be required to directly assess this kind of health impact. However, it is possible to address the potential risk of this spill to human health. The necessary studies would include analyses of the hydrocarbon-contaminated fishery products that are being consumed and estimates of the risks associated with these hydrocarbon levels.

2. Commercial fisheries.

The primary measure of the impact of the IXTOC I spill on the fishery resources will rely on a careful analysis of catch/effort statistics compiled by the Gulf States and the National Marine Fisheries Service. The assessment is complicated, however, in that these catch statistics fluctuate from year to year due to natural or other non-spill related causes. It is essential, therefore, that the results of the damage assessment program show a link between the oil spill and any reductions in the fisheries populations attributed to the oil. This is to be accomplished by a coordinated biological and chemical sampling program that provides indirect evidence that identifies the IXTOC I oil as the cause of the fisheries impacts.

The economic damages to market-valued resources may be derived from such conventional statistics as expenditures to restore or replace damaged equipment and the loss in net revenue to the affected sectors. Baseline data for many of the market-valued resources already exist. The principal research effort will be directed at quantifying changes from baseline levels of activity.

As distinguished from market-valued resources, nonmarket resources are goods and services that are produced and consumed without any exchange on organized markets. Spilled oil potentially affects a very wide array of nonmarket activities and resources including tourism, recreation, recreational fishing, aesthetics, endangered species, wildlife, and human health. Measurement of the economic value of nonmarket resource damages is difficult and must rely upon innovative and imaginative research techniques.

Regional impacts refer to the secondary economic impacts from the spill. Changes in the size of commercial fishery landings have secondary impacts on fish processors, wholesalers, and retailers, as well as suppliers of gear and other support to the commercial fishing sector. Similarly, reductions in tourism and recreation will have repercussions on restaurants, regional gasoline outlets, and a host of other suppliers to the tourist sector.

5. Intrinsically valuable marine and coastal environments.

Certain marine and coastal environments have an intrinsic value arising from public opinion and legal mandates. In the northwest Gulf, these environments include the Flower Gardens coral reefs, the Padre Island National Seashore, the Aransas Wildlife Refuge, and other areas of local, state or national importance. Studies assessing damage to these areas will support the habitat studies discussed in the fisheries and key species sections. Unlike the fisheries and key species habitat studies, however, these studies would not be applied on as broad a geographic scale.

6. Improved damage assessment program.

It is recognized that assessment of damage from oil spills is a relatively new process with a developing matrix of scientific and management expertise. While the present program owes a great deal to past assessment programs, much remains to be learned. Although it is designed for the assessment of the IXTOC I spill, the present plan is intended to become a generic model that can be applied to future spills. The plan and the management structure incorporate inputs and participation by local, State, and Federal agencies. Under this program element, scientific and management reviews by objective evaluators from outside the program will be used to continuously update and improve the program plan to ensure that data collection is state-of-the-art and scientifically sound, and that management is efficient in meeting program objectives.

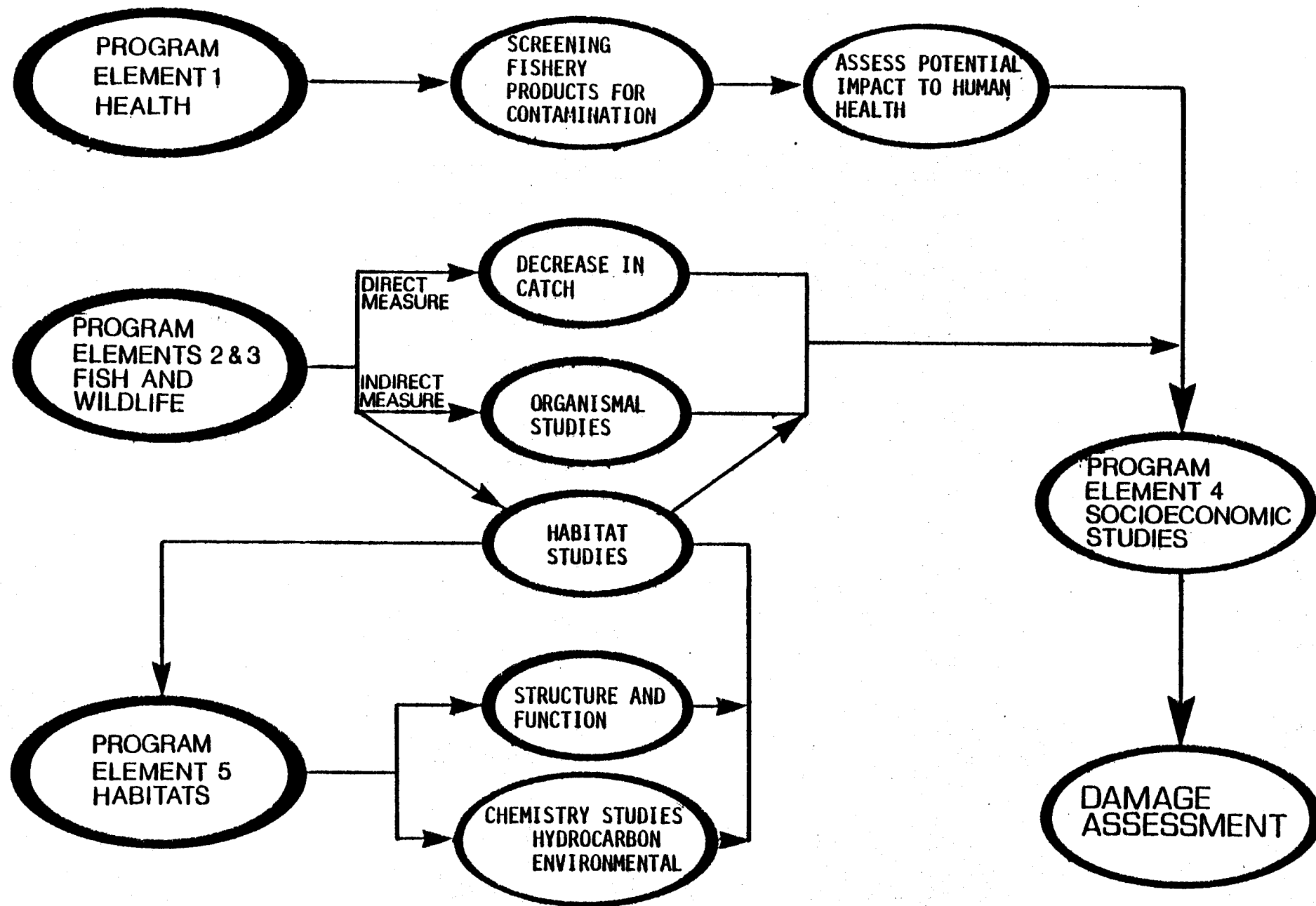


Figure III-1. Integration of program elements leading to damage assessment

IV

CRITERIA

Oil from the IXTOC I oil spill has to date only impacted the southern Texas coastline. Oil is still flowing freely from the well-head in the Bay of Campeche and will, therefore, continue to impact the offshore, shoreline, and estuaries of the northwest Gulf of Mexico for some time to come. Three oil impact scenarios are presented below showing best, and worst and most likely situations.

A. Best case scenario:

The relief well is drilled and the well capped by mid-September 1979. Initial impact is expected for 3 months after the well is capped, but is limited by winds and currents to the coastal areas of Texas and offshore areas in the northwestern Gulf of Mexico. Secondary oiling from weathered oil occurs in these areas for several years.

B. Worst case scenario:

The relief well is drilled and the well is capped by early November. One or more major storms occur and force large amounts of oil into Gulf Coast bays and estuaries. Both initial and secondary oil pollution occurs in Texas, Louisiana, Mississippi, Alabama, and Florida in varying amounts; many areas are impacted with new oil for 6 months or more after the well is capped.

C. Most likely case:

The relief well is drilled and well is capped by the first of October. A moderate amount of oil impacts bays and estuaries from Brownsville, Texas, to the Mississippi River delta. Offshore and coastal systems over this geographical area receive major impacts. This impact extends over a period of at least 2 years.

The damage assessment program elements designed to fulfill the objectives are presented in the approach section of this document. Each program element is composed of a number of projects that specifically address damage assessment questions relating to the objectives. The projects, presented in Appendix 1, were provided by those agencies having ultimate responsibility for the resources in the predicted zone of impact and are geared to answering damage assessment questions either specific to a resource or to determining the effects on the ecological and socioeconomic parameters that support a resource. For the most part, the projects presented in Appendix 1 are not geographically specific. As noted in the scenarios, the zone of impact could extend from the coastal areas of Texas and offshore in the northwestern Gulf of Mexico for the best case and the entire Gulf of Mexico as the worst case. Therefore, a mechanism is necessary to activate damage assessment projects as the oil continues to impact already oiled areas, or impacts new open water and coastal areas.

Figure IV-1. Sample Decision Tree

- A. Are there potential threats to human health?
yes - Activate health studies
No - Continue to monitor
- B.
1. Where is the oil? Where is oil predicted to impact?
Beach - proceed to 2
Offshore - proceed to 5
Estuaries - proceed to 9
 2. What is extent or predicted extent of oiled shoreline?
Answer _____ Proceed to 3.
 3. Does adequate baseline information exist to evaluate living and nonliving resources in zone of impact?
Yes - proceed to 4
No - activate necessary baseline investigations and proceed immediately to 4
 4. Determine threatened living and nonliving resources in zone of impact.
Wildlife - proceed to 12
Rare and Endangered Species - proceed to 20
Socioeconomic - proceed to 21
 5. What is extent of floating mousse and sheen?
Answer _____ Proceed to 6.
 6. Do we know extent of oil in water column?
Yes - proceed to 7
No - Call for studies from operations supporting On-Scene Coordinator or initiate very short term special studies - proceed to 7
 7. Does adequate baseline information exist to evaluate living and nonliving resources in zone of impact?
Yes - proceed to 8
No - Conduct briefing with key scientists familiar resources in similar or adjacent offshore areas - obtain best assumption; proceed immediately to 8
 8. Determine threatened living and nonliving resources in zone of impact.
Wildlife - proceed to 12
Rare and Endangered Species - proceed to 20
Fisheries - proceed to 22
 9. What is extent of oiling in lagoons, marshlands, mangrove swamps, mud flats, grass beds, dredge spoil islands and open channels?
Answer _____ Proceed to 10.

MANAGEMENT PLAN

Program Management

A program management organization (fig. V-1) has been designed to insure that the damage assessment program meets user needs, is comprehensive and can command and coordinate all necessary scientific and administrative support functions.

A Program Manager having overall technical and administrative responsibility for the program will be supplied by the lead agency, the National Oceanic and Atmospheric Administration (NOAA). Technical Managers will be supplied by NOAA and the Environmental Protection Agency (EPA), who will share responsibility for technical quality and ultimate effectiveness of the program, as well as its direct planning, supervision, scheduling, and reporting.

Reporting to the Technical Manager(s) are two major advisory committees (Program Management and Scientific), the data management group, and the principal investigators for individual projects.

The Program Management Advisory Committee will be made up of representatives of major user and interest groups. They will receive user input, assist in project selection and modification, give advice and guidance in relating research to user needs, and in general act as the direct link between project output and user interests.

The Scientific Advisory Committee comprises experts in scientific fields related to damage assessment. With the advice and support of local scientific advisors, this group will review proposals and establish selection criteria and project priorities for the Technical Manager(s); the committee will also be responsible for scientific quality assurance and for determining what research support is required for individual projects.

Principal Investigators are those scientists selected to oversee approved individual projects. They will be responsible for actual field work, including data collection, monitoring, analysis, and user-oriented output.

Five to seven full-time employees will be required to manage and coordinate the program activities.

Data Management

Data Management (fig. V-2) is a support function for administrative and scientific management, and provides functional outputs to users at all stages of damage assessment. This team is made up of data management specialists and has primary contacts with research scientists and the Technical Manager(s).

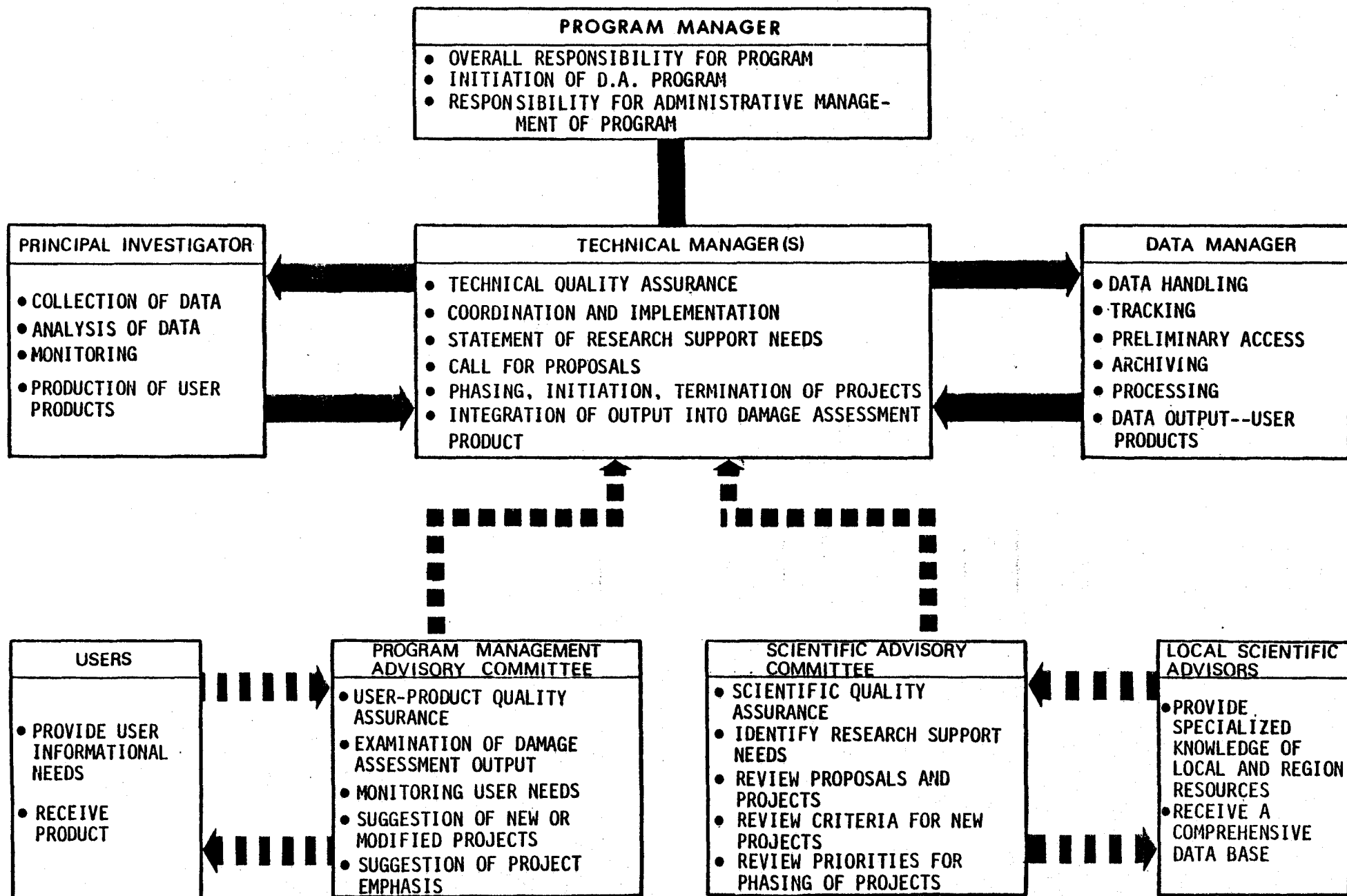


Figure V-1. Program Management Organization and Functions

VI

SCHEDULE

The chronology of the IXTOC I spill and proposed damage assessment program are shown in Figure VI-1. This spill is unique because of the uncertainty in spatial and temporal distribution as well as magnitude of impact. It is expected that oil now impacting the northwestern Gulf of Mexico will continue to do so for at least 5 months and possibly longer. Secondary oiling of coastal areas may occur due to seasonal changes in winds and currents over a longer period.

Currently, the damage assessment program is in the program planning phase, which will be completed by 1 September 1979. A technical planning phase will follow to produce a coherent technical plan to assess damages from the IXTOC I spill. During September and October, the program funds are expected to come from individual agencies so that the projects that must be started immediately can be initiated. Supplemental funding will be requested to enable additional studies to be initiated depending on the severity of impact and geographical extent of oiling.

Program evaluations will be made at 3 to 6 month intervals to ensure that the original focus of the program has been retained, and to redirect efforts if necessary. A critical evaluation of the entire program will be conducted following the damage assessment in order to produce guidelines for future spill damage assessments.

VII

BUDGET SUMMARY

Because of the uncertain temporal, spatial, and magnitude aspects of the IXTOC I spill, the budget has been designed for three different scenarios, shown in Table VII-1 and presented graphically in Figure VII-1. As shown in Table VII-2, \$16.6 million will be required to provide a damage assessment for the most likely case. It is expected that approximately \$5.4 million will be needed during the first year; the remaining \$11.2 million will be distributed over the following 4 years.

The budget estimate accounts for necessary baseline studies, monitoring of spill movement, uptake of hydrocarbons within various resources, and the actual damage assessment studies for various resources. Some baselines, such as those for fisheries and offshore studies, already exist as a result of on-going or recently completed programs. In other cases baselines have had to be generated for this spill; e.g. bird surveys and beach profiling. The monitoring phase of the program elements is extremely important in helping to establish severity of impact and to provide a mechanism by which certain studies may be activated. Some studies, such as socioeconomic concerns, will be activated before oil impacts an area since tourism, recreational fishing, etc., will be impacted by public opinion as much as by oil. The length of the damage assessment studies may range from 2 months to 5 years.

TABLE VII - 2

Funding requirements (in millions of dollars) for program elements of the damage assessment program by years for the most likely case scenario.

<u>PROGRAM ELEMENTS</u>	<u>YEAR 1</u>	<u>YEARS 2 - 4</u>	<u>TOTAL</u>
Human Health	\$0.2	\$ 0.2	\$ 0.4
Fishery Resources	0.9	2.5	3.4
Marine Mammals, Birds and Endangered Species	0.8	1.8	2.6
Socioeconomic Concerns	0.3	0.7	1.0
Marine Ecosystem Habitats	2.1	2.8	4.9
Improved Approaches	0.1	0.4	0.5
Program Management	1.0	2.8	3.8
TOTALS	<u>\$5.4</u>	<u>\$11.2</u>	<u>\$16.6</u>

APPENDIX 1
PROPOSED PROJECTS

IMPACTS TO FISHERY RESOURCES

Project Title	Lead Agency	Duration	Best	Cost Likely	Worst	Scope of Work
1. Local Scientific Advisory Coordinator	NOAA	5 months	18	18	18	1) Identify local expertise 2) Compile data bases 3) Annotated bibliography of biological studies in region
2. Mortalities of economically important finfish and shellfish	NOAA	3 months	0	15	15	Post spill mortality estimates by species, size, in inshore coastal areas
3. Bioassays	NOAA	2 months	9	9	9	Expose test organisms to in situ contamination and analyze
4. Catch/effort trends historical vs. future trends	NOAA	1 year	153	153	153	Impact of oil on catch and effort for selected species
5. Sub-lethal effects on selected economic fishery species	NOAA	3 years	0	0	640	Laboratory studies on the impact on physiological and behavioral responses of adult Gulf menhaden, shrimp, and selected ground fish
6. Impacts to juvenile shrimp and finfish recruitment	NOAA	3-5 years	500	900	1,500	Monitor abundance of juvenile shrimp and finfish. Relate changes to levels of oil in sediment and water
7. Effects of oil on reef and hard bottom fish populations	NOAA	3-5 years	1,500	2,250	3,750	Assess the impact of oil on fish populations of reefs and hard bottom areas
8. Eckman Transport Modeling	NOAA	1 year	0	50	50	Estimate shrimp and finfish recruitment rates to oil impacted areas from application of Eckman/Transport/surface water flow model

Project Title	Lead Agency	Duration	Best	<u>Cost</u> <u>Likely</u>	Worst	Scope of Work
8. Effects of oil on other endangered species (brown pelican, whooping crane, bald eagle, alligator)	FWS/STATE	3 years	30	30	30	Histopathological Studies
9. Effects of oil on essential habitats in Nueces/Corpus Christi Bays, Texas	FWS/STATE	1 year	0	290	290	Effects on productivity and recovery of delta, bays, marshes and seagrass beds

IMPACTS TO MARINE AND COASTAL ENVIRONMENTS

Project Title	Lead Agency	Duration	Best	Cost Likely	Worst	Scope of Work
1. Intertidal organisms- Mustang Padre Island	NOAA	1 week	7	7	7	Intertidal-subtidal biological samples for baseline data
2. Determination of origin	NOAA	5 months	7	7	7	Density, fingerprinting and determination of origin
3. IXTOC I Cruise 1	NOAA	1 year	930	930	930	1) Chemical modification and mixing 2) Physical behavior and transport 3) Biological effects
4. Spatial distribution of hydrocarbons in the sediments	NOAA/EPA	6-8 months	200	300	300	Collect and analyze approx. 400 sediment samples utilizing semi-quantitative chemical technique
5. Oil-sediment interaction	NOAA	3 months	10	10	10	Determine degree of sediment contamination by physical and chemical techniques
6. Hydrocarbon fate monitoring	EPA/NOAA	3-5 years	500	1,000	1,000	Monitor the chemical-physical fate of oil in the sediments
7. Microbial degradation	NOAA	6 months	50	50	50	Determine rate of breakdown of oil under simulated ambient conditions
8. Monitoring oil spill impacts-Texas Estuaries	NOAA	18 months	140	140	140	Infrared coverage of the major pass and analysis of vegetation changes due to oiling
9. Sargassum community assessment	NOAA	3 months	0	0	8	Obtain oiled and unoled sargassum mats and analyze

Project Title	Lead Agency	Duration	Cost			Scope of Work
			Best	Likely	Worst	
18. Impact to beach habitats via remote sensing	NOAA	1 year	0	0	150	Analyze land sat photographs to quantify impacts and recovery of beach flora
19. Effects of oil on essential wildlife habitats	FWS	3-5 years	0	500	1,000	Field studies on impacts to migratory bird and endangered species habitats

APPENDIX 2

AGENCY/PERSONNEL PARTICIPANTS IN INITIAL PREPARATION OF ENVIRONMENTAL DAMAGE ASSESSMENT PROGRAM

(Names Taken From Registration List)

I. Federal Agencies

A. National Oceanic and Atmospheric Administration

1. Bob Anderson, Washington, D.C.
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11. Don Hoss, Beaufort, North Carolina
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17. Norm Meade, Washington, D.C.
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4. Richie Marple, Dallas, Texas
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1. Dale Beaumariage, Tallahassee, Florida
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I. Center for Law and Social Policy

1. Cliff Curtis, Washington, D.C.

J. Independent Consultant

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