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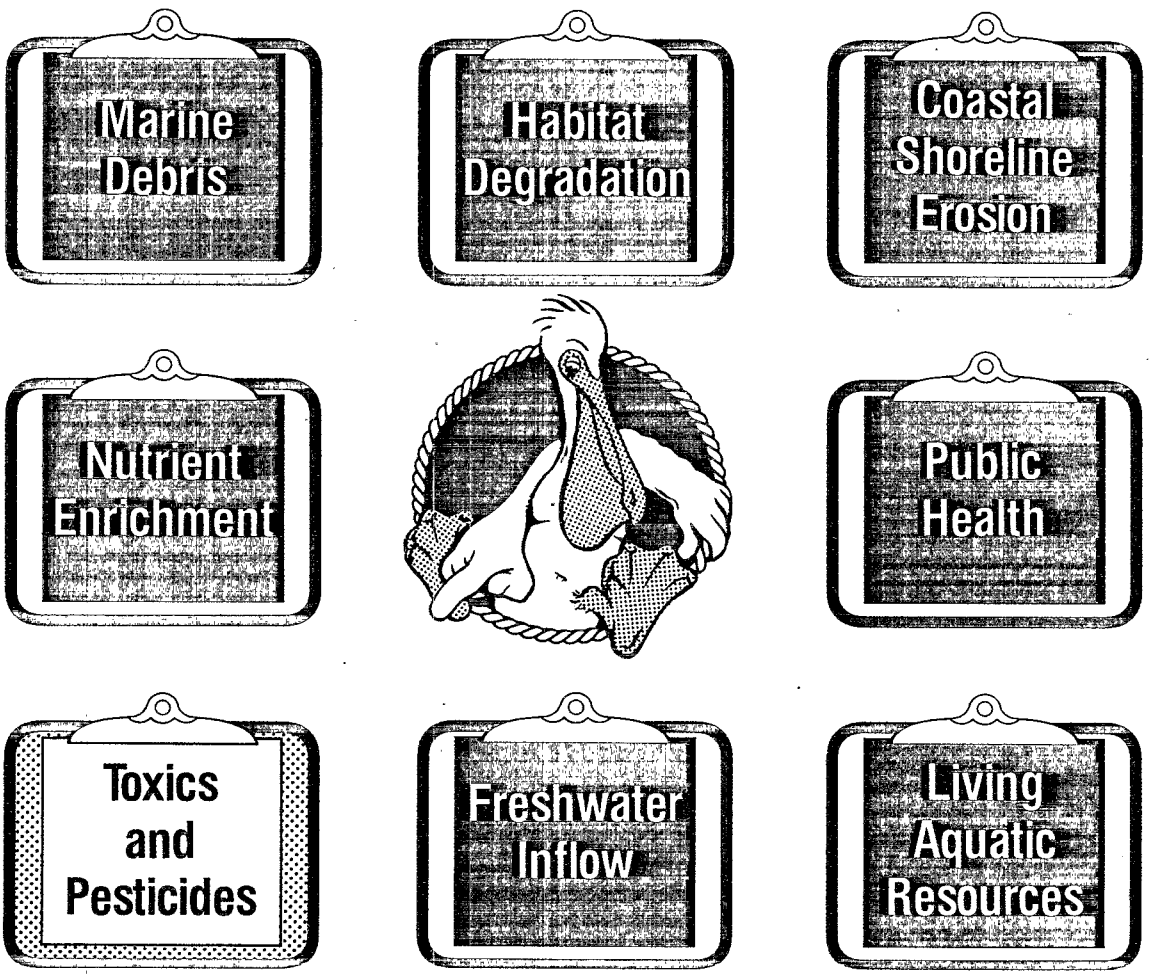
Toxic Substances And Pesticides Action Agenda For The Gulf Of Mexico

First Generation—Management Committee Report

Framework for Action



Toxics and Pesticides Action Agenda for the Gulf of Mexico

PREFACE

One of the initial goals for the first five years of the Gulf of Mexico Program was to establish a "framework-for-action" for implementing management options for pollution controls, determining research direction and environmental monitoring protocols, and implementing remedial and restoration measures for environmental losses. As a means of developing this framework-for-action, the Gulf Program established eight committees, composed of experts, to deal with the following environmental issue areas:

- Habitat Degradation
- Marine Debris
- Freshwater Inflow
- Nutrient Enrichment
- Toxic Substances & Pesticides
- Public Health
- Coastal & Shoreline Erosion
- Living Aquatic Resources

Each committee was charged with: 1) characterizing the status of the issue, 2) developing goals and objectives for remedial and restoration activities, and 3) developing descriptions of the projects and tasks to be implemented in order to achieve the stated objectives. This information was incorporated into an "Action Agenda" for each environmental issue area.

This document is the first generation of one of these Action Agendas. Representing the consensus of a large number of subject specialists, this document is considered to be a draft working paper for the Gulf of Mexico Program Management Committee. Since this first generation Action Agenda has not been reviewed and approved by all agencies, it is being made available for informational purposes only.

EXECUTIVE SUMMARY

The Gulf of Mexico contains ecological and commercial resources matched by few other bodies of water. Yet its blue-green waters disguise the increasing environmental threats that endanger these resources. In recognition of the growing threats, Regions 4 and 6 of the U.S. Environmental Protection Agency (USEPA), which share jurisdiction over the five Gulf Coast States (Alabama, Florida, Louisiana, Mississippi, and Texas), initiated the Gulf of Mexico Program in August 1988. The goal of the Gulf of Mexico Program is to protect, restore, and enhance the coastal and marine waters of the Gulf of Mexico and its coastal natural habitats, to sustain living resources, to protect human health and the food supply, and to ensure the recreational use of Gulf shores, beaches, and waters--in ways consistent with the economic well being of the region.

The Gulf of Mexico Program is a cooperative partnership among federal, state, and local government agencies, as well as with people and groups who use the Gulf of Mexico. During the early stages of Program development, eight priority environmental problems were identified and the following Issue Committees have been established to address each of these problems: Marine Debris, Public Health, Habitat Degradation, Coastal & Shoreline Erosion, Nutrient Enrichment, Toxic Substances & Pesticides, Freshwater Inflow, and Living Aquatic Resources. There are important linkages among these various Issue Committees and the Gulf of Mexico Program works to coordinate and integrate activities among them.

The Toxic Substances & Pesticides Committee was charged with characterizing toxic substance and pesticide contamination and devising ways to prevent or mitigate this contamination. The Toxic Substances & Pesticides Committee has been meeting for more than four years--to review information and data collected by citizens and scientists, identify problem areas, discuss actions that can resolve the problems, and evaluate methods for achieving and monitoring results. The culmination of Issue Committee efforts is this Toxic Substances & Pesticides Action Agenda which specifies an initial set activities needed to reduce toxic substance and pesticide inputs to Gulf waters. This Action Agenda is the first generation of an evolving series of Action Agendas that will be developed to meet the future needs of the Gulf of Mexico.

There are important linkages between the Gulf of Mexico Program Toxic Substances & Pesticides Action Agenda and the Public Health Action Agenda. The Public Health Action Agenda, which was endorsed by the Policy Review Board in September 1992, addresses public health concerns from all contributing sources, while the Toxic Substances & Pesticides Action Agenda focuses on the ecological impacts from toxic substances and pesticides. The Toxic Substances & Pesticides Action Agenda will provide an appropriate balance to the work of the Public Health Committee.

Chapter 1 of the Toxic Substances & Pesticides Action Agenda provides an overview of Gulf of Mexico resources and the threats now facing those resources. In addition, Chapter 1 describes the structure of the Gulf of Mexico Program, including the Action Agenda development process.

Chapter 2 is a summary of the scientific characterization information compiled by the Toxic Substances & Pesticides Committee (*i.e.*, what is known about the current status and trends of toxic substances and pesticides within the Gulf of Mexico).

Chapter 3 describes the legal and institutional framework currently in place in the Gulf of Mexico to address toxic substances and pesticides.

Chapter 4, **The Unfinished Agenda**, contains the goal, objectives, and specific activities established by the Gulf of Mexico Program to address toxic substance and pesticide contamination in the Gulf. The long-term goal established by the Issue Committee is to:

- Reduce and, where possible, eliminate adverse ecological impacts from toxic substances and pesticides in the Gulf of Mexico system.

Forty-five action items have been developed to support the goal and these are grouped under five types of activities and twelve objectives (see **Index of Toxic Substances & Pesticides Objectives**). The action items included in Chapter 4 have been screened by the Gulf of Mexico Program and represent those activities that are currently the most significant and most achievable. This is a fairly comprehensive, but not exhaustive, list. This document begins an evolving process of Action Agendas in which action items are designated, implemented, and then reassessed as progress in the Gulf is made. In the future, new action items will be developed to meet the changing needs in the Gulf of Mexico.

Action items contained in Chapter 4 are not listed in priority order. Each action item is supported by one or more project descriptions. Some of the projects are already underway but not yet completed. Others are included because they will guide federal, state, and local government agencies and private sector organizations in allocating resources where they are most needed and in justifying future management strategies. This Action Agenda should prompt specific agencies and groups to become involved.

The Gulf of Mexico Program recently developed ten short-term environmental challenges to restore and maintain the environmental and economic health of the Gulf. Within the next five years, through an integrated effort that complements existing local, state, and federal programs, the Program has pledged efforts to obtain the knowledge and resources to:

Index of Toxic Substances & Pesticides Objectives

Monitoring & Assessment

Objective: Determine the inputs and concentrations of point and nonpoint sources of toxic substances and pesticides in Gulf of Mexico waters to establish baseline conditions and monitor changes over time.

Objective: Determine ecological effects in the Gulf of Mexico that can be associated with inputs of toxic substances and pesticides.

Objective: Develop a coordinated Gulfwide monitoring strategy to maximize the effectiveness of efforts to address toxic substance and pesticide issues.

Research

Objective: Develop a coordinated Gulfwide research plan designed to address the need for knowledge, interpretation, and evaluation of toxic substances and pesticides.

Objective: Monitor developments and technological advances and support research to determine the fate and effects of toxic substances and pesticides in the Gulf of Mexico.

Planning & Standards

Objective: Implement and promote a coordinated Gulfwide toxic substances and pesticides management strategy which addresses, in priority order, source reduction, recycling, treatment, and disposal.

Objective: Reduce and, where possible eliminate the discharge of contaminants of concern into Gulf of Mexico and Caribbean waters.

Objective: Expand nonpoint pollution control programs to reduce toxic substance and pesticide runoff to Gulf of Mexico waters.

Compliance & Enforcement

Objective: Increase the effectiveness of permitting, compliance, and enforcement strategies to better address the inputs of toxic substances and pesticides to the Gulf of Mexico.

Public Education & Outreach

Objective: Develop public information and education efforts to promote awareness of environmental problems associated with improper use and disposal of toxic substances and pesticides.

Objective: Develop public information and education efforts to target specific actions for reducing toxic substance and pesticide inputs to and effects on the Gulf of Mexico.

Objective: Evaluate the effectiveness and results of all public education and outreach strategies for use in developing future toxic substance and pesticide outreach strategies.

- Significantly reduce the rate of loss of coastal wetlands.
- Achieve an increase in Gulf Coast seagrass beds.
- Enhance the sustainability of Gulf commercial and recreational fisheries.
- Protect the human health and food supply by reducing input of nutrients, toxic substances, and pathogens to the Gulf.
- Increase Gulf shellfish beds available for safe harvesting by ten percent.
- Ensure that all Gulf beaches are safe for swimming and recreational uses.
- Reduce by at least ten percent the amount of trash on beaches.
- Improve and expand coastal habitats that support migratory birds, fish, and other living resources.
- Expand public education/outreach tailored for each Gulf Coast county or parish.
- Reduce critical coastal and shoreline erosion.

This Toxic Substances & Pesticides Action Agenda supports these five-year environmental challenges.

For the public, this Gulf of Mexico Action Agenda should serve three purposes. First, it should reflect the public will with regard to addressing toxic substance and pesticide concerns. Second, it should communicate what actions are needed for eliminating the adverse ecological effects of toxic substances and pesticides and provide the momentum for initiating these actions. Third, it should provide baseline information from which success can be measured.

This Action Agenda is a living document; therefore, the Gulf of Mexico Toxic Substances & Pesticides Committee intends to periodically revise and update this document.

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The Gulf of Mexico - A Vast & Valuable Resource

Bounded by a shoreline that reaches northwest from Florida along the shores of Alabama, Mississippi, and Louisiana, and then southwest along Texas and Mexico, the Gulf of Mexico is the ninth largest body of water in the world. The Gulf's U.S. coastline measures approximately 2,609 km (1,631 miles)--longer than the Pacific coastline of California, Oregon, and Washington. The Gulf region covers more than 1.6 million km^2 (617,600 mi^2) and contains one of the nation's most extensive barrier-island systems, outlets from 33 major river systems, and 207 estuaries (Buff and Turner, 1987). In addition, the Gulf receives the drainage of the Mississippi River, the largest river in North America and one of the major rivers of the world. A cornerstone of the nation's economy, the Gulf's diverse and productive ecosystem provides a variety of valuable resources and services, including transportation, recreation, fish and shellfish, and petroleum and minerals.

Encompassing over two million hectares (five million acres) (about half of the national total), Gulf of Mexico coastal wetlands serve as essential habitat for a large percentage of the U.S.'s migrating waterfowl (USEPA, 1991a). Mudflats, salt marshes, mangrove swamps, and barrier island beaches of the Gulf also provide year-round nesting and feeding grounds for abundant numbers of gulls, terns, and other shorebirds. Five species of endangered whales, including four baleen whales and one toothed whale, are found in Gulf waters. These waters also harbor the endangered American crocodile and five species of endangered or threatened sea turtles (loggerhead, green, leatherback, hawksbill, and Kemp's Ridley). The endangered West Indian (or Florida) manatee inhabits waterways and bays along the Florida peninsula.

In addition, a complex network of channels and wetlands within the Gulf shoreline provides habitat for estuarine-dependent commercial and recreational fisheries. The rich waters yielded approximately 771 million kg (1.7 billion pounds) of fish and shellfish in 1991. Worth more than $641 million at dockside, this harvest represented 19 percent of the total annual domestic harvest of commercial fish (USDOC, 1992). The Gulf boasts the largest and most valuable shrimp fishery in the U.S. and also contributed 41 percent of the U.S. total oyster production in 1991 (USDOC, 1992). Other Gulf fisheries include diverse shellfisheries for crabs and spiny lobsters and finfisheries for menhaden, herring, mackerel, tuna, grouper, snapper, drum, and flounder. The entire U.S. Gulf of Mexico fishery yields more finfish, shrimp, and shellfish annually than the South and Mid-Atlantic, Chesapeake, and Great Lakes regions combined.

The Gulf's bountiful waters draw millions of sport fishermen and beach users each year. It is estimated that the Gulf supports more than one-third of the nation's

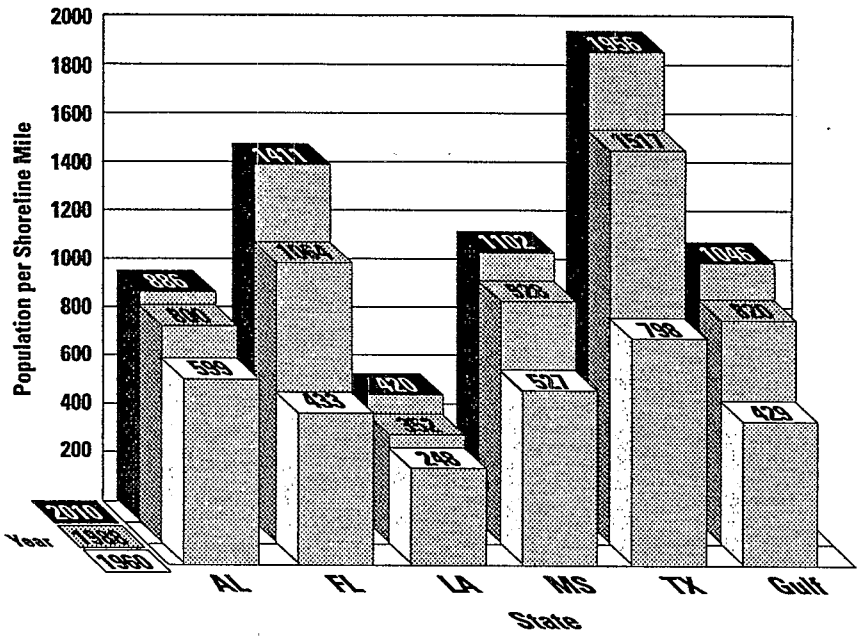
marine recreational fishing, hosting four million fishermen in 1985 who caught an estimated 42 million fish (USDOC, 1992). Popular nearshore catches include sea trout (weak fish), cobia, redfish, flounder, grouper, red snapper, mackerel, and tarpon; offshore catches include blue marlin, white marlin, sailfish, swordfish, dolphin, and wahoo. Tourism-related dollars in the Gulf Coast States contribute an estimated $20 billion to the economy each year (USEPA, 1991a).

Gulf oil and gas production are equally valuable to the region's economy and are a critical part of the nation's total energy supply. In 1990, more than 1,600 Outer Continental Shelf (OCS) leases were in production, yielding approximately 90 percent of U.S. offshore production. These OCS royalties annually contribute about $3 billion to the Federal Treasury. Thirty-eight percent of all petroleum and 48 percent of all natural gas reserves in the U.S. are estimated to be in the Gulf of Mexico. The industry employs some 30,000 people in the Gulf of Mexico.

Approximately 45 percent of U.S. shipping tonnage passes through Gulf ports, including four of the nation's busiest: Corpus Christi, Houston/Galveston, Tampa, and New Orleans. The second largest marine transport industry in the world is located in the Gulf of Mexico. According to USEPA, vessel trips in and out of American Gulf ports and harbors exceeded an estimated 600,000 trips in 1986. The U.S. Navy is also implementing its Gulf Coast Homeporting Plan, designed to dock at least 25 vessels in Ingelside, TX, Pascagoula, MS, and Mobile, AL.

Millions of people depend on the Gulf of Mexico to earn a living and flock to its shores and waters for entertainment and relaxation. The temperate climate and abundant resources are attracting more and more people. The region currently ranks fourth in total population among the five U.S. coastal regions, accounting for 13 percent of the nation's total coastal population. Although the Gulf region is not as densely settled as others, it is experiencing the second fastest rate of growth; between 1970 and 1980, the population grew by more than 30 percent (USDOC, 1990a). According to the U.S. Department of Commerce, the Gulf's total coastal population is projected to increase by 144 percent between 1960 and 2010, to almost 18 million people. **Figure 1.1** shows the Gulf of Mexico coastal population density or population per shoreline mile projected to the year 2010. Florida's population alone is expected to have skyrocketed by more than 300 percent by the year 2010. The increasing coastal population is of concern with regard to toxic substances and pesticides because as the population increases, so does the potential for increased inputs of toxic substances and pesticides.

Figure 1.1 ***Gulf of Mexico Coastal Population per Shoreline Mile***



(Source: USDOC, 1990a)

The Gulf's resources and environmental quality are affected not only by the millions living and working in the region, but also by activities occurring throughout much of the nation. Two-thirds of the land area of the contiguous U.S. drains into the Gulf, bringing with it potential environmental problems associated with pesticides, fertilizer, toxic substances, and trash.

The Gulf of Mexico - A Resource At Risk

Increasing population pressures mean increased use and demands on Gulf of Mexico resources. Until recently, the Gulf was considered too vast to be affected by pollution and overuse. Recent trends indicate, however, serious long-term environmental damage unless action is initiated today. Potential problems or causes of degradation throughout the Gulf system include the following (USEPA, 1991a):

- ❑ Fish kills and toxic "red tides," and "brown tides" were an increasing phenomenon in Gulf waters during the 1980s.

- Alabama, Mississippi, Louisiana, and Texas are among those states that discharge the greatest amount of toxic chemicals into coastal waters.

- Diversions and consumptive use for human activities have resulted in significant changes in the quantity and timing of freshwater inflows to the Gulf of Mexico.

- More than half of the shellfish-producing areas along the Gulf Coast are permanently or conditionally closed. These closure areas are growing as a result of increasing human and domestic animal populations along the Gulf Coast (USDOC, 1991b).

- Louisiana is losing valuable coastal wetlands at the rate of approximately 14-66 km^2/year (5-25 mi^2/year) (Dunbar, *et al.*, 1992).

- Almost 1,800 kg/mi (2 tons/mi) of marine trash covered Texas beaches in 1988.

- Up to 9,500 km^2 (4,000 mi^2) of oxygen deficient (hypoxia) bottom waters, known as the "dead zone," have been documented off the Louisiana and Texas coasts (Rabalais, *et al.*, 1991).

- Gulf shorelines are eroding up to 30 m/year (100 ft/year). Few coastal reaches in the Gulf can be characterized as "stable" or "accreting."

The Gulf of Mexico Program - Goals & Structure

Problems plaguing the Gulf cannot be addressed in a piecemeal fashion. These problems and the resources needed to address them are too great. The Gulf of Mexico Program (GMP) was formed to pioneer a broad, geographic focus in order to address major environmental issues in the Gulf before the damage is irreversible or too costly to correct.

The program is part of a cooperative effort with other agencies and organizations in the five Gulf States, as well as with people and groups who use the Gulf. In addition to the U.S. Environmental Protection Agency (USEPA), other participating federal government agencies include: National Aeronautics and Space Administration (NASA), U.S. Army Corps of Engineers (USACE), U.S. Department of Agriculture (USDA), U.S. Department of Commerce (USDOC), U.S. Department of Defense (USDOD), U.S. Department of Energy (USDOE), U.S. Department of the Interior (USDOI), U.S. Department of Transportation (USDOT), U.S. Food and Drug Administration (USFDA), and Agency for Toxic Substances and Disease Registry (ATSDR).

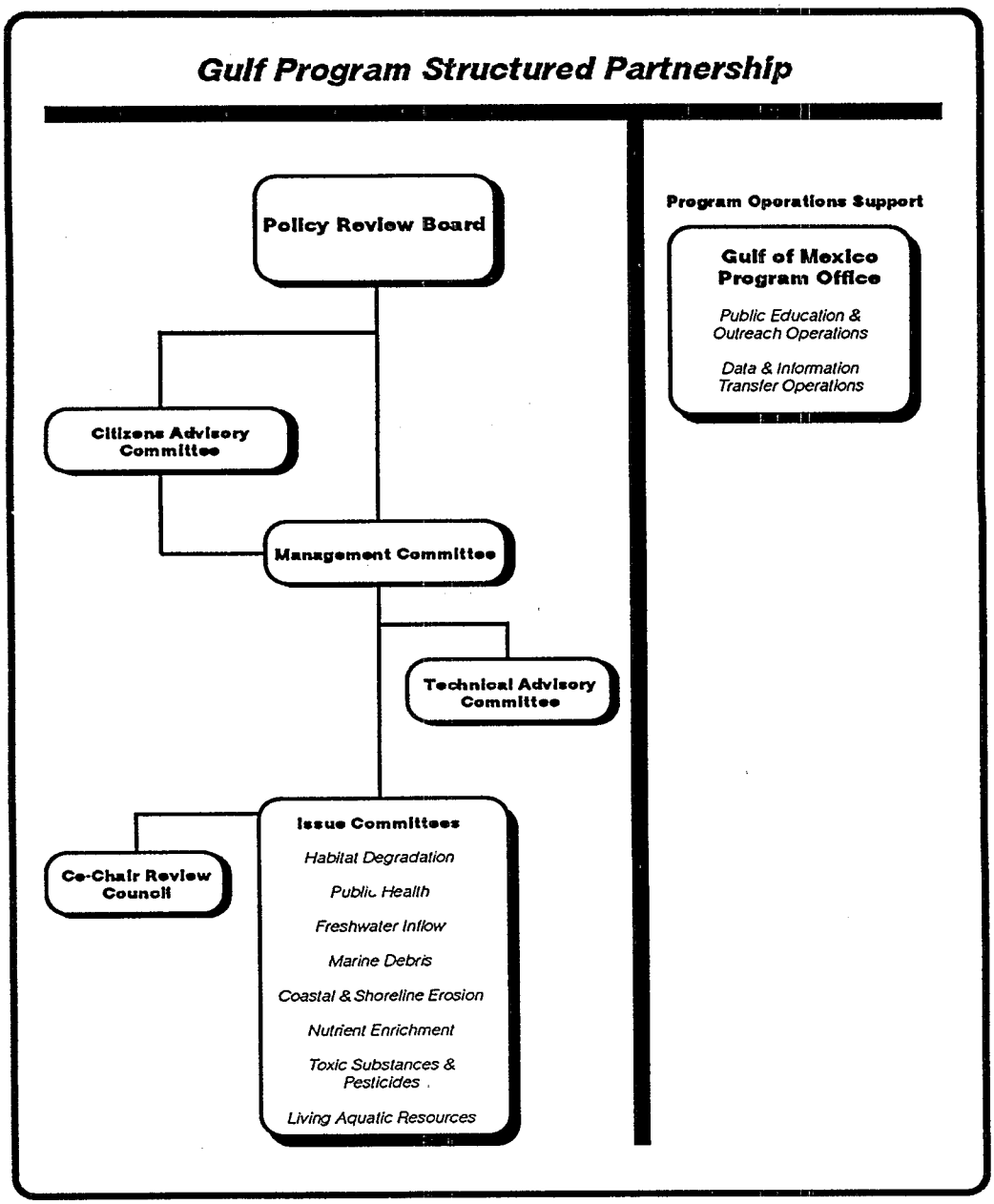
The Gulf of Mexico Program also works in coordination and cooperation with five National Estuary Programs (NEPs) within the Gulf: Tampa Bay, Sarasota Bay, Galveston Bay, Corpus Christi Bay, and the Barataria-Terrebonne Estuarine Complex. The Gulf of Mexico Program supports and builds on certain activities of these programs, bringing a Gulfwide focus and providing a forum for addressing issues of Gulfwide concern.

By building on and enhancing programs already underway, as well as by coordinating new activities, the Gulf of Mexico Program will serve as a catalyst for change. The program's overall goals are to provide:

- A mechanism for addressing complex problems that cross federal, state, and international jurisdictional lines;
- Better coordination among federal, state, and local programs, thus increasing the effectiveness and efficiency of the long-term effort to manage and protect Gulf resources;
- A regional perspective to address research needs, which will result in improved transfer of information and methods for supporting effective management decisions; and
- A forum for affected groups using the Gulf, for public and private educational institutions, and for the general public to participate in the solution process.

The Gulf of Mexico Program is supported by four committees: Policy Review Board (PRB), Management Committee (MC), Citizens Advisory Committee (CAC), and Technical Advisory Committee (TAC) (see **Figure 1.2**). Composed of 20 senior level representatives of state and federal agencies and representatives of the technical and citizens committees, the Policy Review Board guides and reviews overall program activities. The Management Committee guides and manages Gulf of Mexico Program operations and directs the Action Agenda activities of the Issue Committees. The Citizens Advisory Committee is composed of five governor-appointed citizens who represent environmental, fisheries, agricultural, business/industrial, and development/tourism interests in each of the five Gulf Coast States. This committee provides public input and assistance in publicizing the Gulf of Mexico Program's goals and results. Representatives of state and federal agencies, the academic community, and the private and public sectors are members of the Technical Advisory Committee and provide technical support to the Management Committee.

Figure 1.2


Gulf Program Structured Partnership
Policy Review Board
Citizens Advisory Committee
Management Committee
Technical Advisory Committee
Issue Committees
Habitat Degradation
Public Health
Freshwater Inflow
Marine Debris
Coastal & Shoreline Erosion
Nutrient Enrichment
Toxic Substances & Pesticides
Living Aquatic Resources
Co-Chair Review Council
Program Operations Support
Gulf of Mexico Program Office
Public Education & Outreach Operations
Data & Information Transfer Operations

The Gulf of Mexico Program has established the following eight Issue Committees, each co-chaired by one federal and one state representative, to address priority environmental problems:

- **Habitat Degradation** of such areas as coastal wetlands, seagrass beds, and sand dunes;
- **Freshwater Inflow** changes resulting from reservoir construction, diversions for municipal, industrial, and agricultural purposes, and modifications to watersheds with concomitant alteration of runoff patterns;
- **Nutrient Enrichment** resulting from such sources as municipal waste water treatment plants, storm water, industries, and agriculture;
- **Toxic Substances & Pesticides** contamination originating from industrial and agriculturally based sources;
- **Coastal & Shoreline Erosion** caused by natural and human-related activities;
- **Public Health** threats from swimming in and eating seafood products coming from contaminated water;
- **Marine Debris** from land-based and marine recreational and commercial sources; and
- **Living Aquatic Resources**.

Two cross-cutting technical operating committees support the public education and information and resource management functions of the eight environmental Issue Committees. These are:

- **Public Education & Outreach Operations**
- **Data & Information Transfer Operations**

The action planning process used by each Gulf of Mexico Program Issue Committee includes the following key activities:

- Definition of environmental issues;
- Characterization of identified problems, including sources, resources, and impacts;
- Establishment of goals and objectives;

- ❑ Evaluation/assessment of corrective actions and control measures, including cost/benefit analysis;
- ❑ Selection of priority action items;
- ❑ Establishment of measures of success;
- ❑ Implementation of actions; and
- ❑ Evaluation of success and revision of the Action Agenda.

As the Issue Committees progress through each of these activities, ample opportunities are provided for public review and Policy Review Board endorsement is requested at appropriate points. The Gulf of Mexico Program will continuously work to integrate related activities of the eight Issue Committees. Through the consensus of Program participants, a coordinated response will be directed to the successful maintenance and enhancement of resources of the Gulf of Mexico.

The Toxic Substances & Pesticides Committee

The Co-Chairs and membership of the Toxic Substances & Pesticides Committee are as follows:

Co-Chairs:

Ray Wilhour	U.S. Environmental Protection Agency
Phil B. Bass	Mississippi Department of Environmental Quality

Members:

Ronnie Albritton	Georgia-Pacific
Robert Baker	U.S. Geological Survey
William Benson	University of Mississippi
Kenneth Blan	Soil Conservation Service--Gulf of Mexico Program
Fred Bedsole	Scott Paper Company
Michael Brim	U.S. Fish & Wildlife Service
Brian Burgess	U.S. Environmental Protection Agency
Brian Cain	U.S. Fish & Wildlife Service
John Carlton	Alabama Department of Environmental Management
George Cason	Gulf of Mexico Program--Citizens Advisory Committee
Emelise Cormier	Louisiana Department of Environmental Quality
Philip Crocker	U.S. Environmental Protection Agency
Phillip Dorn	Shell Development Company
Roxane Dow	Florida Department of Environmental Regulation
David Engel	National Marine Fisheries Service
Joseph Ferrario	U.S. Environmental Protection Agency
Robert Fisher	National Council for Air & Stream Improvement
Catherine Fox	U.S. Environmental Protection Agency
Valanne Glooschendo	U.S. Fish & Wildlife Service
Don Grothe	Monsanto Company
Lore Hantske	Texas General Land Office
Matthew Keppinger	Louisiana Department of Agriculture & Forestry
Richard Kiesling	Texas Water Commission
Arnold King	Soil Conservation Service
Julia Lytle	Gulf Coast Research Laboratory
Foster Mayer	U.S. Environmental Protection Agency
Merrill McPhearson	U.S. Food & Drug Administration
Rick Medina	U.S. Army Corps of Engineers
David Moore	U.S. Army Corps of Engineers
Randy Palachek	Engineering Science, Inc.
Richard Pierce	Mote Marine Laboratory
Russell Ray	Lower Colorado River Authority
Pat Roscigno	Minerals Management Service
William Schroeder	University of Alabama
Terry Wade	Geochemical & Environmental Research Group

The Toxic Substances & Pesticides Committee developed the following long-term goal for addressing toxic substances and pesticides in the Gulf of Mexico:

- Reduce and, where possible, eliminate adverse ecological impacts from toxic substances and pesticides in the Gulf of Mexico system.

The Gulf of Mexico Policy Review Board endorsed this goal on November 8, 1990. In developing this Action Agenda, the Toxic Substances & Pesticides Committee has sought input and advice from other technical Issue Committees as well as from organizations, interest groups, and private concerns outside of the Gulf of Mexico Program.

An "Action Agenda Workshop" was sponsored by the Toxic Substances & Pesticides Committee in Hammond, LA, on November 16-18, 1992. Approximately 40 persons, comprising a mix of Program and non-Program participants, gathered to review an early version of this Action Agenda. In addition to Gulf of Mexico Program participants, representatives from the following agencies, organizations, and industries attended the workshop: National Council on Air & Stream Improvement, Southern University, Alabama Department of Public Health, Florida Department of Natural Resources, Florida Department of Environmental Regulation, Louisiana Department of Environmental Quality, Louisiana Department of Agriculture & Forestry, Matagorda County Water Council, Texas State Soil & Water Conservation Board, Exxon Biomedical Sciences, National Marine Fisheries Service, U.S. Environmental Protection Agency--Environmental Monitoring & Assessment Program, Gulf Coast Research Laboratory, Soil Conservation Service, and U.S. Fish & Wildlife Service. This meeting generated a significant number of comments that were addressed in the present document. (See **Appendix D: Participants in the Action Agenda Development Process**.)

2 TOXIC SUBSTANCES & PESTICIDES IN THE GULF OF MEXICO*

***NOTE: Information in Chapter 2 is based on 1989 Toxic Release Inventory data and the following DRAFT reports that have not been fully peer reviewed:**

- **"Impact of Toxic Substances & Pesticides on Nearshore Gulf of Mexico: A Preliminary Comparison (Toxicity Indices) of Twenty-Five Estuarine Drainage Systems Based on Releases of Toxics From Industrial and Municipal Sites and Pesticide Run-Off From Agricultural Operations in 1989"; by Jeri Brecken-Folse and Maureen G. Babikow, Technical Resources, Inc., and Dr. T.W. Duke, Consultant, under contract to USEPA Gulf Breeze, FL.**
- **"Evaluation of Gulf of Mexico Sediment Inventory"; by Jeri Brecken-Folse and Maureen G. Babikow, Technical Resources, Inc., and Dr. T.W. Duke, Consultant, under contract to USEPA Gulf Breeze, FL. Draft 1993.**
- **"Gulf of Mexico Toxic Substances and Characterization Report"; by John Brabeck and Jeri Brecken-Folse. Draft 1993.**

NOTE: Current TRI data is available on the Gulf of Mexico Program Electronic Bulletin Board System.

Introduction

Although the Gulf of Mexico is viewed as one of the most healthy and productive of U.S. coastal environments, during recent decades it has begun to show signs of deteriorating environmental quality. The introduction of toxic substances and pesticides within populated coastal counties is of increasing concern.

Indicators of the declining environmental quality of the Gulf include species extinction, the loss of resource use of certain areas (*e.g.*, no swimming/skiing because of toxicants, oil sheens) or the reduced value or aesthetics of an area, increased incidence of diseases in aquatic organisms and wildlife (tumors, lesions, etc.), impacts on health of humans who consume contaminated seafood (*e.g.*, increased rate of cancer), and changes in population dynamics, communities, or ecosystems.

Toxic substances (including pesticides) are materials either synthesized by humans or present in Gulf of Mexico waters that are capable of producing an adverse effect in a biological system, seriously injuring ecosystem structure or function, or causing death. It should be noted that human and other pathogens were excluded from consideration by the Toxic Substances & Pesticides Committee because these issues are being addressed by the Public Health Committee.

A **pesticide**, broadly defined, is any agent used to kill or control undesired insects, weeds, rodents, fungi, bacteria, or other organisms. Thus, the term "pesticides" includes insecticides, herbicides, rodenticides, fungicides, nematicides, and

arachnicides, as well as disinfectants, fumigants, and plant growth regulators. For the purposes of this action agenda, the term "pesticide" refers to chemical agents only; biological agents are not addressed as part of this Action Agenda.

Toxic substance and pesticide contamination can be a serious coastal environment problem. However, historically, more visible problems like marine debris, eutrophication, and coastal erosion captured the public attention and garnered public support for action. Today, concerns about discharges of toxic substances in the Gulf of Mexico are growing because of the increased concentration of industrial activities. USEPA's Toxic Release Inventory (TRI) is a computerized data base containing public information on the annual releases and transfers of approximately 320 toxic chemicals reported by U.S. manufacturing facilities to USEPA and the states. Since 1987, federal law has required facilities to report the amount of both routine and accidental releases of the 320 listed chemicals to the air, water, and soil, and the amount contained in wastes transferred off-site. Some 695 facilities report this data within the 68 counties that border the Gulf. According to 1989 TRI data, all five Gulf Coast States are listed in the top 20 states nationally for total chemical emissions to the environment. Four Gulf States (Alabama, Mississippi, Louisiana and Texas) were among the top five states with the largest surface water discharges of chemicals. Other, less identifiable, sources of pollutants enter rivers, estuaries, and coastal areas from runoff. Many of these nonpoint sources also contribute chemicals and pesticides, as well as other material to the receiving waters of the Gulf of Mexico.

Comparable data are not currently available to address the fate and effects of these discharges on the aquatic environment. A toxicant entering the marine environment may move into the water, sediment, biota, or atmosphere. Several models exist that assist in predicting fate; however, these models need to be refined and validated to incorporate parameters such as flushing time. Models for predicting effects are not as available. Yet, it is clear that toxic contamination can cause a slow, subtle poisoning of water, soil, and aquatic resources that is fairly invisible to beach users, boaters, or casual observers of Gulf waters.

Consequences for Living Resources

The toxic effects of chemical contaminants to aquatic organisms are dependent on several factors, such as the bioavailability and persistence of specific contaminants, and the interference of contaminants with metabolic processes (Capuzzo and Moore, 1986). The responses of organisms to toxic chemicals can be exhibited at four levels of biological organization: 1) biochemical and cellular; 2) organismal, including the integration of physiological, biochemical and behavioral responses; 3) population, including alterations in population dynamics; and 4) community, resulting in alterations in community structure and dynamics (Capuzzo and Moore, 1986). One of the least understood problems is the effect of sub-lethal concentrations of toxic materials on ecosystem function.

Signs of increasing degradation and contamination from toxic substances and pesticides in the Gulf of Mexico include the following examples:

- In a USEPA study of three Gulf Coast estuaries, sampling stations near heavily industrialized sites yielded larger numbers of diseased fish and oysters when compared to more distant sampling stations (USEPA, 1990b).

- Biscayne Bay, Mississippi Sound, and Galveston Bay have been reported (Overstreet, 1986) to contain striped mullet with mesenchymal neoplasms; sciaenid and other fishes with lymphocystis; fish with ulcers, red sores, fin erosion, and granulomata; crustaceans with shell disease; and other "pollution-associated" diseases.

- According to NOAA National Status and Trends Mussel Watch data, mercury is generally enriched in Florida sites, where 12 of 25 of the sites sampled are well above average. The oysters from Old Tampa Bay and Lavaca Bay are especially high in mercury (USDOC, 1987).

- In some locations in Texas, where oysters are known to be contaminated with mercury, harvesting has been limited because of the potential of a human health threat.

- The brown pelican became locally extinct in the northern Gulf because the presence of the pesticide DDT in large quantities inhibited the pelican's ability to reproduce (USEPA, 1991c; USEPA, 1990b). Regulatory controls have supported the recovery of this species in many areas; however, the brown pelican remains endangered in Texas.

- Total DDT is the most abundant chlorinated pesticide found in Gulf oysters. The regional distribution of total DDT shows that four of the five highest concentrations are associated with major river outfalls including the Brazos, Mississippi, Mobile, and Choctawatchee rivers. There are also relatively high total DDT concentrations at St. Andrew's Bay and Panama City, although there are no major rivers nearby. Polycyclic aromatic hydrocarbons (PAHs) are also highest in these regions. Possible sources of contaminants may be nearby oil-storage tanks and a paper/pulp mill. DDTs associated with soils may be transported downstream and collect in estuaries. This process provides a plausible explanation of the higher total DDT associated with major river outfalls. There are somewhat higher concentrations near areas of higher population density (*i.e.*, Galveston Bay, Mobile Bay, etc.) (Wade *et al.*, 1991).

- PCBs have been detected in all oyster samples analyzed in NOAA's National Status & Trends Program. The highest regional concentration is from St. Andrew's Bay.

- Moderately elevated concentrations of sediment pesticides and PCBs appear along the central Louisiana coast (possibly associated with Mississippi River discharge) and at isolated stations in Matagorda Bay and Galveston Bay. High concentrations of chlorinated hydrocarbons are observed along the Mississippi-northern Florida coast and at sampling stations in Tampa Bay. The most abundant chlorinated hydrocarbons in Gulf of Mexico oysters are PCBs, DDTs, chlordanes, and dieldrin. Overall, the geographical trends in organochlorine contaminant load in oysters follow those observed in sediments. (Texas A & M Research Foundation, 1989).

Gulfwide Comparison of Impacts

Environmental Monitoring & Assessment Program--Estuaries (EMAP-E)

The following data is from the first annual statistical summary for the Louisianian Province of the Estuaries component of USEPA's Environmental Monitoring and Assessment Program (EMAP). This summary represents data from a single year of field operations (July-August, 1991). Because the probability-based scientific design used by EMAP necessitates multiple years of sampling, there may be significant levels of uncertainty associated with some of these data. This uncertainty will decrease as the full power of the approach is realized by the collection of data over several years. Similarly, temporal changes and trends cannot be reported, as these require multiple years of observation. Appropriate precautions should be exercised when using the information for policy, regulatory, or legislative purposes. The following section has been excerpted from Summers *et al.*, 1993.

EMAP is a national program to evaluate the status and trends of the ecological resources of the U.S. The Louisianian Province represents a single biogeographic area of the country corresponding to the Gulf of Mexico area. One hundred and eighty-three sites between Anclote Anchorage, FL, and the Rio Grande, TX, were sampled from July-August 1991. A series of indicators that are representative of the overall condition of estuarine resources was measured at each site. These indicators were designed to address three major attributes of concern: 1) estuarine biotic integrity, 2) aesthetics representing societal values related to public use of estuarine resources, and 3) pollutant exposure or the conditions under which biota live. Only information related to toxic and pesticide contaminant levels are provided in this Action Agenda.

In general, contaminant concentrations in fish and shellfish were low with the exception of some heavy metals (arsenic, chromium, mercury, and zinc) (See **Tables 2.1**, **2.2**, and **2.3**). Concentrations of pesticides and PCBs measured in brown and white shrimp tissue did not exceed existing USFDA and international criteria (USFDA, 1984, 1982; Nauen, 1983). However, certain heavy metals were characterized by concentrations exceeding criteria in small portions of the sampled populations of shrimp (see **Table 2.1**). Arsenic concentrations exceeding 2 ppm were found in three percent of the croaker population. Eight percent of catfish contained elevated levels of arsenic, exceeding 2 ppm. Zinc concentrations exceeded 60 ppm in two percent of the catfish populations. Mercury exceeded 1 ppm in one percent of the catfish populations.

Overall, the number of contaminants seen in fish and shellfish exceeding the USFDA action limits was low. However, a few contaminants (selected heavy metals) occurred in high enough concentrations to exceed USFDA action limits in small portions of the populations examined. These contaminants were arsenic, zinc, mercury, and chromium. Because of the paucity of information concerning U.S. standards for heavy metals other than mercury in fish, the criteria levels used for metals in **Tables 2.1**, **2.2**, and **2.3** (*i.e.*, World Health Organization guidelines)

Table 2.1 *Overview of the Contaminant Levels Observed in Edible Flesh of Brown Shrimp & White Shrimp (N=370)*

Contaminant	Observed Range	Criterion[1]	Proportion Exceeding Criterion
Pesticides (ng/g wwt)			
DDD	0-4.9	5000	0%
DDE	0-1.7	5000	0%
DDT	0-74.0	5000	0%
Aldrin	0-1.6	300	0%
Chlordane	0-1.9	300	0%
Dieldrin	0-1.6	300	0%
Endosulfan	0-0.0	NA[2]	0%
Endrin	0-12.8	300	0%
Heptachlor	0-0.0	300	0%
Heptachlor Epoxide	0-3.9	300	0%
Hexachlorobenzene	0-2.5	200	0%
Lindane	0-0.0	200	0%
Mirex	0-43.5	100	0%
Toxaphene	0-0.0	5000	0%
Trans-Nonachlor	0-1.3	NA	U[3]
PCBS (ng/g wwt)			
21 Congeners	0-16.1	500	0%
Total PCBs	0-30.3	2000	0%
Heavy Metals (ng/g wwt)			
Aluminum	0-78.5	NA	U
Arsenic	0-3.9	2	4%
Cadmium	0-0.3	0.5	0%
Chromium	0-6.1	1	4%
Copper	0-9.6	15	0%
Lead	0-0.3	0.5	0%
Mercury	0-0.3	1	0%
Nickel	0-9.0	NA	U
Selenium	0-0.3	1	0%
Silver	0-0.3	NA	U
Tin	0-1.1	NA	U
Zinc	1-18.8	60	0%

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[1]Criteria were selected from FDA established limits for pesticides and PCBs (USFDA 1982, 1984) except hexachlorobenzene and lindane which are based on Swedish limits (Nauen 1963); no FDA limits exist for metals other than mercury; metals criteria reflect mean of international limits (Nauen 1983)

[2]NA = Not Available

[3]U = Unknown because no criterion level available

(Source: Statistical Summary, EMAP-E Louisianian Province - 1991)

may not be acceptable. However, the contaminant data are available to be compared to any criteria and can be used to track potential trends in contaminant concentrations in flesh for the croaker, catfish, and shrimp populations in the Louisianian Province.

Laboratory bioassays were conducted to determine if the sediments in the Louisianian Province were toxic to representative estuarine organisms, using an amphipod and a common mysid. Based upon the results of these tests, seven percent of the Province contained sediments that were toxic to estuarine organisms. Elevated levels of metals in sediments were observed in 33 percent of the Province. These metals were primarily mercury, nickel, chromium, and zinc.

In the 1991 Louisianian Province Demonstration, 25 pesticides and derivations were examined. For this summary, total pesticides, total DDT, and total chlordane are reported. National sediment quality criteria have not yet been completed by USEPA, and suggested criteria are only available for nine of the 25 pesticides examined. Long and Morgan (1990) report the following criteria concentrations for DDT, DDD, DDE, chlordane, dieldrin, and endrin: 7 ppb, 20 ppb, 15 ppb, 0.5 ppb, 0.02 ppb, and 0.02 ppb, respectively. Long and Morgan values are derived from an Apparent Effects Threshold (AET) method for developing sediment criteria and represent concentrations at which effects to estuarine organisms could result.

The DDT criteria value of 7 ppb was exceeded for less than one percent of the sediments in the Louisianian Province. Total chlordane showed concentrations greater than 0.5 ppb in two percent of the sediments of the Louisianian Province with some individual sediment samples exceeding 5 ppb.

Total pesticides were evaluated by examining each individual pesticide and computing the number of sediment samples in which at least one criterion was exceeded. Based on this approach, 24 percent of the Louisianian Province sediments exceeded these pesticide concentrations. This exceedance was primarily related to high concentrations of DDT, dieldrin, and chlordane. Tributyltin was measured at sediment concentrations greater than 1 ppb in 13 percent and 75 ppb in four percent of the sediments of the Louisianian Province. Of the 31 percent of Gulf sediments that had poor benthic communities, 75 percent were related to elevated levels of toxics and pesticides.

Table 2.2 *Overview of the Contaminant Levels Observed in Edible Flesh of Atlantic Croaker*

(N=580, NA=Not Available, U=Unknown, no criterion level is available)

Contaminant	Observed Range	Criterion[1]	Proportion Exceeding Criterion
Pesticides (ng/g wwt)			
DDD	0-16.0	5000	0%
DDE	0-3.5	5000	0%
DDT	0-24.2	5000	0%
Aldrin	0-3.2	300	0%
Chlordane	0-8.2	300	0%
Dieldrin	0-26.2	300	0%
Endosulfan	0-1.7	NA	U
Endrin	0-22.5	300	0%
Heptachlor	0-5.7	300	0%
Heptachlor Epoxide	0-16.7	300	0%
Hexachlorobenzene	0-77.4	200	2%
Lindane	0-0.0	200	0%
Mirex	0-88.5	100	0%
Toxaphene	0-1800	5000	0%
Trans-Nonachlor	0-1.3	NA	U
PCBS (ng/g wwt)			
21 Congeners	0-40.6	500	0%
Total PCBs	0-62.5	2000	0%
Heavy Metals (ng/g wwt)			
Aluminum	0-6.9	NA	U
Arsenic	0-2.1	2	3%
Cadmium	0-0.1	0.5	0%
Chromium	0-0.3	1	0%
Copper	0-5.3	15	0%
Lead	0-0.3	0.5	0%
Mercury	0-0.4	1	0%
Nickel	0-0.3	NA	U
Selenium	0-0.3	1	0%
Silver	0-1.8	NA	U
Tin	0-0.7	NA	U
Zinc	1-11.8	60	0%

[1]Criteria were selected from FDA established limits for pesticides and PCBs (USFDA 1982, 1984) except hexachlorobenzene and lindane which are based on Swedish limits (Nauen 1963); no FDA limits exist for metals other than mercury; metals criteria reflect mean of international limits (Nauen 1983)

Table 2.3 *Overview of the Contaminant Levels Observed in Edible Flesh of Catfish*

(N=1130, NA=Not Available, U=Unknown, no criterion level is available)

Contaminant	Observed Range	Criterion[1]	Proportion Exceeding Criterion
Pesticides (ng/g wwt)			
DDD	0-207.4	5000	0%
DDE	0-12.2	5000	0%
DDT	0-39.4	5000	0%
Aldrin	0-2.7	300	0%
Chlordane	0-6.1	300	0%
Dieldrin	0-24.4	300	0%
Endosulfan	0-1.8	NA	U
Endrin	0-10.1	300	0%
Heptachlor	0-5.7	300	0%
Heptachlor Epoxide	0-5.7	300	0%
Hexachlorobenzene	0-4.0	200	0%
Lindane	0-4.1	200	0%
Mirex	0-30.7	100	0%
Toxaphene	0-1400	5000	0%
Trans-Nonachlor	0-4.3	NA	U
PCBS (ng/g wwt)			
21 Congeners	0-19.5	500	0%
Total PCBs	0-67.9	2000	0%
Heavy Metals (ng/g wwt)			
Aluminum	0-105.1	NA	U
Arsenic	0-10.1	2	8%
Cadmium	0-0.4	0.5	0%
Chromium	0-0.8	1	0%
Copper	0-10.3	15	0%
Lead	0-0.4	0.5	0%
Mercury	0-1.2	1	1%
Nickel	0-0.7	NA	U
Selenium	0-0.4	1	0%
Silver	0-0.3	NA	U
Tin	0-1.2	NA	U
Zinc	1-234.0	60	2%

[1]Criteria were selected from FDA established limits for pesticides and PCBs (USFDA 1982, 1984) except hexachlorobenzene and lindane which are based on Swedish limits (Nauen 1963); no FDA limits exist for metals other than mercury; metals criteria reflect mean of international limits (Nauen 1983)

(Source: Statistical Summary, EMAP-E Louisianian Province - 1991)

Toxic Substances & Pesticides Committee Draft Inventory & Ratings

The Toxic Substances & Pesticides Committee has developed a draft inventory and ratings of Gulf estuarine drainage systems with respect to potential toxicity as a first step in an overall assessment of adverse impact. The focus of the initial assessment is on municipal and industrial discharges, agricultural pesticide use, and produced water discharges. Contamination from sources such as atmospheric deposition, urban runoff, "upstream" contamination, and others are not included in this initial assessment.

The Issue Committee evaluated the short-term impact of the contaminants by: 1) listing sites that cannot reasonably be expected to attain or maintain water quality standards or assure protection of public health or protection of shellfish, fish, and wildlife in Gulf coastal waters in accordance with §304(l) of the Clean Water Act; 2) identifying areas where fish and shellfish were contaminated to the extent that they constituted a potential threat to human health and welfare and, therefore, were closed to harvest (State Fisheries Advisories); and 3) locating other contaminated sites known to members of the Issue Committee. Twenty-nine such sites were identified.

A more detailed Gulfwide approach was also taken whereby the impact from three sources of toxic substances and pesticides data were evaluated: 1) USEPA's Toxic Release Inventory of the Gulf and Permit Compliance System; 2) pesticides that are applied to cultivated fields and could drain into the Gulf; and 3) discharges from nearshore oil and gas platforms.

Inventory and pesticide application data were also used to calculate a "rating" whereby the potential contamination and impact of these chemicals on the estuarine drainage systems could be compared. The comparison considered toxicity and amounts of the chemicals applied and the volume of the receiving drainage basin. The pesticide data and the inventory were not integrated because they were collected in different years.

Metals and organics released in "produced waters" from oil and gas platforms into nearshore waters of the Gulf add to the load of toxic contaminants entering nearshore areas. Produced water is water brought up from hydrocarbon-bearing strata with the produced oil and gas. A preliminary listing of the amounts of these chemicals released in 1991 off the coasts of Louisiana and Texas were summarized.

Findings include the following: Relatively large amounts, approximately 13 million pounds per year, of toxic substances were discharged from industrial and municipal sites and reached the estuarine drainage areas of the Gulf of Mexico in 1989. Other contaminants include pesticides from agricultural fields and produced waters from nearshore oil and gas platforms. These sources have contributed to elevated levels of these contaminants in nearshore waters of the Gulf.

A simplified rating system (toxicity, amounts of the chemicals, and volume of the receiving drainage system) used to compare potential impact and contamination among Gulf estuarine drainage systems showed Calcasieu Lake to be the most susceptible, followed in descending order by the Brazos River, Corpus Christi Bay, Sabine Lake, Galveston Bay, Escambia Bay, Mobile Bay, Perdido Bay, Atchafalaya/Vermillion Bay and San Antonio Bay.

Approximately 43 million pounds of toxics were discharged into municipal treatment systems from coastal counties, of which one million were released into Gulf nearshore waters after treatment. Approximately 12 million pounds of toxics were discharged into surface waters resulting in a total of 13 million pounds reaching Gulf waters.

The ten most toxic chemicals released to the estuarine drainage systems ranked highest to lowest according to a calculated toxicity index were: ammonium sulfate, chlorine, ammonia, chromium, hydrazine, copper/copper compounds, zinc/zinc compounds, cyanide/cyanide compounds, ethylbenzene, and sulfuric acid. (See **Appendix E: Toxicological Profiles of the Top Ten Gulfwide Releases.**)

The frequency of occurrence of some of the most toxic chemicals discharged was: ammonia appeared in 17 of 25 drainage systems, chlorine in 11, copper/copper compounds in nine, and zinc/zinc compounds in nine systems.

Site specific, mostly short-term, adverse or potentially adverse effects have occurred in coastal waters of the five states bordering the Gulf of Mexico. This is reflected in numerous seafood advisories and reports under §304 (l) of the Clean Water Act.

Potential ecosystem effects are indicated Gulfwide when the kinds and amounts of chemicals entering estuarine drainage basins of known volumes of water are compared with concentrations known to cause toxic effects to indicator organisms.

Approximately 4.5 million kg (10 million pounds) of pesticides were applied to agricultural fields in Gulf coastal counties in 1987, and 2.3 million kg (5.1 million pounds) in 1990. According to a rating index developed by NOAA in 1987, potential contamination of the Laguna Madre estuarine drainage system was the greatest, followed by Tampa Bay and Charlotte Harbor. The index applied to the 1989 data showed Laguna Madre to be the greatest followed by Atchafalaya/Vermillion Bay and Matagorda Bay.

A preliminary report (Avanti) on produced water discharged in 1991 from oil and gas platforms and coastal processing plants located in near coastal waters of Louisiana and Texas showed the discharges contained approximately 12.7 million kg (28 million pounds) of metals (minus calcium and magnesium) and 1.1 million kg (2.5 million pounds) of organic pollution.

Based on this Committee assessment, toxic substances and pesticides are having an adverse effect on living resources in the Gulf of Mexico. It appears that the effects are localized and caused by high concentrations and/or acute events, but the exact causes are not easily identified without case studies designed to identify cause.

These contaminants are continuously entering the estuarine drainage systems. The variety and amount of the contaminants and the limited mixing capacity of the system make it very likely that broad scale ecological effects are occurring Gulfwide; but because of subtle, long-term changes, such effects can go unnoticed until systems react. The dramatic loss of submerged aquatic vegetation in some parts of the Gulf is an example of such a reaction.

Sources of Toxic Substances & Pesticides

The factors that may be affecting the water quality of an estuarine basin are many, and determining specific sources or causes of water quality problems is a complicated process. The economy of Gulf Coast States depends heavily on the chemical, petroleum, and paper industries. These industries can contribute toxic substances resulting from manufacturing operations and permitted effluent discharges, as well as accidental releases. The waste water generated by the operations of these industries, which can be carried to Gulf waters, contains such toxics as mercury, dioxins, PCBs, carcinogenic hydrocarbons, and radionuclides (RA 226/228). The coastal regions of the Gulf of Mexico have experienced rapid population growth in recent years. Factors associated with such growth include demands for additional sewage treatment (and associated discharges), new industrial discharges, and increases in urban and suburban runoff. This runoff can contain heavy metals, oil and grease, PAHs, and organic contaminants. In addition, increased agricultural activities that accompany growth can have an adverse impact with increased pesticide and organic contaminant runoff to Gulf waters. Finally, large quantities of toxic pollutants are transported to the Gulf from other parts of the country via the Mississippi River, which drains 40 percent of the continental U.S. In some instances this pollution has caused elevated concentrations of toxic substances and pesticides in the water, sediment, and biota of coastal systems.

Point Sources

Industrial. The Gulf of Mexico region has 3,700 permitted point sources of pollution--more than any other region in the U.S. (USDOC, 1990b). Over half of the 3,700 permits are to industrial facilities. A federal government-sponsored study found that 347 major permits are to industrial facilities that discharge wastes through pipelines directly into the waters of the Gulf and its surrounding estuaries (Weber *et al.*, 1992). These were distributed among the Gulf States as follows: Texas (192), Louisiana (79), Mississippi (30), Alabama (29), and the Gulf Coast of Florida (17). The majority of these permitted dischargers are petroleum refineries and petrochemical plants, although there are many forest product and fish processing permits as well. Galveston Bay, TX, has the greatest concentration of permitted point sources, followed by Mississippi Sound (USDOC, 1991a). Only two of these permittees discharge into coastal waters; the rest of these permits are for discharges into Gulf estuaries.

In addition to these direct point source dischargers, there are many other permitted sources that discharge their treated wastes into streams and rivers that ultimately flow into the Gulf. After draining more than 40 percent of the land area of the contiguous U.S., the Mississippi River flows into the Gulf transporting large amounts of contaminants from other parts of the country (Weber *et al.*, 1992).

Municipal Wastewater Treatment Plants. There are 1,293 permitted municipally-owned wastewater treatment plants in Gulf of Mexico estuarine drainage areas (USDOC, 1990b). The 113 municipalities immediately surrounding the Gulf release more than a billion gallons a day of treated sewage effluent into Gulf waters (Weber *et al.*, 1992). Most of these municipalities discharge into estuaries; only six discharge into coastal waters.

Although the effectiveness of waste treatment has significantly improved over the past thirty years, treated sewage effluent can contain heavy metals and toxic household wastes, in addition to nutrients and pathogens. Based on population projections, waste treatment loadings in Florida are expected to increase by more than 300 percent by the year 2000 (Windsor, 1985); similar trends can be expected elsewhere. Additional sewage outfalls into estuarine and coastal waters are potentially one consequence of these population increases.

Accidental Spills. Accidental spills and discharges that exceed permit limitations continue to present risks to human health and the environment. The major source of pollutants entering the Mississippi River in Louisiana, other than permitted industrial and municipal discharges, is accidental spills. During the period from October 1989 through September 1991, the LA Department of Environmental Quality Water Quality Management Division investigated 1,524 spills statewide. Ambient monitoring for priority organic pollutants in the Mississippi River has revealed that, most of the time, few, if any, pollutants are detected, and when detected, they are usually associated with short-term spill events (LADEQ, 1992).

Nonpoint Sources

Nonpoint sources have been identified as the main factor contributing to a large and recurring area of oxygen-depleted waters off the Louisiana coast. There is evidence of oxygen-depleted waters in other parts of the Gulf as well. Nonpoint sources have also been identified as the primary pollution factor in many estuaries nationwide that are too polluted to support fishing, swimming, and the propagation of marine life. (Weber *et al.*, 1992).

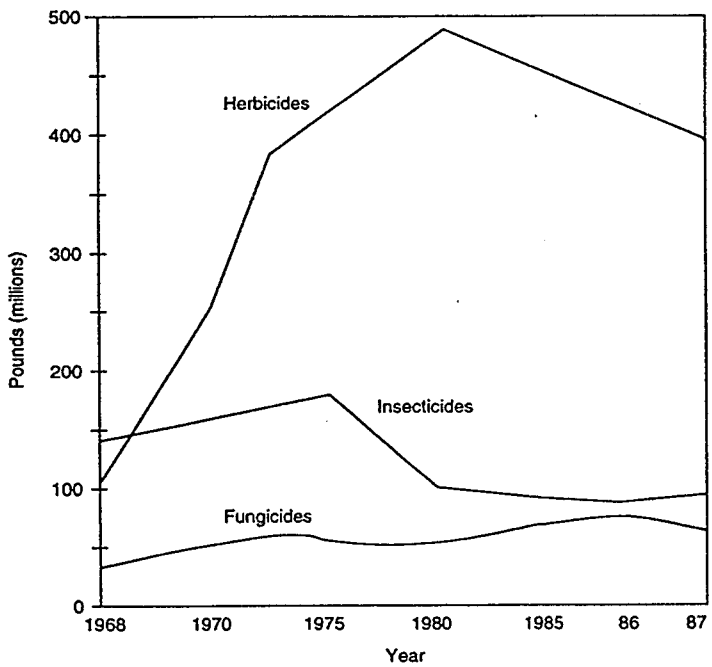
Urban. Urban nonpoint pollution sources include runoff from cities, industrial sites, air pollutants (carried by precipitation), underground transport through aquifers, and other releases of pollutants, such as the leaching of tributyltin from ship hulls. Urban nonpoint source pollution can also originate from septic tank systems and from overflows of municipal storm sewers. Urban runoff can contribute substantial quantities of oil and grease, lead, and chromium into marine waters.

Agricultural. Agricultural activity accounts for 30 percent of the land use in the Gulf of Mexico estuarine watersheds (Pait *et al.*, 1992). This land use includes the application of insecticides, herbicides, and fungicides. Rainwater and irrigation can

wash pesticides off vegetation and soil, into the nearest stream or river, and ultimately into Gulf coastal waters. Pesticide contamination is a serious concern because older pesticides persist in sediments, have higher toxicity, and tend to bioaccumulate in biota.

The overall agricultural application of pesticide active ingredients in the U.S. increased by approximately 170 percent between 1964 and 1982. This was due primarily to an increase in herbicide use, from 95 million kg (210 million pounds) in 1971 to more than 206 million kg (455 million pounds) in 1982 (see **Figure 2.1**). Insecticide use nationwide peaked around 1976 at approximately 70 million kg (155 million pounds). Fungicide use has only slowly increased over the last 20 years. Between 1982 and 1987, however, the USDA estimates that the nation's total agricultural pesticide use declined by approximately 14 percent. This decline has been attributed to land set-asides (*e.g.*, erosion control) and to the introduction of newer pesticides with lower application rates (Pait *et al.*, 1992).

Figure 2.1 ***U.S. Agricultural Pesticide Use from 1966 to 1987***



(Source: Pait *et al.*, 1992)

In 1987, application of commonly used pesticides to agricultural lands in the Gulf of Mexico region was estimated at 4.5 million kg (10 million pounds)--the most among all U.S. regions. The average application of pesticides was 61.8 kg/km^2 (352 pounds/mi^2). The South Ten Thousand Islands estuarine watershed had the highest intensity of application of a group of 35 commonly applied pesticides in the region [494 kg/km^2 (2,819 pounds/mi^2 of cropland)], followed by the Choctawhatchee Bay estuarine watershed [252 kg/km^2 (1,439 pounds/mi^2 of cropland)] (Pait *et al.*, 1989).

Using a rating system that combines use with three other parameters (LC50, bioconcentration factor and soil half life) that are important to the fate and aquatic impacts of pesticides, estuarine watersheds such as South Ten Thousand Islands, Rookery Bay, Charlotte Harbor and Tampa Bay rated highly in terms of the use of the more aquatically hazardous compounds. Pesticides such as endosulfan, chlorpyrifos, and chlorothalonil applied to crops such as tomatoes and citrus were responsible for the high rating (Pait *et al.*, 1989).

Progress has been made in reducing the aquatic impacts of agriculturally applied pesticides over the last several decades. One of the most significant of these has been the changes in the pesticides themselves. Many currently used pesticides do not remain active in the environment for a long period of time, so accumulation is less likely to occur. Lower application rates of the more toxic pesticides mean there will be less pesticide to enter the aquatic environment. When detections and/or detectable impacts were found on 35 inventoried pesticides, the evidence indicated that they tended to occur near the site of application and during the growing season (Pait *et al.*, 1992).

In addition to changes in the pesticides themselves, some agricultural practices have also been developed to reduce the use and/or transport of pesticides into the aquatic environment. Best Management Practices (BMPs), which have traditionally addressed soil erosion problems, have also been developed to control water quality problems caused by the input of agrochemicals. Examples of BMPs include no-till and ridge-till agriculture, crop rotation, strip cropping, vegetated filter strips, and grass waterways.

Integrated Pest Management (IPM) is a strategy based on using pest control measures when the cost of the impending damage that will be done by the pest exceeds the cost of its control. IPM involves a number of practices including the scouting of fields to determine current levels of pests and the optimum time to apply pesticides, understanding and using naturally occurring predator/prey relationships, crop rotations, and planting dates. IPM, where successful, usually reduces the volume of pesticide use. There has been considerable discussion, however, regarding the use and efficacy of these alternative systems to reduce pesticide use and maintain high levels of production.

Oil & Gas Drilling

Offshore oil and gas development was introduced to the Gulf in the 1930s, and over the years, it has generated a number of environmental concerns. According to the Minerals Management Service, the federal agency charged with administering the offshore oil program in federal waters, in the first 30 years of the program there were 106 incidents involving "significant pollution" [greater than 7,949 litres (2,100 gallons)] in the Gulf (Weber *et al.*, 1992). During the same period, there were 145 well blowouts and 767 fires on offshore structures. Also, there were 31 pipeline breaks and 224 major accidents (fires and explosions causing damage of over $1 million, spills greater than 31,794 litres (8,400 gallons), and fatalities and serious injuries). Offshore oil platforms may also generate pollutants, including sewage, galley wastes, drilling mud, well cuttings, and contaminated runoff.

Oil Spills. As demand for petroleum products increases, the risk of spills and their consequences also increases (USEPA, 1990b). Gulf States are among three regions of the U.S. that are most particularly at risk from spills (Southern States Energy Board, 1991). It is estimated that 48 percent of the oil imported by the U.S. is offloaded in the Gulf of Mexico.

Since 1976, there have been eight oil spills, releasing more than one million gallons of oil each, in U.S. waters. Five of these spills occurred in the Gulf of Mexico (Southern States Energy Board, 1991). In 1986, there were 1,206 oil spills in the Gulf of Mexico, totaling over 3.8 million litres (1 million gallons) of oil (Weber *et al.*, 1992). Many of these were small accidental releases.

Historically, it has been unusual for more than 10-15 percent of oil to be recovered from a large spill, where attempts have been made to recover it. According to the Office of Technology Assessment (OTA), even using the best technology available and assuming a timely and coordinated response effort, it is not realistic to expect that a significant amount of oil from a major offshore spill could be recovered, except under the most ideal conditions (OTA, 1987).

Produced Water. There is another potential route for contamination from oil and gas activities. Production of oil and gas in the Gulf results in "produced water" -- water brought up from hydrocarbon-bearing strata with the produced oil and gas that is discharged into inshore (wetlands, estuaries, coastal, and inner-continental shelf) or offshore waters. Discharge of waste drilling mud and produced water into bays and estuaries of the Gulf is allowed, and may be permitted, by both Texas and Louisiana. USEPA has not yet issued NPDES permits for these discharges. In 1990, the daily production of produced water in the Gulf of Mexico was 2.37 million barrels. The production for individual discharges varies between less than 500 to 24,000 barrels per day. There are presently three discharges greater than 20,000 barrels, the largest of which is 44,592 barrels per day.

Produced water may contain substances that exert oxygen demand from 100 to 3000 mg/L, depending on the chemical composition of the effluent. Benzene and PAHs are present in produced water and metals such as lead, copper, nickel, and mercury may also be present. Produced water discharges in 1991 from oil and gas platforms and coastal processing plants in the near coastal waters of Louisiana and Texas showed that the discharge contained approximately 12.7 million kg (28 million pounds) of metals (minus calcium and magnesium) and 1.1 million kg (2.5 million pounds) of organic pollution (Brecken-Folse and Babikow, Draft 1993). Biocides can also contribute to the toxicity of produced water (Mayer *et al.*, date unknown). Naturally occurring radioactive materials, such as radium, from oil-bearing formations, may also be a potential problem in produced waters (St. Pe', 1991 and Mayer *et al.*, date unknown). However, a recent evaluation of radionuclide discharges by Brookhaven National Laboratory concluded that these discharges present a low ecological and health risk for coastal discharges to Louisiana and offshore (Meinhold and Hamilton, 1992; Hamilton *et al.*, 1992).

High concentrations of volatile and semivolatile hydrocarbons have also been documented in produced waters. Studies indicate that these pollutants can accumulate in sediments close to produced water discharge points. The possible human health impacts of consuming seafood contaminated with polynuclear aromatic hydrocarbons and aromatic hydrocarbons such as benzene, ethylbenzene, xylene, and toluene are under investigation (St. Pe, 1991).

Concern also exists about the biological effect of some inshore produced water discharges on wetlands, both freshwater and saltwater. Receiving waters may be at risk from the natural constituents (salt, metals, petroleum hydrocarbons from naturally occurring seeps) as well as the added constituents (treatment chemicals) in produced water. However, a study for MMS (Rabalais *et al.*, 1991, 1992) identified contamination by various chemicals, but not always a corresponding effect on the biological communities. The cumulative impacts from permitted, accidental, and natural releases are not known.

Dredged Materials & Contaminated Sediments

Dredged material accounts for about 80 to 90 percent by volume of the waste material that is disposed nationally in the marine environment each year, mostly into near shore waters. Over 90.7 metric tons (100 million tons) of sediment are dredged from the Gulf each year, representing about 20 percent of the national total. Under §404 of the Clean Water Act, the Corps of Engineers regulates discharges of dredged or fill material in these near shore waters, wetlands, and estuaries, using guidelines developed jointly by USEPA and the Corps. Offshore, USEPA designates acceptable dredged material disposal sites under the Marine Protection, Research and Sanctuaries Act; the Corps permits disposal operations at these disposal sites.

Dredged materials sometimes are contaminated with toxic heavy metals, organic chemicals, and other pollutants originating from municipal and industrial discharges and nonpoint sources. Sediments near sewage or industrial outfalls, sludge dump sites, or near the site of a spill, may have high levels of contaminants. These sediments promote the degradation or complete elimination of sensitive benthic species and may require remedial activities and or special considerations not ordinarily required for sediments dredged for navigation.

The Committees' draft Contaminated Sediments Inventory (CSI) contains coastal sediment chemistry and biological effects data collected by state and federal, as well as academic sources for the last 13 years. The database, which contains almost 27,000 records, consists of detailed information on each sample collected as well as QA/QC information when available. Data consist largely of bulk sediment chemistry information, a large proportion of which utilize detection limits above many threshold effects levels. Due to the nature of the CSI, Florida's draft sediment quality guidelines were used to evaluate the data in order to identify both chemicals and estuaries of concern. It should be noted that evaluation of bulk sediment chemistry data on many chemicals, particularly pesticides, is difficult. In addition, characterization of Florida's coastal sediment was more complete than much of the rest of the Gulf Coast. Therefore, it is likely that many areas not listed also may be of concern (Brecken-Folse and Babikow, Draft 1993).

Preliminary analysis of the CSI shows that Perdido Bay ranks highest in potential ecological impact caused by contaminated sediments. Tampa Bay, Galveston Bay, Escambia Bay, Choctawatchee Bay, Ten Thousand Islands, Calcasieu Lake, St. Andrews Bay, Apalachicola Bay, and Mobile Bay also rank highly as potential areas of concern based on historical sediment quality data. Gulfwide contaminants of concern are chlordane, followed by dieldrin, pyrene, lead, mercury, chysene, phenanthene, silver, fluoranthene and total PCBs (Brecken-Folse and Babikow, Draft 1993).

Shipping

Major shipping centers are found in each of the Gulf States. There are more than 25,000 ships of over 907 gross registered metric tons (1,000 tons) in the world's merchant fleet. About 5,500 of these are tankers, including 265 U.S. flag tankers. Most of these vessels will call at a U.S. Gulf port at some time in their useful lives (Weber *et al.*, 1992).

In addition to the number of tankers, there are also numerous tank barges that use Gulf ports. The exact number is not known, and is complicated by the fact that most barges are confined to inland waters, including the Mississippi River system and the Gulf Intracoastal Waterway. Nevertheless, there are more than 30,000 barges under U.S. flag, including over 4,200 tank barges, most of which operate in the Gulf area in support of the extensive petroleum and petrochemical industries.

In 1987, the most recent year for which complete data are available, tankers made 29,700 movements--either arriving or departing--at Gulf Coast ports, while tank barges made 259,300 movements (Weber *et al.*, 1992).

These vessels may be involved in accidents including sinkings, groundings, fires, explosions, collisions, and damages. In 1986, the most recent year with complete data, there were four total losses of tankers in U.S. waters, and two total losses of barges. There were 250 other accidents involving tankers and 531 involving tank barges (Weber *et al.*, 1992).

In 1986, in addition to the 1,206 oil spills in the Gulf of Mexico, there were 76 hazardous substance spills, involving almost 507,190 litres (134,000 gallons); and 120 spills of other substances, in which about 28,389 litres (7,500 gallons) were spilled. All of these quantities were within the normal range of variation seen over the previous ten years (Weber *et al.*, 1992).

Ships and barges do not always use port facilities (or are unable to due to lack of facilities) for disposal of bilge and tank washings and wastes. The thousands of ships using the Gulf can contribute pollutants by dumping galley wastes, sewage, and other pollutants in Gulf waters (Weber *et al.*, 1992).

Another environmental issue related to the transport of oil through Gulf waters is floating tar, which generally comes from tankers flushing out their ballast tanks before entering port to take on new cargoes of petroleum. This problem is especially prevalent in the areas of the Loop Current and the Straits of Florida (Weber *et al.*, 1992). About half the floating tar in the Gulf originates in the Gulf; the remainder comes from the Caribbean via currents. Currents carry tar throughout the Gulf, where it often washes up on beaches. Texas beaches, especially, are noted for heavy concentrations of tar (Weber *et al.*, 1992). Tar is not only a problem for recreational beach users, but also for marine wildlife.

Atmospheric Deposition

Atmospheric deposition results when nitrogen and sulfur compounds or other substances, such as heavy metals and toxic organic compounds, are transformed by complex chemical processes and deposited on the earth away from the original sources. The transformed chemicals return to the earth in either a wet or dry form. Wet forms may be rain, snow, or fog; dry forms may exist as gases or particulates. Once these transformed substances reach the earth, they can pollute surface waters, including rivers, lakes, and estuaries.

Based on patterns observed elsewhere around the country, atmospheric deposition is likely to be a contributor to pollution in the Gulf of Mexico. For example, nitrogen loadings in the Chesapeake Bay have been estimated at one-third of the total loadings to the Bay and a significant number of toxics are contributed to the Great Lakes from atmospheric deposition.

Sources -- A Broader Perspective

The broader Caribbean region should also be considered when addressing the issue of toxic substances in the Gulf of Mexico. Most Caribbean countries dispose of their sewage directly into coastal or inland waters with little or no treatment. Industrial waste waters in Caribbean countries include wastes from onshore refineries and petrochemical plants; sugar-factories and rum distilleries; breweries, soft-drink plants and canneries; abattoirs and meat canneries; tanneries; metal and electroplating plants; textile dyeing industries; edible-oil production plants; cooling and scale-removal activities at power plants; banana washing and packing activities; wood and pulping operations; and fertilizer mining and processing. Industrial activities are concentrated along the coast and major rivers that flow into the Gulf.

The International Convention for the Prevention of Pollution from Ships (MARPOL) controls the discharge of oil and oily substances and noxious liquid substances, primarily derived from tank cleaning and deballasting from ships capable of operating beyond the U.S. territorial sea; however, not all countries surrounding the Gulf have accepted this Convention.

Consequences for Human Health

The objectives and action items in this Toxic Substances & Pesticides Action Agenda will develop information on bioaccumulation and residue levels as they relate to the effects on coastal fish and wildlife. Such data may be useful to the Public Health Committee in determining the effects of the residues on humans. Thus, there is a substantial need for coordination between these two Gulf of Mexico Program Issue Committees.

This section provides a brief summary of the potential consequences for human health from toxic substance and pesticide contamination. The Gulf of Mexico Program Public Health Action Agenda provides a more comprehensive description.

Quantifying the potential human health effects resulting from exposure to toxic chemicals present in the marine environment is difficult since the effects may not take the form of an obvious acute effect. Few studies have been able to actually measure the impacts of exposure to toxic chemicals; however, this should not necessarily imply that these effects do not occur. Exposure to toxic chemicals may induce chronic effects such as an increased incidence of cancer which may not yet be detectable in an epidemiological study of an exposed population.

According to the National Academy of Sciences (NAS, 1991), the levels of toxic chemicals in seafood in certain areas are high enough to warrant additional control measures. It is suspected, however, that the risks from toxic chemicals are not on the order of magnitude of environmental health hazards associated with human pathogens for the populations as a whole (NAS, 1991), although certain groups within the populations may be at higher risk (*e.g.*, recreational and subsistence fishermen, children, and pregnant women).

Direct exposure to hazardous waste (where it occurs) is a problem in the Gulf of Mexico (USEPA, 1992). However, little information is available about the frequency of exposure in the Gulf States. Toxic chemicals can be classified by organic and inorganic compounds. It is known that inorganic contaminants, such as mercury, accumulate in both fish and shellfish consumed by humans. The potential for exposure to organic toxic contaminants through bioaccumulation in the food chain is well documented (Barron, 1990). Some toxic substances introduced into Gulf Coast waters may bioaccumulate in the food chain and may cause illness at some levels.

Toxic chemicals of primary concern (to human health at least) have the following properties: high persistence in the aquatic environment; high bioaccumulation potential; and high toxicity to humans. Chemicals with these properties that have been found in fish tissue and the marine environment include dioxins and furans; PCBs (polychlorinated biphenyls); PAHs (polycyclic aromatic hydrocarbons) (*e.g.*, benzo(a)pyrene); pesticides; and heavy metals such as arsenic, lead, mercury, and selenium. In addition, a variety of potentially toxic chemicals is introduced into the

marine environment from aquaculture. Chemotherapeutic drugs such as sulfonamides and nitrofurans are the primary aquaculture chemicals of concern to human health (NAS, 1991).

Bioaccumulation and biomagnification are important processes that largely determine the potential for indirect human exposure to toxic metals and organic chemicals. Marine organisms, especially benthic organisms, can bioaccumulate metals by filtering water during feeding or swimming, ingesting particulate matter onto which such substances are absorbed, or ingesting other contaminated organisms (OTA, 1987). Biomagnification of a metal can result in an increase in an organism's tissue concentration of several orders of magnitude or more, and hence represents a major potential pathway for human exposure. Even when bioaccumulation is not a factor, significant quantities of metals can concentrate in the gut or gills of marine organisms without actual absorption into the tissues.

Inorganic Contaminants. Toxic metals are capable of inducing a variety of human health effects--lethal and sublethal, acute, and chronic. Arsenic, cadmium, lead, and mercury are particularly important contaminants because of their known or potential toxicity to humans and their presence in relatively high concentrations in wastes disposed of in estuaries and coastal waters. Metals of secondary concern include chromium, copper, tin, and selenium. Other toxic metals are present in much lower concentrations in both wastes and in regions of the marine environment that are likely to lead to human exposure (OTA, 1987). In marine environments, consumption of contaminated seafood is generally the major route to human exposure to metals. Direct human exposure to metals is usually less important because they are generally present in very low concentrations in the water column (OTA, 1987). Some of the known properties and effects of exposure to the metals of primary concern in marine environments are summarized in **Table 2.4**.

Organic Contaminants. Organic chemicals vary considerably with respect to their behavior and toxicities in natural environments. Given this complexity, it is essential to use some type of simplified classification if a health hazard evaluation is to become manageable (OTA, 1987). One approach is to classify compounds according to how they behave in the environment, thus concentrating on those substances that have a potential to reach humans; information on human health effects would then need to be developed for only this group.

As is the case for metals, the consumption of contaminated seafood is the primary pathway for human exposure to most organic chemicals. Indeed, compounds such as PCB and DDT have been shown to accumulate in humans through consumption of contaminated seafood (OTA, 1987). The importance of bioaccumulation and biomagnification varies greatly for different organic chemicals and for different organisms, and there is relatively little information on the long-term fate and behavior of most organic compounds in marine environments.

Table 2.4

Properties and Effects of Metals of Primary Concern in Marine Environments

	Arsenic	Cadmium	Lead	Mercury
Bioaccumulation	Low except in some fish species	Moderate	Low or none	Significant (methylated form)
Biomagnification	Low or none	Low or none	Low or none	Significant (methylated form)
Properties	Metallic form: insoluble Readily methylated by sediment bacteria to become highly soluble, but low in toxicity	Metallic form: relatively soluble Not subject to biomethylation Less bioavailable in marine than in fresh water Long biological residence time Synergistic effects with lead*	Generally insoluble Absorption rate age-dependent, 4 to 5 times higher in children than in adults Synergistic effects with cadmium*	Metallic form: relatively insoluble Readily methylated by sediment bacteria to become more soluble, bioavailable, persistent, and highly toxic
Major environmental sink	Sediments	Sediments	Sediments	Sediments
Routes of human exposure in marine environments	Seafood: very minor route, except for some fish species	Seafood contributes approximately 10% of total for general population	Seafood comparable to other food sources	Seafood is primary source of human exposure
Health effects	Acute: gastrointestinal hemorrhage; loss of blood pressure; coma and death in extreme cases Chronic: liver and peripheral nerve damage; possibly skin and lung cancer	Emphysema and other lung damage; anemia; kidney, pancreatic, and liver impairment; bone damage; animal (and suspected human) carcinogen and mutagen	Acute: gastrointestinal disorders Chronic: anemia; neurological and blood disorders; kidney dysfunction; joint impairments; male/female reproductive effects; teratogenic and peripheral nerve damage; possibly skin and lung cancer	Kidney dysfunction; neurological disease; skin lesions; respiratory impairment; eye damage; animal teratogen and carcinogen**

(Source: OTA, 1987)

* The toxicity of lead and cadmium depends on nutritional status.

** Debate exists over whether mercury should be listed as a carcinogen. While there is a correlation between mercury and chromosomal aberrations or cancer, mercury's mechanism of action by binding to sulfhydryl or thiol groups or concurrent exposure to other genotoxic substances could explain these results.

Assessing Ecological Risk (USEPA, Risk Assessment Forum, 1991d *Draft*)

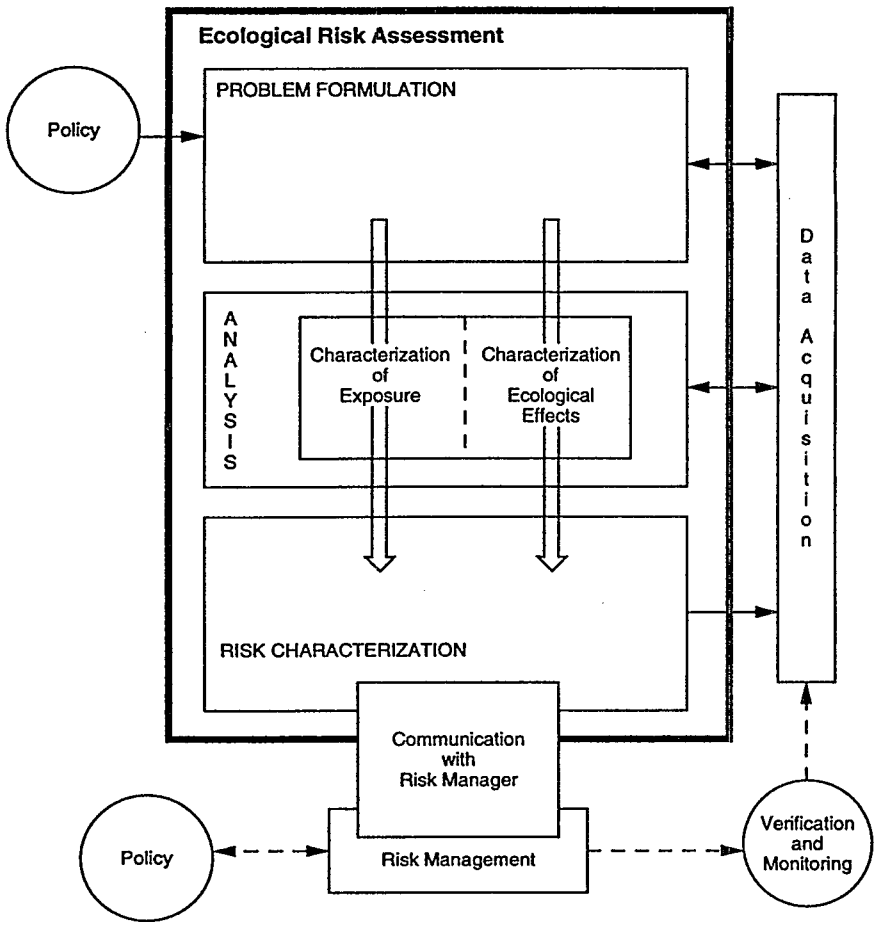
Ecological risk assessment is defined as a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. Ecological risk assessments can help identify environmental problems, establish priorities, and provide the scientific basis for regulatory actions. The process can identify existing risks or forecast the risks of stressors not yet present in the environment. However, while ecological risk assessments can play an important role in identifying and resolving environmental problems, risk assessments are not a solution for addressing all environmental problems, nor are they always a prerequisite for environmental management. Many environmental matters, such as the protection of habitats and endangered species, are compelling enough that there may not be enough time or data to do a risk assessment. In such cases, professional judgment and the mandates of a particular statute will be the driving forces in making such decisions.

Draft Framework for Ecological Risk Assessment

The U.S. Environmental Protection Agency has produced a draft framework for ecological risk assessment (see **Figure 2.2**). The first phase of the framework is **Problem Formulation**. Problem formulation includes a preliminary characterization of exposure and effects, as well as examination of scientific data and data needs, policy and regulatory issues, and site-specific factors, to define the feasibility, scope, and objectives for the ecological risk assessment. The level of detail and the information that will be needed to complete the assessment are also determined. This systematic planning phase is proposed because ecological risk assessments often address the risks of stressors to many species, as well as risks to communities and ecosystems. In addition, there may be many ways a stressor can elicit adverse effects (*e.g.*, direct effects on mortality and growth and indirect effects, such as decreased food supply). Problem formulation provides an early identification of key factors to be considered, which in turn will produce a more scientifically sound risk assessment.

The second phase of the framework is termed **Analysis** and consists of two activities, **Characterization of Exposure** and **Characterization of Ecological Effects**. The purpose of Characterization of Exposure is to predict or measure the spatial and temporal distribution of a stressor and its co-occurrence or contact with the ecological components of concern, while the purpose of Characterization of Ecological Effects is to identify and quantify the adverse effects elicited by a stressor and, to the extent possible, to evaluate cause and effect relationships.

Figure 2.2 ***Draft Framework for Ecological Risk Assessment***



The third phase of the framework is **Risk Characterization**. Risk characterization uses the results of the exposure and ecological effects analysis to evaluate the likelihood of adverse ecological effects associated with exposure to a stressor. It includes a summary of the assumptions used, the scientific uncertainties, and the strengths and weaknesses of the analysis. In addition, the ecological significance of the risks is discussed with consideration of the types and magnitudes of the effects, their spatial and temporal patterns, and the likelihood of recovery. The purpose is to provide a complete picture of the analysis and results.

In addition to the three phases of the framework, **Figure 2.2** illustrates the roles of **Policy** and **Risk Management** in the ecological risk assessment process. The interface of policy, risk assessment, and risk management is crucial in all regulatory programs. Social and economic values are reflected in the various laws enacted to protect one or more components of the environment. Those values are important to risk management decisions. Therefore, it is important that these factors be

considered initially to ensure that the risk assessment will provide relevant information to the risk manager charged with protecting societal values. In addition, the breadth and scope of a particular assessment is likely to be influenced not only by goals but also by the limitations of a particular statute.

Figure 2.2 also indicates a role for **Verification** and **Monitoring** in the framework. Verification can include validation of the ecological risk assessment process, as well as confirmation of specific predictions made during a risk assessment. Monitoring can aid in the verification process and may identify additional topics for risk assessment. Verification and monitoring can help determine the overall effectiveness of the framework approach, provide necessary feedback concerning the need for future modifications of the framework, help evaluate the effectiveness and practicality of policy decisions, and point out the need for new or improved scientific techniques.

State-By-State Overview of Indicators of Toxic Substances & Pesticides

Alabama

Mobile Bay, the Mobile-Tensaw River Delta, Perdido Bay, the eastern end of Mississippi Sound, and the tidally influenced smaller bays, adjacent lagoons and marshes, and tributary bayous and small rivers comprise Alabama's estuarine system. Portions of both the Mississippi Sound and Perdido Bay are shared with the adjacent States of Mississippi and Florida, respectively.

Surface Waters Affected by Toxic Substances. Alabama's surface waters are affected by point and nonpoint sources of contaminants from industrial, municipal, urban, agricultural, and silvicultural sources. Some of the contaminants from these sources may be toxic. There are approximately 106 industrial, 15 municipal, and 29-semi-public and private point source dischargers of treated wastewaters to Alabama's coastal waters. The total permitted, treated, point source wastewater discharge to Mobile Bay is approximately 5.3 billion litres (1.4 billion gallons) daily (USDOC, 1989). Nonpoint urban, agricultural, and silvicultural discharges are not regulated to the same degree; however, new regulatory programs have been recently instituted that will place a greater emphasis on regulating these sources.

The Alabama Department of Environmental Management (ADEM) has in place a number of programs to indicate the presence of toxic substances and pesticides and to reduce their introduction into surface waters. Monthly water column monitoring is conducted at sixteen ambient trend monitoring stations in Mobile and Baldwin Counties (Alabama's coastal counties) for ammonia, at eighteen stations for cyanide, and at four stations for volatile suspended solids. The ADEM Water Division developed a Toxicity Control Strategy in 1989 that implemented individual control strategies creating more stringent toxicity limits and incorporating whole effluent toxicity biomonitoring requirements into point source (NPDES) permits. The effectiveness of ADEM's source control program is reflected by the percent change of toxic inputs to surface waters and publicly-owned treatment works. For example, between 1989 and 1990, there was a 57 percent reduction in toxic inputs to surface waters, ranking Alabama fifth amongst all states in percent reductions. Bioassessments of wastewater effluents are conducted to assess potential instream toxicity; as are unannounced compliance sampling inspections to monitor a facility's compliance with the effluent limitations imposed by a Department permit. ADEM has conducted special studies in Alabama's coastal areas to identify methods for evaluating contamination in coastal water bottom sediments as well as to apply these methodologies to sediments in and around waterfront shipyard facilities. Also, the U.S. Army Corps of Engineers conducted a survey of lower Mobile River sediments in May 1990, to investigate the sources and extent of PCDD (polychlorinated dibenzo-p-dioxins) and PCDF (polychlorinated dibenzofurans) sediment contamination. Of the five samples taken, there were no major

concentration differences of PCDDs and PCDFs. As a result, it was determined that the sediments have a fairly even distribution of contamination.

Toxicants in Fish Tissue. ADEM has conducted fish tissue monitoring for toxicants in fresh waters and has conducted limited tissue work for mercury from fishes in the Mobile-Tensaw River Delta. USEPA has conducted a limited fish tissue analysis from samples taken in coastal Alabama as a part of its Environmental Monitoring and Assessment Program - Estuaries (EMAP-E).

Fish & Shellfish Consumption Advisories and Fishing Bans. Two limited consumption advisories were issued for portions of 1991 and 1992 by the Alabama Department of Public Health for portions of the Mobile River due to the presence of dioxin. A limited consumption advisory states that women of reproductive age and children less than fifteen years of age should avoid eating fish from specified areas. In 1992, a no consumption advisory was issued for a portion of Cold Creek Swamp adjacent to the Mobile River due to the presence of mercury. A no consumption advisory recommends that everyone should avoid eating certain species of fish in specific areas. A total of 14.5 km (9 mi) of the Mobile River was affected by the limited and no consumption advisories.

Though there were shellfish restrictions and harvest closures that occurred in Alabama coastal waters, none occurred due to toxics or pesticides contamination. All restrictions and closures that did occur were attributed to the presence of bacteria and pathogens.

Fish Kills. In the fiscal years 1989 through 1992, thirty-two fish kills were reported in Mobile and Baldwin Counties. Of these thirty-two, none were attributed to toxics or pesticides.

Closure of Surface Drinking Water Supplies. No surface drinking water supplies have been closed, nor have advisories been posted, for any systems in Alabama's coastal counties.

Coastal Ambient Monitoring Activities. Much emphasis has been placed, and is being given, to measuring water quality conditions and trends in Alabama's coastal counties. Water quality at thirty-two stations is being monitored for an array of parameters measured in-situ and in ADEM's laboratories. Specific parameters as indicators of toxics and pesticides and the number of locations for which they are monitored are discussed above in the section titled "Surface Waters Affected by Toxic Substances".

Other federal programs currently monitoring for toxics and pesticides in coastal Alabama include NOAA's National Status and Trends Program for Marine Environmental Quality and USEPA's EMAP-E program. NOAA's Status and Trends Program uses uniform techniques to monitor toxic chemical contamination of bottom-feeding fish, mussels and oysters, and sediments at coastal and estuarine

sites, two of which are located in southwest Mobile Bay. The EMAP-E program is designed to provide a quantitative assessment of the regional (Gulfwide) extent of coastal environmental problems by measuring change in selected environmental parameters, through a wide range of parameters. Sampling has been conducted in coastal Alabama since 1991 and annually thereafter as funding permits. Many of the program's indicators are toxicity based parameters.

ADEM is currently revamping its coastal monitoring program. It is anticipated that a three-pronged monitoring approach will be adopted that includes watershed surveys, long-term trend monitoring, and wetland and submerged aquatic vegetation monitoring. With regard to toxics and pesticides, the first two components of the revamped monitoring program will directly apply. The watershed surveys will identify impairments to water quality and seek to identify major factors contributing to the impairment. The long-term trend monitoring component will be a probability based sampling scheme to identify trends by measuring change in selected ecological indicators of known interpretability. It is envisioned that ADEM's monitoring results will be compatible with the USEPA's EMAP-E program, thereby providing benefit to both the state and federal monitoring efforts by increasing the scale of coverage.

Florida

Florida has about 13,612 km (8,460 miles) of coastline and the fourth largest population in the country. All of the state and large portions of Georgia drain into its coastal waters. Toxics and pesticides reach Gulf of Mexico waters from land-based activities such as use of anti-fouling paints and spills from vessels. There are relatively few point source discharges due to the state's emphasis on water conservation, but pulp and paper production and chemical manufacturing remain sources of concern. Atmospheric deposition is increasingly becoming a source of concern.

State Waters Affected by Toxics. Water quality standards exceedances have been commonly documented for mercury, lead, and copper in ambient water samples. Sampling tends to be prioritized in areas of expected problems, and 49 percent of the monitored estuarine area has shown exceedances at some point in time. Sediment sampling has been done for metals in most major estuaries in Florida with enrichment of lead, mercury, and zinc found in many areas.

Toxicants in Fish Tissue. Fish consumption advisories have been issued for most freshwater systems in Florida due to elevated levels of mercury found in muscle tissue of bass. Sampling in other animals indicates that mercury may be affecting all trophic levels dependent on fish consumption, from raccoons and waterfowl to the Florida panther, an endangered species. The highest levels of mercury occur in parts of the Everglades drainage, but all but very eutrophic systems have fish tissue concentrations at levels of concern.

Sampling for estuarine and marine fishes is not as extensive, but there is an advisory on consumption of sharks.

Elevated levels of dioxin in fish below bleached kraft pulp mills have resulted in consumption advisories for the Fenholloway River in Taylor County and Elevenmile Creek in Escambia County. Improvements to the production and treatment processes to the mill in Escambia County have reduced the tissue concentration levels and the advisory may be lifted. The Fenholloway mill has apparently also affected ground water, resulting in the abandonment of private water wells.

Fish Kills. During 1990 and 1991, 275 fish kills were recorded in the state. By far the greatest numbers of fish were killed in estuarine and coastal waters, though from relatively few events. Most of the species affected were menhaden, which float because of their high oil content, which may make them more noticeable than other species. Two of the kills were associated with sewage spills; the remainder are attributed to low dissolved oxygen levels due to high temperatures, poor flushing, and summer rains increasing nutrient loads.

Fish kills are a persistent problem in the Pensacola and Escambia bays in the Panhandle of Florida.

Fish abnormalities and indications of disease have been a chronic problem in the St. John's River estuary, and a periodic problem in other bays and estuaries of Florida. Ulcerative Disease Syndrome (UDS) in Florida fish appears to be similar to that reported among Atlantic menhaden in Chesapeake Bay. Biscayne Bay and Tampa Bay periodically report outbreaks.

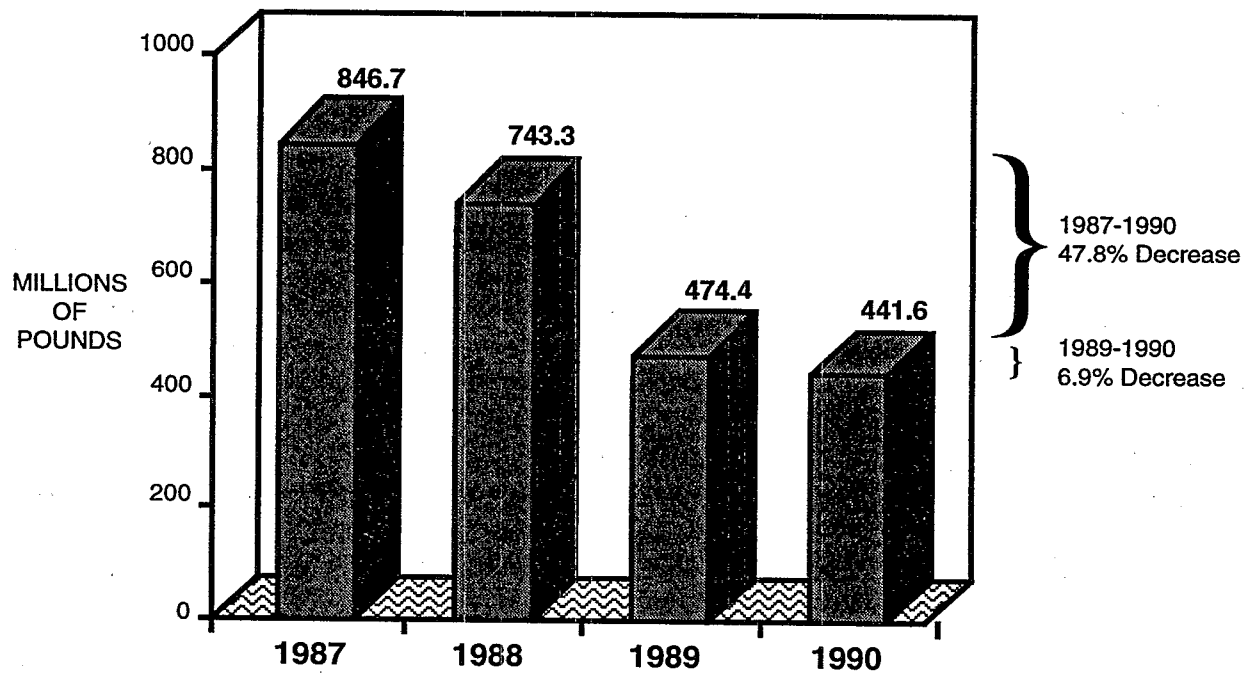
Closure of Surface Drinking Water Supplies. No surface water supplies have been closed in Florida due to toxicants or conventional pollutants.

Ambient Coastal Monitoring Activities. Various federal, state, regional, and local governments conduct routine ambient water quality monitoring in Florida's coastal and estuarine waters. Some citizen monitoring programs have been initiated as well. Special monitoring projects are common among governmental entities, and permit applicants and academic institutions sponsor activities as well. The state has designated STORET as the official data base for all applicable water quality data collected by entities supported by state funds.

Louisiana

Overview. Overall, there was a 47.8 percent decrease of toxic releases into Louisiana's environment during 1990 when compared to 1987 (see **Figure 2.3**). In 1990, a total of 200 million kg (441.6 million pounds) of toxic chemicals were reported as having been released into Louisiana's environment. Of this amount, approximately 24 percent were released into the air, 23 percent were released into the water, 50 percent were deepwell injected, and less than one percent were released to the land in one of the following ways: on-site landfill, land treatment/application farming, surface impoundment, or other disposal methods. Less than one percent were transferred to publicly-owned treatment works (POTWs), and about three percent were transferred to off-site facilities for disposal, treatment, or storage.

Figure 2.3 ***Toxic Chemical Releases in Louisiana***



Delisted chemicals are excluded.

(Source: LADEQ, Louisiana Toxics Release Inventory, 1987, 1988, 1989, 1990)

Table 2.5

Louisiana Toxic Chemical Releases (in pounds/year)

	Air	*Water*	*Injection*	*Land*	*POTW**	*Transfers*	*Totals*
1987	140,285,727	192,781,843	484,943,431	1,519,083	324,109	26,878,598	846,732,791
1988	132,832,148	159,302,320	423,616,398	2,205,546	3,535,016	21,820,704	743,312,132
1989	127,416,691	46,211,445	285,884,028	2,377,855	76,400	12,411,942	474,378,361
1990	105,721,329	99,310,577	219,836,672	1,450,959	215,325	15,105,920	441,640,782

Excludes chemicals delisted for 1988, 1989, 1990
LA DEQ TRI 1987, 1988, 1989, 1990

*POTW = Publicly Owned Treatment Work

(Source: LADEQ, Louisiana Toxics Release Inventory, 1987, 1988, 1989, 1990)

The total amounts of reportable chemicals released into each medium, as well as transfers to POTWs and other off-site locations, are shown in **Table 2.5** for 1987 through 1990. The largest decrease in releases was in deepwell injections which fell by 54.7 percent from 1987 to 1990. Other reductions from 1987 to 1990 included air releases which decreased by 24.7 percent, releases to water by 48.5 percent, releases to land by 6.7 percent, POTWs by 33.3 percent, and transfers by 43.8 percent.

Comparing reporting years 1990 to 1989, there were decreases in toxic release/transfer amounts as follows: releases to air decreased by 17 percent, deepwell injection by 23.1 percent, and land by 37.5 percent. The following increases in toxic release/transfer amounts were observed from 1989 to 1990: releases to water, which increased by 114.9 percent; POTWs by 181.8 percent; and transfers by 21.7 percent.

Releases to water increased approximately 24 million kg (53.1 million pounds) from 1989 to 1990. Two facilities in St. James Parish accounted for approximately 22.7 million kg (50 million pounds) of this increase. A major source of the increase in the releases to water can also be attributed to an increment in rainfall pattern in 1990 in comparison to the previous year. Many of the major facilities have the ability to store excess storm water runoff for subsequent treatment. However, when this storage capacity is surpassed, some of the contaminated storm water is discharged prior to treatment.

Water Quality. Although an in-depth analysis of the long-term trends in water quality of the Mississippi River has been completed (Turner and Rabalais, 1991), data for Louisiana remain unanalyzed. The water quality in southern Barataria Bay and Terrebonne Bay may be affected by changes in Mississippi River water quality because of its relatively large freshwater inflow and evidence that salinity in Barataria Bay is inversely related to river discharge (Wiseman and Swenson, 1987; Wiseman *et at.*, 1990).

The largest, most severe, and most persistent zone of hypoxia (oxygen depletion) in U.S. coastal waters [9,500 km^2 (4,000 mi^2)] is found in the northern Gulf of Mexico at the terminus of the Mississippi River in Louisiana and amidst the nation's richest and most extensive fishing grounds (Rabalais, 1992).

Calcasieu Estuary. In 1987, because of high levels of toxic and carcinogenic hydrocarbons in the sediments and in certain marine organisms, the Louisiana Department of Environmental Quality (LADEQ) and the Department of Health and Hospitals (DHH) issued joint advisories against fishing and consumption of seafood from the Calcasieu Estuary and against swimming, wading, and water sports in Bayou D'Inde (see **Table 2.6**). Due to laboratory findings, LADEQ and DHH, in February 1989, revised the existing advisory to specify a ban against the sale and consumption of speckled and white trout from the Calcasieu Estuary. In 1991, LADEQ and DHH again reviewed the available tissue data to further examine concentrations of chlorinated organic chemicals in selected seafood species taken from the Calcasieu Estuary. The overall trend of this study clearly demonstrated that Bayou d'Inde and a specific chemical manufacturing facility are the sources of hexachlorobutadiene (HCBD) and hexachlorobenzene (HCB) seafood contamination and that relatively mobile species, such as blue catfish, red drum, spotted seatrout, and sand seatrout, become contaminated while near Bayou d'Inde and then move to other areas of the estuary. Movement of contaminated fish poses a risk to recreational and commercial fisheries throughout the Calcasieu Estuary.

A separate analysis of water samples from Calcasieu Estuary has shown a similar pattern of contamination by volatile organic compounds (VOCs). Water samples taken at 12 sites along Calcasieu River and analyzed for nine VOCs showed peak concentrations of seven compounds at the confluence of Bayou d'Inde and the Calcasieu Ship Channel.

Mean PCB concentrations by species were monitored in Calcasieu Estuary from January 1987 through April 1991. Sand and spotted seatrout along with spotted gar showed the highest accumulation of PCBs for species sampled; however, all species except black drum, blue crab, eastern oyster, and white shrimp showed some PCB contamination. Combined PCB concentration in tissues (all species combined) varied widely throughout the estuary with no overall trends. High tissue concentrations appeared on or near some bayous discharging into the

Table 2.6 ***Fish Advisories in Louisiana***

Advisories/Dates	Parish	Location	Rational/Pollutant	Area
Fish Consumption March 19,1992	St. Tammany	Bayou Bonfouca Slidell	Cresote, PAH's, Superfund site	7 Miles
Fish Consumption Aug. 24, 1987	East Baton Rouge	Capitol Lake Baton Rouge	PCB's, Metals, and banned pesticides	.12 sq.mi
Fish Consumption Oct. 29,1987	East Baton Rouge	Devil's Swamp near Baton Rouge	HCB, HCPD, PCB's Superfund site	.02 sq.mi
Informational fish consumption health advisory April 23, 1992	Calcasieu	Calcasieu River Estuary to the Gulf. Includes Prien Lake and Lake Charles.	HCB, HCBD, PCB's	37 miles
Limited fish consumption advisories. Two meals per month. April 23, 1992	Calcasieu	Bayou d'Inde Headwaters to the mouth at junction with Calcasieu	HCB, HCBD, PCB's	6 miles
Fish Consumption Feb. 21, 1989	Natchitotches	Sibley Lake at Natchitotches	PCB's	3.4 sq.mi
Fish Consumption Nov. 23, 1987	Ouachita	Wham Brake near Swartz	Dioxin	7.2 sq.mi
Pregnant woman and children under 7 - No cons. bass, 2 meals per month all other species Everyone else 2 meals per month bass, No limit on other species Aug. 21, 1992	Union, Ouachita, Caldwell, Morehouse	Ouachita River Arkansas state line to Lock and Dam #3 at Columbia	Mercury	102 miles
Informational fish consumption health advisory Feb. 3, 1992	Tensas, East Carroll, Madison, Franklin	Tensas River Hwy 581 to Bayou Macon	DDT and its metabolites, Toxaphene	83.5 miles

(Source: LADEQ, 1992)

mainstream of the Calcasieu River. PCB tissue concentrations for the main channel of the river and lakes were lower than those near tributaries.

Based on the data reviewed, contamination of seafood species from Calcasieu Estuary appears to be caused by extensive contamination of Bayou d'Inde and the chemical facility's canal with organic compounds. This contamination has occurred over a period of decades and continues to a lesser degree today. Data from the Toxics Release Inventory suggest that the chemical facility may be responsible for most, if not all, of the HCBD and HCB contamination. At this time, the source(s) of PCB contamination have not been identified; however, it is likely that some of the PCBs are derived from agricultural or urban runoff. Some of the PCBs may also have originated from chemical plants discharging into the estuary.

Despite efforts from USEPA, the Louisiana Department of Environmental Quality, and industry, there does not appear to be any reduction in the contamination of seafood over the past five years. Louisiana continues efforts to monitor and improve water quality in the Calcasieu Estuary. A Compliance Order (CO) was issued to the chemical facility on March 7, 1989, regarding the HCB/HCBD contamination in the estuary. This CO was subsequently appealed and the state entered into a Consent Decree with the facility on July 5, 1989. As agreed, the facility conducted studies to determine the transport, fate, and effect of HCB/HCBD in the estuary, the source of HCB/HCBD in the effluent, and the extent of HCB/HCBD in the estuary. The facility proposed to construct another section of the canal to by-pass the most contaminated area and prevent additional contamination from reaching the estuary. Construction has begun; however, in December 1991, a new hotspot of hydrocarbon contamination was discovered. The facility is in the process of evaluating this contamination before continuing the bypass canal construction. Therefore, the facility is behind schedule in its plan to cease discharging, and a date for closure of the most contaminated section of the canal is undetermined.

USEPA issued the facility a Hazardous and Solid Waste Amendments (HSWA) permit on July 9, 1990, and has since issued a Notice of Delinquency because of the inadequacy of required documentation. A sampling plan has been submitted to LADEQ's Inactive and Abandoned Sites Division concerning the newly found hotspot. The plan will determine the horizontal extent of the sediment, as well as groundwater and surface water contamination. From this study remediation activities will be initiated. Continued efforts by all parties are required in order to make the Calcasieu Estuary safe for fish and wildlife propagation and public recreation.

Bayou Bonfouca. USEPA and LADEQ are working to correct the contamination problems at Bayou Bonfouca under the provisions of the Federal Superfund Program. Bayou Bonfouca was placed on the National Priorities List (NPL) in 1982 due to contamination by creosote, a commonly used wood preservative. In 1970, several thousand cubic yards of creosote spilled into Bayou Bonfouca and onto adjacent land areas following a fire and tank explosion at a creosote plant.

Contamination of the area also occurred through a legacy of poor plant operating procedures. The creosote plant had been operating for almost 100 years prior to its closure after the fire. The contamination of Bayou Bonfouca has also been categorized as a nonpoint source residual waste problem.

USEPA is the lead agency in charge of the investigation which is directed at the source of contamination rather than Bayou Bonfouca. There is concern that attempts to remediate the contamination in Bayou Bonfouca will stir up the creosote and the overlying sediment. Therefore, DHH and LADEQ have issued an advisory against swimming and consumption of fish from the bayou.

Alternative remediation methods for the contaminated site have been examined and a feasibility study has been completed. The selected method includes incineration of creosote waste piles and heavily contaminated bayou sediment; capping the site; and pumping, treating, and monitoring contaminated ground water.

Bayou Trepagnier. Bayou Trepagnier is located in the Lake Pontchartrain Basin in southeastern Louisiana, near Norco in St. Charles Parish. Since 1973, Bayou Trepagnier has been designated a "natural and scenic stream" under Louisiana's Natural and Scenic Rivers System.

Through the years, the hydrology of the Bayou Trepagnier - Bayou Labranche system has been altered by man's activities. During the construction of the Bonnet Carre´ Spillway in 1929, a segment of Bayou Trepagnier was filled in and all flow was diverted. During the twenty year period from 1931 to 1951, there was little or no flow in Bayou Trepagnier. From 1951 to 1966, Bayou Trepagnier received municipal and industrial storm water and wastewater from various sources. Since 1966, the only substantial source of dry-weather flow has been the treated wastewater and storm water from an oil refinery and manufacturing complex. The bayou receives some flow from the surrounding wetlands during rainfall events.

LADEQ conducted a survey on Bayou Trepagnier in July 1985, after receiving a report concerning the presence of odorous black sludge deposits on the bayou bottom. Preliminary analytical results of sediment samples collected during the survey indicated relatively high concentrations of oil and grease, chromium, and lead. Sulfide odors were noted during sediment sampling. Further monitoring and additional sampling were conducted from May 1986 to March 1987.

Results of the Bayou Trepagnier study have been reviewed, and a report was completed in early 1989. In general, the analytical water quality data showed very low dissolved oxygen concentrations and elevated concentration of a few organic compounds and certain metals. Higher sediment concentrations of zinc and chromium were observed upstream than downstream. Though there was a

difference in chromium and lead concentrations in the water column, there is insufficient data to show a statistically significant difference between upstream and downstream concentrations. Analyses for VOCs indicated the presence of five compounds (chlorobenzene, ethylbenzene, methyl chloride, toluene, and methylene chloride) at very low levels.

Sediment core samples were analyzed at various depths for metals, phenols, oil and grease. Analytical results showed elevated levels of chromium, lead, and zinc, with the highest concentrations at two of the upstream stations. Metals concentrations decreased with distance from the refinery outfall, and the concentrations increased with depth from the surface. Oil and grease concentrations showed similar patterns, with higher concentrations at the upstream stations and in the deeper layers of the cores. These results indicate that there is a correlation with distance from the refinery discharge and that the heaviest contamination occurred prior to 1980.

Biological assessments of Bayou Trepagnier conducted by LADEQ include macroinvertebrate and fisheries surveys; ambient water, sediment and effluent toxicity tests; and fish tissue analyses. The results of these assessments are all indicative of a pollution problem within Bayou Trepagnier and all show the most impact at the upstream stations closer to the refinery discharge.

Mississippi River. LADEQ is presently conducting a three year study (1991-1993) to identify and quantify the extent and levels of organic and inorganic contaminants in fish and shellfish from the Mississippi River in Louisiana. Other objectives of this study are to establish a data base for future trend analysis; evaluate whether present pollution abatement programs are adequate; and determine possible human health risk from the consumption of Mississippi River fish and shellfish. The following information presents data from the first year of sampling.

LADEQ Surveillance staff collected 72 samples of commercial and recreational fish and shellfish from six stations on the Mississippi River. These composite samples have been analyzed for selected herbicides and priority pollutants. Laboratory results indicate that banned pesticides, such as DDT, are the principal contaminants of fish and shellfish.

Very few acid extractables or base-neutral extractables were detected. Volatile organic compounds were detected in 56 percent of the samples. There were no elevated levels of metals detected. Mercury concentrations ranged from no detection to 0.289 ppm.

Of the 72 composite samples analyzed, no USFDA action levels were exceeded. The concentrations of contaminants found in these samples do not pose an immediate health threat and will not cause acute toxic effect. Based on the Department of Health and Hospitals' *Guideline for Issuing Advisories/Bans on the Consumption of Chemically Contaminated Fish*, a fish consumption advisory was considered by LADEQ for the Mississippi River. However, LADEQ has determined that no fish

consumption advisory is warranted at this time since this data is from the first year of a three year project. After additional data has been collected and assessed, LADEQ, in consultation with DHH, will determine whether an advisory should be issued.

Mississippi

Mississippi Sound, including small bays, marshes, bayous, and rivers along the northern shore, dominates the estuarine system of the state. The hydrology and physical and biological characteristics of Mississippi Sound cross state borders. The Mississippi-Louisiana state line traverses Mississippi Sound between Cat Island to the Pearl River which forms the landward border. The Alabama-Mississippi state line runs directly north of the most easterly end of Petit Bois Island.

Significant water quality improvements along the Mississippi Gulf Coast have accompanied the implementation of regional wastewater treatment plants. All publicly-owned treatment works along the Gulf Coast have completed necessary construction to comply with current water quality standards, including limits for toxic constituents. Tidewater, Edwards, and Watts Bayous, as well as the lower Jordan River, have demonstrated significant water quality improvements as new or improved treatment facilities have been established. In addition, several large areas on the coast have installed sewers, thus eliminating discharges of wastewater from malfunctioning septic tanks into nearby recreational and shellfish harvesting areas. Since construction of the Gautier sewage collection project, Graveline Bayou has been re-opened for shellfish harvesting--possibly the first such opening of any state water body previously closed to shellfish harvesting. Similar projects in other areas will increase the likelihood of re-opening other such areas along the coast.

Since the fall of 1986, the Office of Pollution Control (OPC) has been evaluating the industrial permittees for probable toxicity, by the use of toxic screening procedures. In 1991, this process was begun for municipal dischargers. The program now evaluates application data on the basis of acute and chronic toxicity and human health concerns for all 307(a) toxics plus ammonia and chlorine.

These screening procedures have resulted in toxicity requirements or toxics limits for approximately 20 percent of the industrial permits, ranging from additive prohibitions to chemical specific and whole effluent toxicity limits. As a direct result of toxicity requirements, one major and one minor discharger will cease to discharge directly by connecting to a POTW. The discharge points of others have been relocated and, in some instances, major dischargers have eliminated process lines and ceased to discharge. Still others are significantly upgrading waste treatment procedures or facilities to reduce or eliminate discharges of toxic constituents into the Gulf of Mexico.

In 1989, the Mississippi Cooperative Dioxin Study provided valuable information regarding background conditions and impacts to streams as a result of dioxin discharges which in turn led to fish consumption advisories for two streams. As a result of this study and with funding provided by Georgia Pacific and International Paper, extensive dioxin and water quality monitoring programs were begun in 1990 by OPC biologists. All bleach kraft mills in the state have begun aggressive chlorine substitution programs; results indicate significant reduction in dioxin in these

facilities' effluents. Three years of extensive monitoring have demonstrated that tissue levels are dropping and advisories have been relaxed in 1991 and 1992.

The pretreatment program has devoted much effort toward compliance assurance activities. These activities have resulted in penalty orders with several hundred thousand dollars in fines for several users. At least two facilities will cease to discharge directly to impaired surface waters and will become pretreatment facilities. This action will result in almost immediate compliance with toxic water quality standards.

The pretreatment program has identified a significant non-categorical group of facilities that has caused significant overloading of municipal facilities in the state. Specifically, facilities that stone or acid wash jeans were found to have high volumes, organic loadings, and color discharges. At least six such facilities have been issued pretreatment permits that require them to reduce the strength of their waste to approximately that of domestic sewage [*i.e.*, 50 to 75 percent reduction in biochemical oxygen demand (BOD)].

Toxic Release Inventory. Toxic Release Inventory (TRI) data for Mississippi demonstrates recent improvements in some areas. Fugitive nonpoint air emissions and stack or point source emissions are both down approximately 771,000 kg (1.7 million pounds) from 1990 to 1991. Discharges to surface waters are down 68,040 kg (150,000 pounds) during the same period. Underground injection and releases to land, however, are up 3.6 million kg (8 million pounds) and 181,440 kg (400,000 pounds), respectively.

Surface Waters Affected by Toxic Substances. Contamination from agricultural, forestrial, industrial, and municipal sources has been documented in several areas of Mississippi. Monitoring for surface water toxicants includes both fish tissue for metals and organics and waste column metals. Sediment sampling is primarily limited to special studies especially at hazardous waste sites. OPC performs numerous bioassays on wastewater effluents to assess potential instream toxicity.

Toxicants in Fish Tissue. Numerous lakes and streams in Mississippi have been impaired in the past due to toxicants in fish tissue. These waters were predominantly in the Yazoo River Basin in the Mississippi Delta. Three Delta lakes were closed to commercial fishing in 1973, due to levels of DDT and to toxaphene. All three have since been reopened. Across the state, DDT and its derivatives remain the primary agricultural contaminant and are detected in the majority of fish sampled. Fish from the Delta region continue to have the highest levels of DDT. However, it appears that the levels are declining. Dioxins, PCBs, and mercury are current contaminants of concern. OPC has conducted extensive dioxin monitoring below bleach kraft facilities since 1989.

Of the 3,749 km (2,330 miles) of rivers monitored for toxicants, 1,141 km (709 miles) were found to have elevated levels of pesticides, metals, PCBs, and/or dioxins.

Fish Consumption Advisories & Fishing Bans. At present, five fish consumption advisories and two commercial fishing bans are in effect in Mississippi. The advisories and bans affect the Yockanookany River and Conehoma Creek near Kosciusko, the Old Little Tallahatchie River and Lake Susie near Batesville, Country Club Lake near Hattiesburg, the lower Leaf River near New Augusta, and the lower Escatawpa River near Moss Point. A listing of each advisory and ban including date of issuance, contaminant, contaminant source, size affected, and water body is shown in **Table 2.7**.

Fish Kills. During the period of 1990 through 1991, OPC investigated 37 fish kills. A listing of each kill, including date of occurrence, number of fish, affected area, pollutant, and source is shown in **Table 2.8**. One of the most significant kills occurred on the East Pearl River at the Walkiah Bluff Water Park north of Picayune. The cause of the kill was the diversion of water to the West Pearl River in Louisiana.

Closure of Surface Drinking Water Supplies. No surface water supplies have been lost in Mississippi due to toxicants or conventional pollutants. Some temporary closures have occurred due to spills. No permanent closures of surface water supplies have been reported.

Ambient Coastal Monitoring Activities. Various state, academic, and federal agencies conduct routine ambient water quality monitoring in Mississippi's coastal and estuarine waters. Physical, chemical, bacteriological, toxicological, and biological data from these programs are used in the overall assessment of the state's waters.

Sampling from NOAA's Status and Trends Program has revealed sediment contamination from total PAH at a site in Biloxi Bay. USEPA's Environmental Monitoring and Assessment Program - Estuaries sampling in 1991 has indicated potential low-level sediment toxicity at a few stations in Mississippi Sound.

Lytle and Lytle of the Gulf Coast Research Lab (GCRL) in Mississippi have done extensive sediment monitoring along the Mississippi Coast. According to their findings the greatest area of industrial development has occurred in the Pascagoula River, Escatawpa River, and Bayou Casotte areas. Biloxi Bay has a moderate degree of industrialization and St. Louis Bay and Heron Bay have little industrial development. General results from the studies of Lytle and Lytle indicate highly localized areas of contamination existing within the rivers and bays of the Mississippi Sound region while there are much larger areas that have relatively low pollution from hydrocarbons. Even in rivers emptying directly into the Sound (*e.g.*, the Pascagoula River), there is little evidence that riverine pollutants have much impact on Sound sediments (Lytle and Lytle, 1990). The movement of pollutants related to a paper mill revealed that the only sediments which were

Table 2.7 *Fish Consumption Advisories in Mississippi*

WATERBODY	LOCATION	CONTAMINANT	SIZE AFFECTED	TYPE RESTRICTION	START DATE	COMMENT
Yockanookany River	near Kosciusko	PCBs	12 Miles	Commercial Fishing Ban "No Consumption" Advisory ALL SPECIES	1987	A
Conehoma Creek	near Kosciusko	PCBs	0.3 Miles	Commercial Fishing Ban "No Consumption" Advisory ALL SPECIES	1987	B
Old Little Tallahatchie River and Lake Suzie	near Batesville	PCBs	8 Miles	Commercial Fishing Ban "No Consumption" Advisory ALL SPECIES	1989	C
Country Club Lake	near Hattiesburg	PCP & DIOXINS	46 Acres	"No Consumption" Advisory ALL SPECIES	1990	D
Leaf River	near New Augusta	DIOXIN	45 Miles	"Limit Consumption" Advisory ALL CATFISH > 10 LBS	1989	E
Escatawpa River	near Moss Point	DIOXIN	12 Miles	"Limit Consumption" Advisory CATFISH & BUFFALO > 5 LBS	1990	F

COMMENTS

A. From Highway 35 at Kosciusko to Highway 429 near Thomastown.
B. A tributary of the Yockanookany River.
C. From Highway 6 near Batesville to the south Panola County Line.
D. An impoundment on Mineral Creek.
E. Lower Leaf River from Tallahala Creek to the Pascagoula River.
F. Lower Escatawpa River from I-10 to Pascagoula River.

Table 2.8 Mississippi Fish Kills, 1990 - 1992

WATERBODY	DATE	# FISH	AREA AFFECTED	CAUSE	SOURCE
Escatawpa River Jackson Co.	12-Feb-90	>2,000	unknown	temperature shock	N/A
Buelow Pond Warren Co.	13-Feb-90	113	<1 acre	unknown	N/A
Recon League Lake Bolivar Co.	22-Mar-90	>300	unknown	unknown	unknown
Long Lake Bolivar Co.	29-Mar-90	>50	unknown	oil	Janoush Bro. Marine
Brickyard Bayou Harrison Co.	17-Apr-90	>50	unknown	unknown	unknown
Private Pond Hinds Co.	19-Apr-90	~150	unknown	low DO	unknown
Ross Barnett Res. Hinds/Rankin Co.	29-Apr-90	~250	unknown	spawning stress	natural
Gum Branch Perry Co.	18-Jun-90	>100	1.5 miles	sodium sulfite	G.P. Mill
Lead Bayou Bolivar Co.	08-Jul-90	12	<0.25 acres	low DO	Cleveland WWTP
Lynch Creek Hinds Co.	16-Jul-90	~100	1.3 miles	low DO	Jackson WWTP
Deer Creek Washington Co.	25-Jul-90	>50	1.25 miles	low DO	nonpoint
Roosevelt Lake Scott Co.	02-Aug-90	unknown	unknown	unknown	unknown
Buck Haven Rest Leflore Co.	02-Aug-90	~500	unknown	low DO	natural
Greenbrook Subd. Desoto Co.	17-Aug-90	>1,000	unknown	low DO	natural
Pearl River Pearl River Co.	24-Aug-90	~6,500	unknown	low DO	low flow
Crossgates Lake Rankin Co.	04-Sep-90	>5,000	unknown	low DO	natural
Bayou Pierre Claibourne Co.	16-Sep-90	unknown	1.5 miles	unknown	unknown
Escatawpa River Jackson Co.	08-Oct-90	unknown	unknown	unknown	unknown
Sunflower River Coahoma Co.	09-Oct-90	>35	unknown	unknown	unknown
Escatawpa River Jackson Co.	15-Oct-90	unknown	unknown	stress	natural
Tchoutacabouffa River Harrison Co.	16-Oct-90	<10	unknown	natural	unknown
Tchoutacabouffa River Harrison Co.	16-Oct-90	>200	~1 acre	unknown	unknown
Beaver Creek Amite Co.	20-Nov-90	~100	unknown	unknown	unknown
Pearl River Pearl River Co.	20-Apr-91	unknown	unknown	parasite	natural
Blue Lake Leflore Co.	23-May-91	unknown	unknown	low DO	natural

Table 2.8 (continued) ***Mississippi Fish Kills, 1990 - 1992***

WATERBODY	DATE	# FISH	AREA AFFECTED	CAUSE	SOURCE
Old Pearl River Hinds Co.	14-Jun-91	unknown	unknown	drainage	flood control
Townsend Lake Humphreys Co.	14-Jun-91	>30	unknown	low DO	natural
Williams Lake Rankin Co.	14-Jun-91	>100	~3 acres	ammonia	poultry farm
Six Mile Lake Bolivar Co.	20-Jun-91	<50	~2 miles	herbicide	nonpoint
Whittington Lake Bolivar Co.	24-Jun-91	>3,750	1.5 miles	unknown	unknown
Sardis Lake Panola Co.	30-Jun-91	>2,000	unknown	disease	natural
Little Coplah Coplah Co.	18-Jul-91	15	unknown	low DO	WWTP
Private Pond Quitman Co.	30-Jul-91	~150	~0.5 acres	low DO	natural
Eagle Lake Issaquena Co.	05-Sep-91	~750	unknown	low DO	draw down
Purple Creek Hinds Co.	05-Sep-91	unknown	unknown	municipal runoff	nonpoint
Dabbs Creek Rankin Co.	03-Oct-91	<50	unknown	unknown	unknown
Big Canal Scott Co.	15-Oct-91	unknown	unknown	unknown	unknown
Diamond Head Hancock Co.	28-Feb-92	242	Entire Lake	pesticide	runoff
Pearl River Pearl River Co.	29-May-92	unknown	Sm. Lake	low DO	natural
Deer Creek Sharkey Co.	19-Jun-92	unknown	unknown	low DO	natural
Leaf River Perry Co.	24-Jul-92	117,929	~15 miles	solids low DO	G.P. Mill
Coleman's Bayou Jackson Co.	01-Aug-92	unknown	unknown	low DO	natural
Deer Creek Washington Co.	10-Aug-92	>152,352	~12 miles	insecticide	agricultural runoff
Airplane Lake Warren Co.	11-Aug-92	unknown	unknown	unknown	unknown
Bunker Hill Lake Marion Co.	2-Sep-92	>1,000	Entire Lake	low DO	natural

significantly enriched were in the immediate vicinity of the paper mill (in the Escatawpa River). Tracing hydrocarbon pollutants from Bayou Casotte east of the Pascagoula River also revealed minimal migration of these pollutants from this heavily industrialized bayou into the Sound.

The data for Mississippi in the NOAA Fish Kill Inventory data base are limited. However, of the several fish kills in Mississippi estuarine waters in recent years, only one has been documented to have been the result of a toxic substance or pesticide; dissolved oxygen and temperature have been the major causes of mortality in Mississippi coastal waters.

Only one of the current fish consumption advisories in Mississippi affects a coastal area. Consumption of catfish and small mouth buffalo larger than 2.3 kg (5 pounds), taken from the lower 16 km (10 miles) of the Escatawpa River, is currently limited to one meal per month due to dioxin contamination. In addition, there are allegations that some coastal zone property values have decreased as a result of contamination of surrounding waters by dioxins (USEPA, 1990a).

Texas

Overview. Texas is a water rich state with 307,686 km (191,228 miles) of streams and rivers, nearly 5,180 km^2 (2,000 mi^2) of bays and estuaries, and 1,004 km (624 miles) of coastline. Texas also has extensive groundwater resources.

Several different water pollution control programs are required to ensure protection and restoration of the state's waters. Establishment of the Texas Surface Water Quality Standards (TSWQS) is at the core of these programs. TSWQS recognize the geologic and hydrologic diversity of Texas by dividing major river basins, reservoirs, bays, and estuaries into defined segments (referred to as classified segments). Segment specific desirable uses are assigned by the Texas Natural Resource Conservation Commission (TNRCC, formerly the Texas Water Commission) and numerical water quality criteria are derived to ensure protection for some of the assigned uses.

Ambient water quality data collected routinely at sites located strategically throughout Texas, as part of its Statewide Monitoring Network (SMN), are utilized to document existing conditions, establish trends, and determine compliance with TSWQS.

Surface water quality standards have been established for most major estuarine and marine waters. At present, Texas has established segment specific water quality standards for 5,154 km^2 (1,990 mi^2) of bays and 10,047 km^2 (3,879 mi^2) of Gulf waters. The last statewide assessment reported on a total of 44 bay segments and one Gulf of Mexico segment. Information in this section covers all bay segments and the Gulf of Mexico segment.

Overall, there was a 7.2 percent decrease of toxic releases into the Texas environment from 1990 to 1991; this represents a 15 percent reduction from 1987 according to TRI data.

Toxic-Related Concerns. Pollution in Texas resulting from the introduction of toxic chemicals into an aquatic environment is of growing concern. New programs, studies, and evaluations have been initiated to characterize these inputs from point and nonpoint sources. Currently, Texas has 342 designated segments covering approximately 25,744 km (16,000 miles). In recent years, increased emphasis has been placed on monitoring water, sediment, and fish tissue for toxic substances.

In addition, follow-up surveys to the 1984 priority pollutant studies have been conducted. Estuarine areas sampled for the surveys were the Neches River tidal (0601), Sabine River tidal (0501), Sabine River (0505), Sabine Lake (2412), Arroyo Colorado tidal (2201), Corpus Christi Inner Harbor (2484), and Corpus Christi Bay. The goals of these studies include an estimation of the sources and impacts of the full spectrum of priority pollutants measured in water, sediment, and fish tissue.

Populations of fish and bottom-dwelling invertebrates were collected in order to quantitatively and qualitatively evaluate the biological conditions of these waters. Due to the increased interest in toxicity biomonitoring, water samples were collected from selected discharge effluents for toxicity evaluation.

Water Quality Summary. Assessment of 44 classified bay segments indicates that approximately 66 percent fully met their uses, eight percent partially met their uses, and 26 percent did not support shellfish harvesting due to elevated fecal coliform bacteria contamination. Approximately three percent of the bay waters (Sabine Pass and Sabine lake) are closed to shellfish harvesting due to administrative reasons. Offshore coastal waters met all of their aquatic life uses.

Bays. Of the monitored Texas bays, 66.2 percent [3,414 km^2 (1,318 mi^2)] supported their assigned uses; 7.5 percent partially supported their designated uses; 22.7 percent were not supporting their assigned uses; and 3.6 percent were not attainable. The major causes of use impairments were identified as fecal coliform bacteria [1,388 km^2 (536 mi^2)] and toxics [including metals and priority organics, 62 km^2 (24 mi^2)] (see **Table 2.9**). Major source pollutants contributing to non-attainment of uses were municipal and industrial point sources [647.8 km^2 (250.1 mi^2)] (see **Table 2.10**).

Ocean Waters. TNRCC monitors 10,047 km^2 (3,879 mi^2) of the Gulf of Mexico. All of these waters were assessed as fully supporting designated uses.

Segment Ranking. States are required by Section 303(d) of the Clean Water Act to establish a priority ranking and develop total maximum daily loads for their waters that do not achieve, or are not expected to achieve, water quality standards. The system employed by TNRCC to rank bay segments includes modules for routine water quality parameters, toxics [304(l) list], standards attainment, point sources, nonpoint sources (319 list), aquatic life use designation, public water supply designation, and fish kills.

Eighty of 365 classified segments in Texas (22 percent) are located in estuarine waters. These segments include tidal portions of major rivers (10), tidal streams (18), dredged canals and ship channels (13), primary bays (18), and secondary bays (21). These estuarine segments were evaluated and ranked for toxics contamination. These scores are based on fish tissue, sediment, biomonitoring, and potential toxic substance loading. Scores range from 1000 for the worst sites to 100 for the best sites. See **Table 2.11** for the results of this ranking.

Wetlands Information. Texas has approximately 667,755 hectares (1,650,000 acres) of coastal wetlands which interact with bays and estuaries. Major coastal wetland ecosystems of Texas include salt marshes and tidal flats. Texas is one of 19 states which have exhibited the most significant losses of wetland ecosystems.

Table 2.9 ***Causes Contributing to Use Impairments in Classified Streams, Rivers, Reservoirs, Bays & Estuaries in Texas***

Classified Streams and Reservoirs Cause Categories	Major Impact (miles)	Moderate/Minor Impact (miles)
Pesticides	71	63
Priority Organics	85	12
Metals	-0-	85
Nutrients	137	236
Organic Enrichment/Dissolved Oxygen	300	361
Salinity/TDS/Chlorides	280	63
Fecal Coliform Bacteria (Pathogens)	1,563	790
Classified Reservoirs **Cause Category**	**Major Impact (acres)**	**Moderate/Minor Impact (acres)**
Salinity/TDS/Chloride	35,366	116,508
Fecal Coliform Bacteria (Pathogens)	16,230	1,581
Classified Bays **Cause Category**	**Major Impact (sq. miles)**	**Moderate/Minor Impact (sq. miles)**
Priority Organics	-0-	23.8
Metals	0.5	-0-
Fecal Coliform Bacteria (Pathogens)	173.5	362.1

Table 2.10 ***Sources Contributing to Use Impairments in Classified Streams, Rivers, Reservoirs, Bays & Estuaries in Texas***

Classified Streams and Rivers		
Source Categories	Major Impact (miles)	Moderate/Minor Impact (miles)
Industrial Point Sources	95	12
Municipal Point Sources	1,086	442
Irrigated Crop Production	-0-	63
Pasture Land	-0-	240
Range Land	121	30
Animal Holding/Management Acres	70	-0-
Urban Runoff/Storm Sewers	267	110
Natural	731	20
Other	-0-	143
Unknown	409	157
Classified Reservoirs		
Source Category	Major Impact (acres)	Moderate/Minor Impact (acres)
Municipal Point Sources	16,230	-0-
Natural	35,366	114,208
Unknown	-0-	3,881
Classified Bays		
Source Category	Major Impact (sq. miles)	Moderate/Minor Impact (sq. miles)
Industrial Print Sources	0.5	23.8
Municipal Point Sources	133.7	92.1
Unknown	101.5	23.7

Table 2.11 *Texas Estuary Toxics Rank*

Segment	*Name*	*Toxics Score*
0601	Neches River Tidal	600
1006	Houston Ship Channel	600
2453	Lavaca Bay/Chocolate Bay	600
1007	Houston Ship Channel	600
2484	Corpus Christi Inner Harbor	400
1005	Houston Ship Channel	400
2481	Corpus Christi Bay	400
1201	Brazos River Tidal	400
2427	San Jacinto Bay	400
2437	Texas City Ship Channel	400
1001	San Jacinto River Tidal	400
0702	Intracoastal Waterway	400
0901	Cedar Bayou Tidal	300
1013	Buffalo Bayou Tidal	300
2454	Cox Bay	300
0501	Sabine River Tidal	300
2492	Baffin Bay	200
2421	Upper Galveston Bay	200
1401	Colorado River Tidal	200
2491	Laguna Madre	200
2494	Brownsville Ship Channel	200
2438	Bayport Channel	200
2431	Moses Lake	200
2439	Lower Galveston Bay	100
2201	Arroyo Colorado Tidal	100
2482	Nueces Bay	100
1701	Victoria Barge Channel	100
2483	Redfish Bay	100
0703	Sabine-Neches Canal	100
1101	Clear Creek Tidal	100
2485	Oso Bay	100
2422	Trinity Bay	100

Public Health/Aquatic Life Concerns. The available data on toxic substances were reviewed in order to estimate the extent of waters in Texas which are potentially impacted. This review included sampling data for concentrations of toxic materials in the water column and in edible fish tissue. The results of biomonitoring tests for total toxicity for both instream water and effluents from treated wastewater discharges were also considered. The statewide extent of waterbodies with exceedances of the state water quality standards or other indicators of concern is summarized in **Table 2.12**. Bodies of water which are under a fishing advisory or ban by the Texas Department of Health due to excessive concentrations of toxic substances in edible fish tissue are listed in **Table 2.13**. Fish kills which are suspected or known to have been caused by toxic substances are listed in **Table 2.14**.

Fish Kills. The TNRCC fish kill reporting system contains records for 58 fish kills that occurred from October 1, 1989-September 30, 1991. During this two-year period an estimated 1,400,936 fish were killed. Twenty-eight percent of the kills were attributed to dissolved oxygen depletion from various causes. Some examples are excessive organic loading, excessive algal growth, nonpoint source runoff, and anoxic releases from irrigation works. Causes for 27 percent of the fish kills could not be identified. Twenty-six percent of the kills were caused by toxic substances (*e.g.*, airplane de-icers, chemical spills, pesticide spraying, and chlorine). Nine percent of the kills were caused by wastewater bypasses and the resulting low oxygen and high concentration of metabolites. Seven percent of the kills were temperature-related resulting from sudden winter temperature fluctuations. The remaining three percent were due to runoff from intensive dairy operations and from culling the bycatch in shrimp nets. The majority of estuarine fish kills were reported from the San Jacinto River basin (16 percent). (See **Table 2.14**.)

Priorities & Concerns for Toxic Substances. Expansion of the TNRCC Toxic Control Program includes the following elements that affect bays and estuaries:

- Biomonitoring requirements for larger permitted dischargers.
- Revision of the fixed-station monitoring program, intensive survey priorities, and the development of biological survey procedures to improve surveillance of the occurrence and impact of toxic substances.
- Establishment of a cooperative TOXNET program between TNRCC and USEPA--Region 6. Ambient water is collected quarterly and sent to the Region 6 laboratory in Houston where bioassays are performed to screen for toxic substances.
- Addition of most priority pollutants to routine parameter coverage for water, sediment, and fish tissue samples collected at TNRCC SMN coastal sites.

Table 2.12 ***Texas Waterbodies Exceeding State Water Quality Standards or Other Indicators of Concern***

Waterbody Type/Units	Size Monitored for Toxics	Size with Elevated Levals of Toxics
Streams and Rivers/Miles	3,802	309
Reservoirs/Acres	157,236	500
Bays and Estuaries/Square Miles	919.00	58

Table 2.13 *Fishing Bans & Advisories in Texas*

Segment-Waterbody	Pollutant	Source	Size	Comments
0601-Neches River	Dioxin	Paper Mill	23 miles	All fish advisory
0805-Trinity River below Fort Worth	Chlordane	Urban Use	62 miles	Ban for all fish; chlordane now prohibited
1005, 1006, 1007-Houston Ship Channel	Dioxin	Paper Mill	32 miles	Catfish and blue crab advisory
1201-Brazos River Tidal	Dioxin	Chemical Industry	23 miles	All fish advisory
1429-Town Lake in Austin	Chlordane	Urban Use	500 acres	All fish advisory, chlordane prohibited
2202-Arroyo Colorado above Tidal	Chlordane Toxaphene DDT	Unknown	63 miles	All fish advisory
2453-Lavaca Bay 2454-Cox Bay	Mercury	Spillage at docks	58 square miles	Ban for all fish

Table 2.14 *Toxic Substance-Related Fish Kills in Texas*

Waterbody	Pollutant	Source	Size	Comments
Prairie Dog Town Fork of the Red River	ammonia	suspected discharge from WWTP	6.5 miles	WWTP effluent limits to be reviewed
Sabine River Tidal	triphenyl boron	chemical manufacture	6 miles	discharge via outfall canal, in alkaline solution
Adams Bayou Tidal	nonvolatile resin	chemical manufacture	1 mile	discharge via outfall canal
Lake Creek	methanol	train wreck	0.1 mile	spill and fire
Discharge Canal to Brazos River Tidal	unknown	chemical manufacture	0.5 mile	kill limited to canal
Discharge Canal to Brazos River Tidal	unknown	chemical manufacture	0.1 mile	kill limited to canal suspected, pH problem
Discharge Canal to Brazos River Tidal	unknown	chemical manufacture	1 mile	kill limited to canal dissolved oxygen very low
Colorado River near Sweetwater	corrosion inhibitor	truck wreck	0.07 mile	spill partially contained sediment removed
Nott Branch	herbicide	excessive application	2 miles	water almost black, also low dissolved oxygen
Gilleland Creek	chlorine	WWTP	1 mile	plant recently increased its capacity
Callihan Farm Pond	ammonia	runoff from hog operations	1 mile	fish swimming erratically
Leon Creek	cleaning Solution	aircraft maintenance	1.1 mile	discharge of cleaning solution from C-5 washrack
Water Supply Ditch near Pharr	algicide	excessive application	2 miles	$CuSO_2$ crystals undissolved, low flow
Bayport Ship Channel	vinyl Acetate	Barge spill	2 miles	barge at loading dock
San Fernando Creek	formaldehyde	chemical manufacture	2 miles	spill of untreated wastewater

- Addition and implementation of 35 aquatic life toxic criteria and 61 human health toxic criteria. During the next two years, TNRCC will review and revise the toxic-related portion of TSWQS.

Galveston Bay National Estuary Program. The Galveston Bay National Estuary Program began on September 1, 1989, and will be a five-year effort to accomplish the following goals: 1) identify environmental problems facing the bay; 2) establish a data and information management system; 3) gather historical and new data to address status and trends to identify and describe environmental problems; and 4) draft a comprehensive conservation and management plan.

Site-Specific Problem Areas. Parts of the Texas coast are heavily urbanized and industrialized. These centers of point source discharges are located in the Sabine estuary, the Galveston estuary, and the Corpus Christi estuary. Economically important species such as shrimp are being affected by insecticides used for mosquito control (USEPA, 1991c).

Copper, dioxin, and dieldrin are contaminants of concern in the Neches River tidal area of the state. Texas has issued a fish consumption advisory based on elevated dioxin/furan levels in fish tissue (USEPA, 1990a)

A fish consumption advisory has been issued for the Houston Ship Channel and contiguous waters due to the presence of dioxin at concentrations greater than EPA's 1×10^{-4} level of concern. The Arroyo Colorado has a fish consumption advisory in effect for chlordane, toxaphene, and DDT (USEPA, 1990a).

One site infamous for its serious levels of pesticides and PCB contamination is southern Laguna Madre (Mearns, 1986).

There are approximately 1,800 oil and chemical spills in Texas per year and about 1,000 include oil, crude oil, and partially refined products (O'Neal, 1991).

Lavaca Bay. The State of Texas has issued a ban for portions of Lavaca Bay/Chocolate Bay and Cox Bay for consumption of fish and crabs due to high mercury concentrations in edible tissue. Contamination is still being discharged into the bay complex via storm water and ground water.

Routine monthly monitoring of total mercury concentrations in storm water outfalls since 1984 suggests that drainage from a mercury cell chlorine-caustic plant, as well as recirculation of process waste waters to and from mercury-laden sludge disposal lakes, still contribute to mercury loading in the bay. Various transport pathways have led to the subsequent vertical migration of mercury into the underlying groundwater aquifer. Since 1962, a variety of dredge operations have taken place in Lavaca Bay. These projects may have affected the distribution of mercury in the sediment by temporarily increasing the amount of suspended solids

and bound mercury, displacing sediment concentrations, removing mercury laden sediment from the system, increasing water concentrations via dredge decant, and dike failures of disposal lagoons.

Periodic monitoring in Lavaca and Cox Bays indicates a decline in ambient mercury concentrations in water. However this monitoring also indicates that mercury in contaminated sediments is persistent. Studies of biological organisms from 1970 to present have shown elevated mercury concentrations in plankton, periphyton, aquatic plants, shellfish, finfish, and birds. The area was closed by the Texas Department of Health in 1988, and remains closed to date. Natural resource trustees have begun discussion designed to lead to a cooperative assessment of injuries in Lavaca Bay. USEPA has begun to evaluate Lavaca Bay for potential placement on the National Priority List. Lavaca Bay is currently on the Texas 304(l) list.

Conclusion

Toxic substances and pesticides, found in Gulf of Mexico waters, sediments, and biota, are a warning of potential decline. It is evident that the Gulf is being contaminated; however, the extent of the contamination and the extent of risk to the environment and to human health are not precisely known.

The effects of contamination of the Gulf of Mexico appear to be localized in areas where the toxic substances and pesticides are highly concentrated. But because the system into which these contaminants mix has a limited capacity, it is likely that a wide range of ecological effects will eventually emerge. The deleterious effects of contamination may go unnoticed until the system reacts over time, with subtle and long-term changes, such as the dramatic depletion of submerged aquatic vegetation discovered in some Gulf regions.

Consistent and regular sampling of water, sediment, and biota is necessary to determine whether the presence of contaminants is due to a temporary fluctuation or a more permanent condition. Currently, there is no consistent Gulfwide monitoring program. Such a program is difficult to achieve because of the size of the Gulf system and the many different contributors involved, but it is crucial to a complete evaluation of toxic substances and pesticide contamination in the Gulf of Mexico.

3 FEDERAL & STATE FRAMEWORK FOR ADDRESSING TOXIC SUBSTANCES & PESTICIDES

Many federal agencies are mandated by legislative statutes to control the use of toxics and pesticides in the environment and to mitigate adverse ecological impacts of that use. These agencies include: U.S. Environmental Protection Agency, U.S. Department of Commerce, U.S. Department of the Interior, U.S. Department of Defense, U.S. Department of Agriculture, and U.S. Department of Transportation. Each of the five Gulf of Mexico states also has a regulatory framework for addressing toxic substances and pesticides. (For a description, see **Appendix A**.)

4 THE UNFINISHED AGENDA --
Both Current Commitments & Uncommitted Activities

Goal

This Toxic Substances & Pesticides Action Agenda for the Gulf of Mexico sets forth a framework for conserving, protecting, and restoring Gulf waters that will minimize toxic substances and pesticides; thereby allowing the use and enjoyment of its resources. The Gulf of Mexico Program has established the following long-term goal for addressing toxic substances and pesticides:

- ❑ Reduce and, where possible, eliminate adverse ecological impacts from toxic substances and pesticides in the Gulf of Mexico system.

Action Agenda Framework

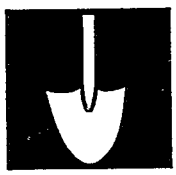
This chapter of the Action Agenda provides objectives, action items, and specific project descriptions for addressing the problem of toxic substances and pesticides in the Gulf of Mexico and for meeting the long-term goal as stated above. Objectives and action items are clustered under five types of activity: 1) Monitoring & Assessment 2) Research, 3) Planning & Standards, 4) Compliance & Enforcement, and 5) Public Education & Outreach (see **Index of Objectives and Action Items**). The forty-five action items represent the Committee's best judgment today, based on existing data and information, as to what must be done initially to tackle the problem of toxic substances and pesticides in the Gulf of Mexico. As current projects are completed and future generations of this document are developed, it is anticipated that more geographically targeted projects will emerge.

Lead. The Toxic Substances & Pesticides Committee has identified a lead agency for each project--the agency with the most authority or jurisdiction over the particular issue. A proposed action item or project may involve the execution of legislative or regulatory authorities or programmatic initiatives which derive from these authorities. In other cases, a proposed action item or project may involve the facilitation or coordination of activities among several agencies or organizations. In these cases, and where there is no clear legislative authority involved, the "lead" could be the agency or organization who expresses an interest in taking on the task during Gulf of Mexico Program Committee deliberations, the action planning workshop or public comment period, or, in the Issue Committee's judgment, is best able to guide multiple parties in carrying out the activity. *This does not necessarily mean that the agency has agreed to carry out the activity or that the agency has the necessary funding. The Toxic Substances & Pesticides Committee understands these action items will require commitments by agencies and organizations that are dependent on budget decisions.* However, the Committee members hope this

document provides the rationale and support for such commitments and that future iterations of this document will include additional specific commitments.

Initiation Date. The date indicated represents a determination by the Committee of the most realistic *initiation date* for the project. As lead agencies begin implementation planning for specific activities, these initiation dates may change due to resource availability and prioritization within the individual agencies.

Underway or Completed Action Item Projects. Some of the action item projects may already be underway or even completed. In these cases, short status reports are provided and the projects are designated with the following icons:



Underway

Completed

Some action items are cross referenced to other action items and are designated with a "→" sign in the left hand column. This signals a close relationship among those actions and a need for coordination.

The Gulf of Mexico Program recognizes the need to identify indicators of environmental progress relative to this Action Agenda for toxic substances and pesticides. Many of the action items specified in Chapter 4 of this document will aid the Program in developing a baseline for measuring success in the future. For the time being, however, acceptance and completion of action item projects specified in this Action Agenda will be considered a measure of success. As future iterations of this document are written, and current projects are completed, new action items and projects will be developed to better measure environmental progress.

There are important linkages between this Action Agenda and the Gulf of Mexico Program Public Health Action Agenda. The Public Health Action Agenda addresses public health concerns from all contributing sources, while the Toxic Substances & Pesticides Action Agenda focuses on the ecological impacts from toxic substances and pesticides. The Gulf of Mexico Program will coordinate action items between these two Action Agendas.

Index of Toxic Substances & Pesticides Objectives & Action Items

Monitoring & Assessment

Objective: Determine the inputs and concentrations of point and nonpoint sources of toxic substances and pesticides in Gulf of Mexico waters to establish baseline conditions and monitor changes over time.

Action Item 1: Develop an inventory report and data base on toxic substance and pesticide contaminant locations within Gulf of Mexico nearshore coastal waters.

Action Item 2: Develop an inventory report on potential sources of toxic substance and pesticide contamination within the Gulf of Mexico.

Action Item 3: Produce a Gulfwide toxic substances and pesticides characterization report.

Objective: Determine ecological effects in the Gulf of Mexico that can be associated with inputs of toxic substances and pesticides.

Action Item 4: Evaluate the need for including radium 226 and 228 in ongoing Gulf of Mexico monitoring programs.

Action Item 5: Prepare an update of the "Toxic Substances & Pesticides Characterization Report" which focuses on community and ecosystem-level effects.

Objective: Develop a coordinated Gulfwide monitoring strategy to maximize the effectiveness of efforts to address toxic substance and pesticide issues.

Action Item 6: Develop a centralized data base and Geographic Information System for toxic substances and pesticides in the Gulf of Mexico.

Action Item 7: Develop an inventory of toxic substance and pesticide monitoring programs throughout the Gulf of Mexico.

Action Item 8: Develop consistent and coordinated monitoring programs for toxic substances and pesticides across the five Gulf of Mexico states.

Index of Toxic Substances & Pesticides Objectives & Action Items

Research

Objective: Develop a coordinated Gulfwide research plan designed to address the need for knowledge, interpretation, and evaluation of toxic substances and pesticides.

Action Item 9: Sponsor a workshop on research needs for toxic substances and pesticides in the Gulf of Mexico.

Action Item 10: Track ongoing research and planning activities related to toxic substances and pesticides in the Gulf of Mexico to facilitate the coordination of activities Gulfwide.

Objective: Monitor developments and technological advances and support research to determine the fate and effects of toxic substances and pesticides in the Gulf of Mexico.

Action Item 11: Develop a coordinated research program on the fate and effects of priority toxic substances and pesticides within the Gulf of Mexico.

Action Item 12: Sponsor a forum on atmospheric deposition as a potential source of toxic substances and pesticides to the Gulf of Mexico.

Action Item 13: Develop a methods manual for analyzing concentrations of toxic substances in water, biota, and sediment.

Action Item 14: Develop bioassessment techniques for evaluating the ecological impacts of toxic substances and pesticides in water, biota, and sediments.

Action Item 15: Develop retrospective and predictive techniques for assessing the ecological impacts of contaminants.

Action Item 16: Develop improved testing technologies for produced waters in the Gulf of Mexico.

Action Item 17: Develop new monitoring methodologies to address complex stressor issues in the Gulf of Mexico.

Action Item 18: Assess the use and ecological effects of various oil spill remediation techniques in the Gulf of Mexico.

Index of Toxic Substances & Pesticides Objectives & Action Items

Planning & Standards

Objective: Implement and promote a coordinated Gulfwide toxic substances and pesticides management strategy which addresses, in priority order, source reduction, recycling, treatment, and disposal.

Action Item 19: Develop an inventory and analysis of programs that control inputs of toxic substances and pesticides to the Gulf of Mexico.

Action Item 20: Conduct a Gulfwide forum on management approaches for toxic substances and pesticides.

Action Item 21: Develop recommendations for strengthening MARPOL as a tool for addressing toxic substances and pesticides in the Gulf of Mexico.

Action Item 22: Require water reuse considerations in conjunction with selected NPDES permit renewals in Gulf of Mexico States.

Action Item 23: Develop national sediment quality criteria for use in setting NPDES permit limitations.

Action Item 24: Develop additional marine water quality criteria for Gulf of Mexico priority toxic substances and pesticides.

Action Item 25: Support the Lower Mississippi River Conservation Committee in integrating programs dealing with fish, wildlife, and water quality.

Action Item 26: Sponsor a Gulfwide bi-annual disposal week for household toxic substances and pesticides.

Objective: Reduce and, where possible, eliminate the discharge of contaminants of concern into Gulf of Mexico and Caribbean waters.

Action Item 27: Conduct ecological risk assessments to determine dischargers and contaminants of concern for Gulf of Mexico waters.

Action Item 28: Accelerate recommendations for remediation actions for in-place contaminants at high priority sites in the Gulf of Mexico.

Objective: Expand nonpoint pollution control programs to reduce toxic substance and pesticide runoff to Gulf of Mexico waters.

Action Item 29: Conduct technology transfer activities for urban nonpoint source controls in the Gulf of Mexico.

Action Item 30: Encourage integrated pest management practices within the Gulf of Mexico agricultural community.

Action Item 31: Evaluate the effectiveness of nutrient reduction activities for decreasing the inputs of toxic substances and pesticides within the Gulf of Mexico drainage basin and promote appropriate nutrient reduction actions.

Action Item 32: Accelerate the implementation of NPDES storm water controls in Gulf of Mexico coastal counties.

Action Item 33: Sponsor an awards program to reward innovative approaches to reduce inputs of toxic substances and pesticides to the Gulf of Mexico.

Index of Toxic Substances & Pesticides Objectives & Action Items

Compliance & Enforcement

Objective: Increase the effectiveness of permitting, compliance, and enforcement strategies to better address the inputs of toxic substances and pesticides to the Gulf of Mexico.

Action Item 34: Evaluate the effectiveness of ongoing programs within the Gulf of Mexico that control pesticides sales and application.

Action Item 35: Conduct comprehensive inspections of targeted Gulf of Mexico toxic dischargers.

Action Item 36: Produce reports on the frequency and types of water permit violations in Gulf of Mexico coastal counties.

Action Item 37: Require additional permit conditions for Gulf of Mexico dischargers to address newly identified contaminants of concern.

Action Item 38: Sponsor an awards program for Gulf of Mexico industry to recognize outstanding performance in the reduction of toxic substance emissions.

Public Education & Outreach

Objective: Develop public information and education efforts to promote awareness of environmental problems associated with improper use and disposal of toxic substances and pesticides.

Action Item 39: Develop a public education strategy to increase public awareness within the Gulf of Mexico drainage basin about the value of the Gulf of Mexico and the potential impacts of toxic substances and pesticides on this resource.

Action Item 40: Expand ongoing Gulf of Mexico educational programs to foreign countries.

Objective: Develop public information and education efforts to target specific actions for reducing toxic substance and pesticide inputs to and effects on the Gulf of Mexico.

Action Item 41: Develop a citizen awards program to recognize outstanding contributions to the reduction of toxic substance and pesticide inputs to the Gulf of Mexico.

Action Item 42: Develop a citizen's handbook for addressing toxic substance and pesticide issues in the Gulf of Mexico.

Action Item 43: Promote citizen monitoring programs for toxic substances and pesticides throughout the Gulf of Mexico.

Action Item 44: Develop public information materials on Gulf of Mexico waste and pesticide disposal locations and requirements.

Objective: Evaluate the effectiveness and results of all public education and outreach strategies for use in developing future toxic substance and pesticide outreach strategies.

Action Item 45: Develop measures of success for evaluating Gulf of Mexico Program public education and outreach activities related to toxic substances and pesticides.

Monitoring & Assessment

Monitoring is necessary to determine baseline conditions and measure trends. Many state, federal and private monitoring efforts are presently underway but most of these efforts are designed to meet specific goals and do not necessarily address Gulfwide regulatory and environmental resource concerns. Although additional monitoring to address Gulfwide concerns may be necessary, enhanced coordination among existing programs will increase the likelihood that reliable, compatible data sets will be generated without duplicative effort. The Gulf of Mexico program hopes to provide this coordination through the work of its Issue Committees and will further strive to integrate monitoring programs across issue areas such as Toxic Substances & Pesticides, Public Health, and Living Aquatic Resources.

Specific objectives, action items, and project descriptions follow:

Objective: Determine the inputs and concentrations of point and nonpoint sources of toxic substances and pesticides in Gulf of Mexico waters to establish baseline conditions and monitor changes over time.

Action Item 1: Develop an inventory report and data base on toxic substance and pesticide contaminant locations within Gulf of Mexico nearshore coastal waters.

Project Description: Develop an inventory report which describes the kinds and amounts of toxic substances and pesticides in Gulf of Mexico water, sediment, and biota, with an emphasis on near-shore coastal waters. The report should summarize findings on types of chemicals and their concentrations, key pollutants of concern, the spatial distribution of key pollutants, locations of concern and areas potentially affected, and data gaps. The report should also include an inventory of coastal sediment quality information, including sediment chemistry, biotoxicity, and bioaccumulation for specific contaminants of concern. A data base users manual will also be included as part of the report.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee and U.S. Environmental Protection Agency--Office of Science & Technology.
Initiation Date: September 1992
Status: 1) The final draft report was released in June 1993 and is currently undergoing peer review. All sediment and tissue chemistry and bioassay data are available in ASCII format and are summarized by site (32 drainage systems in the Gulf of Mexico). Several national and Gulfwide presentations have been made based on this data. Information from this project is provided in Chapter 2 of this Action Agenda.
2) U.S. Environmental Protection Agency--Region 4 has compiled an inventory of coastal sediment quality data. Region 6 has also completed a similar inventory, currently limited to those areas being dredged and material disposed offshore by the Corps of Engineers.
→ 11

Action Item 2: Develop an inventory report on potential sources of toxic substance and pesticide contamination within the Gulf of Mexico.

Project Description: Develop an inventory report which defines and identifies potential sources of toxic substance and pesticide contamination in the Gulf of Mexico, including types and amounts of contaminants as available. Data bases and inventories will be collected from state, federal, industrial, and municipal organizations. A synthesis report will identify potential sources, such as industrial, municipal, agricultural, federal facilities, hazardous waste sites, and atmospheric deposition, and the chemicals released in highest quantities from each source. In addition, the report will compile the total amount of toxic and pesticide compound discharges to each major tidal river basin estuary or to specified areas within the Gulf.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee and U.S. Environmental Protection Agency.
Initiation Date: September 1992
Status: The final draft report was released in June 1993 and is currently undergoing peer review. This report includes a data base to identify the sources and amounts of toxic substances and pesticides released into the Gulf from industry, oil and gas platforms, and pesticide runoff. Relative concentrations of toxic substances and pesticides have been calculated for 32 drainage systems of the Gulf. Excluded from the current inventory are federal facilities, hazardous waste sites, urban runoff, and atmospheric deposition. Several national and Gulfwide presentations have been made based on this data. Information from this project is provided in Chapter 2 of this Action Agenda.
→ 11

Action Item 3: Produce a Gulfwide toxic substances and pesticides characterization report.

Project Description: Integrate data collected in the source inventory and sediment and tissue contaminants inventory with water flow and toxicity data in order to produce a Gulfwide characterization report. This report will: 1) define areas in the Gulf of Mexico where biological effects are likely to occur from toxic substance and pesticide contamination; 2) define the chemicals (toxicants or pesticides) most likely to be causing identified problems; and 3) determine the most significant source(s) of those chemicals.
Lead: Gulf of Mexico Program--Toxic Substance & Pesticide Committee and U.S. Environmental Protection Agency.
Initiation Date: 1993
Status: A draft summary report is currently undergoing peer review. The Issue Committee is writing abstracts for each data set to identify unique qualities. Information from this report is included in Chapter 2 of this Action Agenda.
→ **5**

Objective: Determine ecological effects in the Gulf of Mexico that can be associated with inputs of toxic substances and pesticides.

Action Item 4: Evaluate the need for including radium 226 and 228 in ongoing Gulf of Mexico monitoring programs.

Project Description: Evaluate the importance of and need for including radium 226 and 228 in ongoing Gulf of Mexico monitoring programs and, if feasible, develop a standard approach for monitoring and analyzing these compounds. Questions regarding distribution of these isotopes in the Gulf of Mexico, their potential for ecological effects, and the availability of inexpensive, accurate analytical procedures must be addressed.
Lead: U.S. Environmental Protection Agency, Minerals Management Service, and Gulf of Mexico Program--Toxic Substances & Pesticides and Public Health Committees.
Initiation Date: 1997

Action Item 5: Prepare an update of the "Toxic Substances & Pesticides Characterization Report" which focuses on community and ecosystem-level effects.

Project Description: Using the most current data and risk assessment procedures available, prepare a state-of-the-art update of the 1993 "Toxic Substances & Pesticides Characterization Report." While effects to individuals and populations are important, this document will focus on community and ecosystem-level effects. Pollutants and sources most likely to be causing problems, levels of these priority pollutants that are believed to be ecologically safe, and specific systems known or predicted to be affected by toxic substances and pesticides will be presented.
Lead: U.S. Environmental Protection Agency--Office of Research & Development and National Oceanic & Atmospheric Administration--Strategic Assessment Branch, in coordination with Gulf of Mexico Program, Minerals Management Service, and other appropriate federal agencies.
Initiation Date: 1997
→ **3**

Objective: Develop a coordinated Gulfwide monitoring strategy to maximize the effectiveness of efforts to address toxic substance and pesticide issues.

Action Item 6: Develop a centralized data base and Geographic Information System for toxic substances and pesticides in the Gulf of Mexico.

Project Description: Develop a centralized interagency data base on toxic substances and pesticides entering/existing in the Gulf of Mexico. Initiate a Geographic Information System that will enhance rapid retrieval of toxic substance and pesticide monitoring data throughout the Gulf of Mexico. This action should be coordinated with other Gulf of Mexico Issue Committees as appropriate.
Lead: Gulf of Mexico Program--Data & Information Transfer Operations.
Initiation Date: 1996

Action Item 7: Develop an inventory of toxic substance and pesticide monitoring programs throughout the Gulf of Mexico.

Project Description: Identify and describe all existing and proposed pesticide and toxic substance monitoring programs in the Gulf of Mexico, including state and local authorities (port authorities, cities, water districts, river authorities, etc.), National Oceanic & Atmospheric Administration, U.S. Environmental Protection Agency, Minerals Management Service, U.S. Army Corps of Engineers, U.S. Fish & Wildlife Service, citizens' programs, private industry, and academic institutions in order to create a more holistic approach to Gulf of Mexico toxic substance and pesticide monitoring. To accomplish this, the Issue Committee will collect necessary data through telephone and written surveys, the Gulf of Mexico electronic bulletin board, and other "networking" activities as required.

Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.

Initiation Date: 1991

Status: The Issue Committee has substantially completed an inventory of state monitoring programs, and this information has been added to the Gulf of Mexico Program electronic bulletin board. Efforts need to continue to update this information and to expand the data base to include other sources.

→ 8

Action Item 8: Develop consistent and coordinated monitoring programs for toxic substances and pesticides across the five Gulf of Mexico states.

Project Description A: Develop a systemwide framework to provide consistent and coordinated monitoring methodologies and approaches for toxic substances and pesticides across the five Gulf of Mexico states. The program should harmonize the techniques used to take, store, and analyze a sample, as well as criteria for accepting data, quality assurance, quality control, and round robin testing. The Environmental Monitoring & Assessment Program - Estuaries (EMAP-E) probabilistic design should be supplemented by more spatially or temporally intensive sampling on a state by state basis as determined necessary. The framework should also include a provision for an annual Gulfwide technology transfer and coordination meeting. The draft framework report will be submitted to the full Issue Committee for their comments and approval. A steering committee comprised of Issue Committee members and others will oversee the effort to ensure that reliable data exist to evaluate the impact of toxic substances and pesticides on the Gulf of Mexico.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee, in cooperation with U.S. Environmental Protection Agency--EMAP-E, National Oceanic & Atmospheric Administration--National Status & Trends program, and state environmental agencies.
Initiation Date: 1991
Status: 1) The EMAP-E Program has worked with the State of Alabama and with Tampa Bay, FL, to train personnel on the monitoring design and the selection of appropriate indicators. This assistance will be expanded to cover all Gulf of Mexico states.
2) A critical evaluation of existing monitoring programs that identify inconsistencies and define those programs that fit with no change, moderate change, and massive change has been developed by the Gulf of Mexico Program. This information will be supplemented by information generated at a workshop, "Chemical and Biological Contamination of Fish and Invertebrates: A Workshop to Evaluate Human Health Risk," sponsored by the Public Health Committee and U.S. Environmental Protection Agency. The workshop will be scheduled in 1994.
→ 7, 17

Project Description B: Utilizing information obtained from Action Items 1, 2, 7, and 8A, the Gulf of Mexico Program will develop a final systemwide monitoring framework that will emphasize and coordinate existing monitoring activities and identify gaps and needs, with an focus on the nearshore environment. The Gulf of Mexico Program will convene and facilitate a workshop with appropriate representatives from ongoing monitoring programs, appropriate resource managers from the Gulf of Mexico Program, and other experts in the field of marine monitoring to provide information for the development of a model on the fate of toxic substances and pesticides and other contaminants in the Gulf of Mexico.
Lead: Gulf of Mexico Program.
Initiation Date: 1996
→ 1, 2, 7, 8A, 17

Research

The Gulf of Mexico is a productive resource, but is susceptible to impacts of natural phenomena and human activities. Human activities can result in increased inputs of toxic substances and pesticides that may cause adverse effects on the Gulf's ecosystem. To protect the marine ecosystem from the threats posed by these toxic substances and pesticides, more complete knowledge is needed concerning the relationships of sources of these contaminants to inputs and impacts. Research is also needed to determine the environmental and biological responses to toxic substances and pesticides, on a geographic basis and Gulfwide.

Most research funds are administered by federal agencies or state program offices in support of specific missions, with only limited funding going to research that examines the cumulative effects of decisions on the ecosystem as a whole. This action planning process provides the necessary mechanism to enable producers, consumers, and funders of research to agree on the priorities. A closer connection should be established between the research agenda of the scientific community and the information needs of managers, regulators, and those involved in management decisions for the Gulf of Mexico. Once a research agenda is developed and implemented, the research results should be used to understand the underlying processes and relationships and make appropriate decisions regarding management of Gulf waters.

Specific objectives, action items, and project descriptions follow:

Objective: Develop a coordinated Gulfwide research plan designed to address the need for knowledge, interpretation, and evaluation of toxic substances and pesticides.

Action Item 9: Sponsor a workshop on research needs for toxic substances and pesticides in the Gulf of Mexico.

Project Description: Sponsor a workshop on research needs for toxic substances and pesticides which will: 1) bring federal, state, and local agency program and resource managers together with industry representatives, citizen groups, and research scientists to review the current information base relative to toxic substances and pesticides in the Gulf of Mexico; 2) identify additional research activities needed to determine the fate and effects of toxic substances and pesticides in the water, sediment, air, and biota of the Gulf of Mexico; and 3) recommend priority research activities that will address the defined needs. The product of the workshop will be a written document that encompasses the combined consensus of research scientists and resource managers from all aspects of the Gulf of Mexico community for the application of research to priority information needs. It is anticipated that this document will provide the scientists and environmental managers of the Gulf with guidelines for focusing limited resources on the highest priority informational needs regarding the sources, fate, and effects of toxic substances and pesticides in the Gulf of Mexico.

Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.

Initiation Date: 1993

Status: The workshop was held August 23-25, 1993, at the Mote Marine Laboratory in Sarasota, FL. A final workshop report should be available in October 1993.

→ 10, 11, 19

Action Item 10: Track ongoing research and planning activities related to toxic substances and pesticides in the Gulf of Mexico to facilitate the coordination of activities Gulfwide.

Project Description: Develop a tracking system for ongoing research and planning activities related to toxic substances and pesticides in the Gulf of Mexico as a vehicle for facilitating the coordination of activities Gulfwide. Coordination efforts should include Mexico and countries of the Wider Caribbean. Produce updates on the Gulf of Mexico bulletin board system and develop special reports and briefings as appropriate.
Lead: Gulf of Mexico Program.
Initiation Date: 1994
→ 9

Objective: Monitor developments and technological advances and support research to determine the fate and effects of toxic substances and pesticides in the Gulf of Mexico.

Action Item 11: Develop a coordinated research program on the fate and effects of priority toxic substances and pesticides within the Gulf of Mexico.

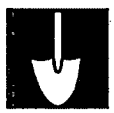
Project Description: Develop a coordinated research program on the fate (distribution and transport) and effects of priority toxic substances and pesticides within the Gulf of Mexico. Research should include the following sources: agricultural, urban, domestic, and non-urban. Research should eventually be expanded to include Mexico and the Wider Caribbean.
Lead: U.S. Environmental Protection Agency, in coordination with other appropriate agencies.
Initiation Date: 1994
→ 1, 2, 9

Action Item 12: Sponsor a forum on atmospheric deposition as a potential source of toxic substances and pesticides to the Gulf Mexico.

Project Description: Sponsor a panel or workshop of air and aquatic experts to exchange information on the potential contribution of atmospheric deposition to toxic substance and pesticides inputs within the Gulf of Mexico. The forum will also provide guidance on how to proceed with atmospheric deposition research and characterization in the Gulf of Mexico.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.
Initiation Date: 1995

Action Item 13: Develop a methods manual for analyzing concentrations of toxic substances in water, biota, and sediment.

Project Description: Develop a methods manual, including quality assurance/quality control procedures, to more appropriately analyze concentrations of toxic substances in water, biota, and sediment. This is a nationally applicable product.
Lead: U.S. Environmental Protection Agency--Office of Science & Technology, in coordination with National Oceanic & Atmospheric Administration, U.S. Food & Drug Administration, U.S. Fish & Wildlife Service, U.S. Geological Survey, and universities.
Initiation Date: 1992
Status: U.S. Environmental Protection Agency--Office of Science & Technology has developed the draft methods manual, which is currently undergoing review; a final document is expected in early 1994.



Action Item 14: Develop bioassessment techniques for evaluating the ecological impacts of toxic substances and pesticides in water, biota, and sediments.

Project Description: Develop and evaluate bioassessment techniques for predicting and evaluating the ecological impacts of contaminants in water, biota, and sediments. To the extent possible, biological indicators (bioindicators) to be used must be: 1) easy to detect and quantify, 2) able to discriminate among natural and anthropogenic stresses, 3) descriptive of effects at various levels of organization (individual, population, community, ecosystem), and 4) compatible with diagnostic approaches for evaluating cause of affected systems/individuals. Complementary diagnostic techniques are required that have the ability to distinguish among effects caused by toxic organic and inorganic chemicals, physical insults, biological stressors, etc. These could include biomarkers, post-mortem examinations, marine sediment toxicant identification evaluations, and single species tests coupled with chemical assays.

Lead: U.S. Environmental Protection Agency--Offices of Science & Technology and Research & Development, in coordination with National Oceanic & Atmospheric Administration.

Initiation Date: 1992

Status: U.S. Environmental Protection Agency--Offices of Science & Technology and Research & Development have developed acute toxicity laboratory bioassay methods for sediments which are currently under review; a final document is expected in early 1994. Work will then proceed on chronic toxicity methods for sediments. Efforts are also underway to develop estuarine and near coastal waters bioassessments and biocriteria.

Action Item 15: Develop retrospective and predictive techniques for assessing the ecological impacts of contaminants.

Project Description: Develop retrospective and predictive techniques for assessing the ecological impacts of contaminants. Develop methods that reduce uncertainty in extrapolating from laboratory to field, lower to higher organizational levels, species to species, and across exposure and effects conditions in estuarine environments. Validated methods, which meet these criteria and are specifically designed for the unique Gulf of Mexico coastal ecosystems, will allow prediction and assessment of current and future toxic substances and pesticides impacts.
Lead: U.S. Environmental Protection Agency--Office of Science & Technology, National Oceanic & Atmospheric Administration, and Minerals Management Service.
Initiation Date: 1992
Status: U.S. Environmental Protection Agency--Office of Science & Technology has completed draft methods for the chemistry and sampling of sediments to support the national dredging program; a final product should be released in 1994. Work continues at several agencies and at many levels on the development of biomarkers as an assessment tool.

Action Item 16: Develop improved testing technologies for produced waters in the Gulf of Mexico.

Project Description: Develop improved testing technologies for assessing the toxicity of produced waters in the Gulf of Mexico. Develop and/or validate testing protocols that are predictive of the effects of produced waters in bays and estuaries of the Gulf of Mexico. Chronic and acute exposures, short- and long-term effects, and responses at the individual through community levels of organization should be considered in the protocols.
Lead: U.S. Environmental Protection Agency--Office of Research & Development (Gulf Breeze Laboratory), Minerals Management Service, and the Gulf States.
Initiation Date: 1998

Action Item 17: Develop new monitoring methodologies to address complex stressor issues in the Gulf of Mexico.

Project Description: Assess and develop new monitoring methodologies to address increasingly complex stressor issues in the Gulf of Mexico. For example, approaches should be developed to deal with the introduction of genetically engineered organisms, including biological control agents and to determine concentrations of specific organic compounds from mixtures of compounds.
Lead: U.S. Environmental Protection Agency, National Oceanic & Atmospheric Administration, Minerals Management Service, and National Research Council.
Initiation Date: 1994
→ 8

Action Item 18: Assess the use and ecological effects of various oil spill remediation techniques in the Gulf of Mexico.

Project Description: Assess and monitor the use and ecological effects of bioremediation, dispersants, and in situ burning as oil spill remediation techniques in the Gulf of Mexico. Existing Regional Response Teams (RRT) are authorized through a National Contingency Plan to monitor these techniques.

Lead: Regional Response Team (this team is co-chaired by U.S. Environmental Protection Agency--Region 6 and U.S. Coast Guard, with participation by U.S. Departments of Interior, Commerce, Agriculture, Defense, State, Justice, Transportation, Health, Energy, and Labor; Federal Emergency Management Agency; General Services Administration; National Research Council; and appropriate state agencies), as well as organizations such as Offshore Operators Committee and Marine Spill Response Corporation.

Initiation Date: Ongoing

Status: The Regional Response Team has had an ongoing work group to assess bioremediation as an oil spill remediation technique for 5-10 years. Currently, this technique does not appear valid for the Gulf of Mexico marine environment. There are currently two pre-approved plans for the use and monitoring of dispersants in the Gulf of Mexico, neither of which has been implemented due to the lack of oil spills. These plans are the Louisiana Offshore Oil Port (LOOP) and the Industrial Task Force on Offshore Lightering (ITOL) which covers upper Texas and western Louisiana. The Marine Spill Response Corporation is currently seeking pre-approval for a Gulfwide plan for in situ burning as a remediation technique for oil spills.

Planning & Standards

The setting of standards is an essential component of toxic substance and pesticide pollution control and prevention. Standards determine enforceable limits and provide a basis for measuring improved environmental quality. However, needs for standards development have grown faster than funding. To address the many needs, priorities should be set on the basis of risk, both from specific dischargers and contaminants of concern. Greater overall environmental results can be achieved if resources are allocated based on risk reduction. In addition, contaminants of concern may be coming from nonpoint sources as opposed to point sources. Information about these sources should be developed to support effective decision-making.

Historically, emphasis has been placed on the treatment and disposal of pesticides and toxic substances rather than on source reduction and recycling of these pollutants. Pollution prevention is now viewed as the cheaper, more efficient, and more effective alternative to traditional control approaches which treat and/or attempt to effectively dispose of these pollutants. Implementing such an approach Gulfwide will require cooperation from many federal, state, and local governments, as well as the private and public sectors.

Specific objectives, action items, project descriptions under this strategy include:

Objective: Implement and promote a coordinated Gulfwide toxic substances and pesticides management strategy which addresses, in priority order, source reduction, recycling, treatment, and disposal.

Action Item 19: Develop an inventory and analysis of programs that control inputs of toxic substances and pesticides to the Gulf of Mexico.

Project Description: Develop an inventory of various federal, state, and local programs that currently exist to control inputs of toxic substances and pesticides to the Gulf of Mexico. Analyze the effectiveness of these programs and develop recommendations to improve existing regulatory programs, including the need to create new programs.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.
Initiation Date: 1994
→ 10

Action Item 20: Conduct a Gulfwide forum on management approaches for toxic substances and pesticides.

Project Description: Conduct a Gulfwide forum for the five states and various federal agencies to share information on alternative management approaches for toxic substances and pesticides and develop a framework for a more effective Gulfwide program. Pollution prevention technology will be emphasized.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee, in coordination with Data & Information Transfer Operations.
Initiation Date: 1994

Action Item 21: Develop recommendations for strengthening MARPOL as a tool for addressing toxic substances and pesticides in the Gulf of Mexico.

Project Description A: Develop recommendations for expanding and strengthening, as necessary, the provisions of the International Convention for the Prevention of Pollution from Ships (MARPOL) as a tool for addressing toxic substances and pesticides in the Gulf of Mexico. This will include adding appropriate countries to the Convention.
Lead: U.S. Coast Guard.
Initiation Date: 1995

Project Description B: Encourage acceptance of MARPOL Annex III (on containerized or packaged harmful substances) by Mexico and Central and South American countries contiguous with the Gulf of Mexico and Caribbean Sea.
Lead: U.S. Coast Guard.
Initiation Date: 1995

Action Item 22: Require water reuse considerations in conjunction with selected NPDES permit renewals in Gulf of Mexico States.

Project Description A: Require a Best Available Technology-oriented water reuse strategy to be identified and explained in NPDES permit renewals for discharges into Gulf of Mexico waters.
Lead: U.S. Environmental Protection Agency and Gulf States.
Initiation Date: 1996

Project Description B: Based on information from Project 22A, where a particular technology is determined to be beneficial in controlling inputs of toxic substances and pesticides to Gulf of Mexico waters, work with the permittee to develop a permit provision to require the technology.
Lead: U.S. Environmental Protection Agency and Gulf States.
Initiation Date: 1996

Action Item 23: Develop national sediment quality criteria for use in setting NPDES permit limitations.

Project Description: Accelerate the development of national sediment quality criteria and associated implementation guidance for toxicants and pesticides. These will be used in setting state water quality standards and NPDES permit limitations in Gulf waters.
Lead: U.S. Environmental Protection Agency--Office of Water, in coordination with U.S. Geological Survey.
Initiation Date: Ongoing
Status: U.S. Environmental Protection Agency has developed draft criteria for five organic compounds: dieldrin, endrin, phenanthene, acenapthene, and flouranthene. Another 8-10 metals are currently under development.

Action Item 24: Develop additional marine water quality criteria for Gulf of Mexico priority toxic substances and pesticides.

Project Description: Accelerate the development of marine water quality criteria for toxic substances and pesticides identified as chemicals of concern to the Gulf of Mexico. These criteria will be used to establish NPDES permit limitations for discharges within the Gulf of Mexico drainage basin.
Lead: U.S. Environmental Protection Agency--Office of Water.
Initiation Date: Ongoing
Status: Forty marine water quality criteria have been promulgated by the U.S. Environmental Protection Agency. This includes 29 criteria covering priority pollutants and another 11 criteria for non-priority pollutants which were generated under a different methodology. Approximately 20 additional new or revised criteria are underway, including a saltwater dissolved oxygen criterion and several pesticide criteria.

Action Item 25: Support the Lower Mississippi River Conservation Committee in integrating programs dealing with fish, wildlife, and water quality.

Project Description: Encourage and support the Lower Mississippi River Conservation Committee in their efforts to better integrate Gulf of Mexico interjurisdictional programs dealing with fish and wildlife and water quality.
Lead: U.S. Fish & Wildlife Service, in coordination with state fish/wildlife and water quality agencies of states bordering the lower Mississippi River, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and Gulf of Mexico Program.
Initiation Date: 1993
Status: Bylaws for the Committee have been developed and are currently being reviewed by the various state and federal agencies.

Action Item 26: Sponsor a Gulfwide bi-annual disposal week for household toxic substances and pesticides.

Project Description: Sponsor a Gulfwide bi-annual, or more frequent, disposal week to facilitate the disposal of household toxic substances and pesticides. This project would be modeled on the marine debris beach cleanups for the five Gulf States. Several of the Gulf States have disposal programs underway but there is no coordinated Gulfwide effort. The designated week would also include forums for the exchange of information on effective disposal approaches.
Lead: Gulf of Mexico Program--Citizens Advisory Committee, in conjunction with Toxic Substances & Pesticides Committee, Public Education & Outreach Operations, and appropriate state agencies.
Initiation Date: 1994
→ **42, 44**

Objective: Reduce and, where possible, eliminate the discharge of contaminants of concern into Gulf of Mexico and Caribbean waters.

Action Item 27: Conduct ecological risk assessments to determine dischargers and contaminants of concern for Gulf of Mexico waters.

Project Description A: Conduct an ecological risk assessment to determine specific toxic substance and pesticide discharges that should be reduced or eliminated in the Gulf of Mexico, including, but not limited to, discharges from tank/bilge facilities, abandoned gas tanks, produced water reinjection technology, and open pits.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee, in conjunction with U.S. Environmental Protection Agency--Regions and states.
Initiation Date: 1995

Project Description B: Conduct a comparative ecological risk assessment to identify specific contaminants of concern in the Gulf of Mexico as a companion document to Project 27A.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee, in conjunction with U.S. Environmental Protection Agency--Regions and states.
Initiation Date: 1995
→ **2, 37**

Action Item 28: Accelerate recommendations for remediation actions for in-place contaminants at high priority sites in the Gulf of Mexico.

Project Description: Accelerate recommendations for actions for in-place contaminants at high priority sites (*e.g.* hazardous waste sites) in the Gulf of Mexico. The focus of these actions will be to reduce ecological impacts.
Lead: U.S. Environmental Protection Agency--Regions 4 & 6 and Gulf States.
Initiation Date: Ongoing
Status: Under the federal Superfund Program, the U.S. Environmental Protection Agency is authorized to provide remedial actions when contaminants pose a danger to human health or the environment. Identified sites are placed on the National Priority List for action. One identified site in the Gulf region is Bayou Bonfouca, LA, which was placed on the List in 1982, due to creosote contamination. Alternative remediation methods for the contaminated site have been examined and a feasibility study has been completed. The selected method includes incineration of creosote waste piles and heavily contaminated bayou sediment; capping the site; and pumping, treating, and monitoring contaminated ground water.

Objective: Expand nonpoint pollution control programs to reduce toxic substance and pesticide runoff to Gulf of Mexico waters.

Action Item 29: Conduct technology transfer activities for urban nonpoint source controls in the Gulf of Mexico.

Project Description: Conduct technology transfer activities to share information across the Gulf States on urban nonpoint source controls. One such project is a pilot project in the City of Austin, TX, which addresses the reduction of urban nonpoint source inputs and the use of Best Management Practices to control slugs of trash and sedimentation.
Lead: U.S. Environmental Protection Agency and City of Austin.
Initiation Date: 1993
Status: The City of Austin has developed a four-task workplan and initiated activities on this project. This effort is scheduled to be completed in 1996.

Action Item 30: Encourage integrated pest management practices within the Gulf of Mexico agricultural community.

Project Description: Encourage and promote integrated pest management practices within the agricultural community of the Gulf of Mexico. Produce an annual report on the degree to which these practices are occurring within the Gulf of Mexico drainage basin.
Lead: U.S. Department of Agriculture--Extension Service, in coordination with Soil Conservation Service and Agricultural Stabilization & Conservation Service.
Initiation Date: 1994
→ 42

Action Item 31: Evaluate the effectiveness of nutrient reduction activities for decreasing the inputs of toxic substances and pesticides within the Gulf of Mexico drainage basin and promote appropriate nutrient reduction actions.

Project Description: Evaluate the effectiveness of nutrient reduction activities for decreasing the inputs of toxic substances and pesticides within the Gulf of Mexico drainage basin and promote appropriate nutrient reduction actions. Provide incentives to the agricultural community to adopt appropriate nutrient reduction measures.
Lead: Gulf of Mexico Program--Nutrient Enrichment Committee, in coordination with U.S. Environmental Protection Agency--Nonpoint Source Program.
Initiation Date: 1995

Action Item 32: Accelerate the implementation of NPDES storm water controls in Gulf of Mexico coastal counties.

Project Description: Accelerate the implementation of NPDES storm water controls in coastal counties of the Gulf of Mexico as a vehicle for reducing inputs of toxic substances and pesticides.
Lead: Gulf States, in conjunction with U.S. Environmental Protection Agency.
Initiation Date: 1993
Status: The Clean Water Act regulations require municipalities with populations over 100,000 to implement storm water controls by October 1993.

Action Item 33: Sponsor an awards program to reward innovative approaches to reduce inputs of toxic substances and pesticides to the Gulf of Mexico.

Project Description: Sponsor an awards program, for both the agricultural and non-agricultural community, to reward innovative approaches to reduce inputs of toxic substances and pesticides to the Gulf of Mexico.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.
Initiation Date: 1995
→ **38, 41**

Compliance & Enforcement

The effectiveness of regulatory programs is greatly enhanced by active compliance monitoring and enforcement programs. Strong permit conditions are only effective if met. Enforcement surveillance and resolution of violations are essential to an effective regulatory program.

Currently many federal and state regulatory programs do not have the number of field level personnel which are required to achieve effective compliance and enforcement. Other incentives for compliance should be explored.

Specific objectives, action items, and project descriptions follow:

Objective: Increase the effectiveness of permitting, compliance, and enforcement strategies to better address the inputs of toxic substances and pesticides to the Gulf of Mexico.

Action Item 34: Evaluate the effectiveness of ongoing programs within the Gulf of Mexico that control pesticides sales and application.

Project Description: Evaluate and assess the effectiveness of ongoing cooperative efforts and information sharing among agencies that control the sale and appropriate application of pesticides. Encourage the enhancement of appropriate activities to minimize adverse impacts within the Gulf of Mexico from the use of such products.
Lead: U.S. Environmental Protection Agency--Office of Pesticides & Toxic Substances, in coordination with Gulf States.
Initiation Date: 1995

Action Item 35: Conduct comprehensive inspections of targeted Gulf of Mexico toxic dischargers.

Project Description: Conduct comprehensive inspections of selected dischargers within Gulf of Mexico states that are targeted for the greatest potential risk reduction of total toxic releases. The following factors and information will be used to target dischargers: highly industrialized and populated coastal counties and parishes in the Gulf, toxic release inventory reports, records of past violations, and other computerized environmental data.
Lead: U.S. Environmental Protection Agency and Gulf States.
Initiation Date: 1995

Action Item 36: Produce reports on the frequency and types of water permit violations in Gulf of Mexico coastal counties.

Project Description: Produce a regular report on the frequency and types of water permit violations in Gulf of Mexico coastal counties to identify chronic problems associated with toxic substances and pesticides. Develop a strategy for selected dischargers to work toward voluntary compliance, or enforcement action, as necessary.
Lead: U.S. Environmental Protection Agency and Gulf States.
Initiation Date: 1995

Action Item 37: Require additional permit conditions for Gulf of Mexico dischargers to address newly identified contaminants of concern.

Project Description: Require additional permit conditions as part of the permit renewal process of appropriate Gulf of Mexico NPDES dischargers to measure any newly identified contaminants of concern.
Lead: U.S. Environmental Protection Agency and Gulf States.
Initiation Date: 1996
→ **27B**

Action Item 38: Sponsor an awards program for Gulf of Mexico industry to recognize outstanding performance in the reduction of toxic substance emissions.

Project Description: Develop and sponsor an awards program for Gulf of Mexico industry to recognize outstanding performance in the reduction of emissions beyond minimum requirements. This program should be coordinated with the U.S. Environmental Protection Agency's pollution prevention awards program.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee.
Initiation Date: 1995
→ 33, 41

Public Education & Outreach

People living in two-thirds of the U.S. ultimately affect the environmental quality of the Gulf of Mexico. Alternatively, the entire population of the U.S. can potentially be affected by the environmental quality of the Gulf of Mexico.

Many farmers, landowners, and businesses are using chemicals and pesticides for various purposes. Some of these toxic substances are in concentrated form, and in many cases it is difficult for an individual to purchase the exact amount that is needed; the unused portion may be improperly stored or disposed. The accumulation of these chemicals has created a potential pollution problem or health hazard. In addition, one of the major threats to the water quality of the Gulf of Mexico is storm water runoff, which can include toxic substances and pesticides, from residential areas and neighborhoods-- from lawns, gardens, roofs, driveways, sidewalks, and streets.

Effective toxic substance and pesticide controls will require an ongoing commitment from an informed citizenry. Public information, education, and involvement are three components of an effective outreach strategy, which can reap significant benefits both for the Gulf of Mexico and for citizens utilizing its resources. An effective strategy can foster recognition of the Gulf as a regional and national resource; stimulate civic, governmental, and private sector support for changing lifestyles; develop the financial commitments necessary to preserve the resource; and enable all individuals, whether living on the coast or along the upper stretches of the Mississippi, to see themselves as caretakers of a vital, shared resource.

Public education and outreach needs include the following:

- Knowledge about sources and impacts of contaminants;
- Risk assessments and communication;
- Information briefs on priority items/issues;
- How to use and apply information; and
- How the governmental process works in relation to "getting things accomplished."

Specific objectives, action items, and project descriptions follow:

Objective: Develop public information and education efforts to promote awareness of environmental problems associated with improper use and disposal of toxic substances and pesticides.

Action Item 39: Develop a public education strategy to increase public awareness within the Gulf of Mexico drainage basin about the value of the Gulf of Mexico and the potential impacts of toxic substances and pesticides on this resource.

Project Description A: Use the information from Action Items 2 and 3 to develop and distribute specific toxic substances and pesticide fact sheets for target audiences throughout the Gulf of Mexico drainage basin.
Lead: Gulf of Mexico Program--Public Education & Outreach Operations and Citizens Advisory Committee.
Initiation Date: 1994
→ 2, 3

Project Description B: Involve educators in developing a Gulf of Mexico environmental code of ethics, which is communicated through continuing education classes, short courses, and workshops.
Lead: Gulf State education agencies, Agricultural Extension Service, and Soil Conservation Service agents, in coordination with Gulf of Mexico Program--Citizens Advisory Committee. This effort should be coordinated with other Gulf of Mexico Program committees.
Initiation Date: 1995

Project Description C: Develop a specific strategy to reach the Gulf of Mexico electronic and print media about the value of the Gulf of Mexico, the need to protect and conserve Gulf resources, and the potential impact of toxic substances and pesticides on these resources.
Lead: Gulf of Mexico Program--Public Education & Outreach Operations. This effort should be coordinated with all Gulf of Mexico Program Issue Committees.
Initiation Date: 1994

Project Description D: Support and promote an biennial public education event highlighting the Gulf of Mexico, which could include, for example, a signatory document.
Lead: Gulf of Mexico Program. This effort should be coordinated with all of the committees of the Gulf of Mexico Program.
Initiation Date: 1989
Status: The first biennial symposium on the "Environmental and Economic Status of the Gulf of Mexico" was held December 2-5, 1990, in New Orleans, LA. Nearly 1,000 representatives from federal, state, and local agencies, industry, academia, and the public-at-large attended. This gathering fostered a greater understanding and exchange of information on the many complex issues facing the Gulf of Mexico. The second Gulf of Mexico Symposium was held December 10-12, 1992, in Tarpon Springs, FL, to celebrate the "Year of the Gulf." Presentations and discussions were held to focus on solving the environmental problems in the Gulf of Mexico. The highlight of the Symposium was the signing of the "Partnership for Action" by all of the Gulf of Mexico Program partners.

Project Description E: Promote the Gulf of Mexico Program Bulletin Board System as a useful citizen tool for tracking Gulf of Mexico related information and research and information exchange.
Lead: Gulf of Mexico Program--Data & Information Transfer Operations.
Initiation Date: 1994

Action Item 40: Expand ongoing Gulf of Mexico educational programs to foreign countries.

Project Description: Develop strategies to expand ongoing Gulf of Mexico educational programs to other countries. This effort should be coordinated with other Issue Committees throughout the Gulf of Mexico Program.
Lead: Gulf of Mexico Program. This effort should be coordinated with all of the committees of the Gulf of Mexico Program.
Initiation Date: 1996

Objective: Develop public information and education efforts to target specific actions for reducing toxic substance and pesticide inputs to and effects on the Gulf of Mexico.

Action Item 41: Develop a citizen awards program to recognize outstanding contributions to the reduction of toxic substance and pesticide inputs to the Gulf of Mexico.

Project Description: Develop a citizen awards program, including monetary awards, to recognize outstanding contributions to the reduction of toxic substance and pesticide inputs to the Gulf of Mexico. The program should be targeted to various levels of public school systems and universities, as well as various areas (state winners and Gulfwide winners). Gulfwide winner's awards should be presented at Gulf of Mexico Program Symposia.
Lead: Gulf of Mexico Program--Public Education & Outreach Operations and Citizens Advisory Committee. This effort should be coordinated with all Gulf of Mexico Program committees.
Initiation Date: 1994
→ **33, 38**

Action Item 42: Develop a citizen's handbook for addressing toxic substance and pesticide issues in the Gulf of Mexico.

Project Description: Develop a citizen's handbook for addressing toxic substance and pesticide issues in the Gulf of Mexico. This will include a description of concepts, such as the toxic substances and pesticides management hierarchy, multimedia approach, citizen responsibility; existing legislation; programs (*e.g.*, "amnesty" days) and contacts; and a "how to" section. This should be accomplished by using the information obtained in Action Items 1, 2, and 3. Also, the handbook will include residential water quality guidelines focusing on educating urban homeowners in coastal areas on how to reduce pesticide and fertilizer inputs and conserve large quantities of ground water through lawn care alternatives, such as integrated pest management, low maintenance landscape materials, proper pesticide and fertilizer use, alternatives to pesticide use, pet and yard waste reduction, soil sampling, erosion control, and household hazardous waste management.
Lead: Gulf of Mexico Program--Toxic Substances & Pesticides Committee, in conjunction with Public Education & Outreach Operations, U.S. Environmental Protection Agency, state soil & water conservation agencies, local Soil & Water Conservation Districts, Soil Conservation Service, Agricultural Extension Service, local garden clubs, and civic organizations.
Initiation Date: 1995
→ 1, 2, 3, 26, 31, 44

Action Item 43: Promote citizen monitoring programs for toxic substances and pesticides throughout the Gulf of Mexico.

Project Description: Promote citizen monitoring programs for toxic substances and pesticides throughout the Gulf of Mexico. This effort will build on volunteer monitoring programs for conventional parameters already underway in the five Gulf States, such as Alabama's Baywatch Program (partially supported by Gulf of Mexico Program funding). Stringent quality assurance/quality control protocols will be incorporated in monitoring program design.
Lead: Gulf of Mexico Program--Citizens Advisory Committee, U.S. Environmental Protection Agency--Regions 4 & 6, and Gulf of Mexico National Estuary Programs. This effort should be coordinated with all Gulf of Mexico Program Issue Committees.
Initiation Date: 1995

Action Item 44: Develop public information materials on Gulf of Mexico waste and pesticide disposal locations and requirements.

Project Description: Develop public information materials on waste and pesticide disposal locations and requirements for Gulf Coast citizens. Provide relocation businesses with a one-page handout which lists waste disposal locations and guidelines for new people moving into the Gulf of Mexico region.
Lead: Gulf State agencies, in coordination with Gulf of Mexico Program--Citizens Advisory Committee, local governments, and real estate associations.
Initiation Date: 1995
→ **26, 42**

Objective: Evaluate the effectiveness and results of all public education and outreach strategies for use in developing future toxic substance and pesticide outreach strategies.

Action Item 45: Develop measures of success for evaluating Gulf of Mexico Program public education and outreach activities related to toxic substances and pesticides.

Project Description: Develop measures of success (criteria) for evaluating: 1) public education and 2) public involvement activities related to reducing toxic substance and pesticide inputs to the Gulf of Mexico.
Lead: Gulf of Mexico Program--Public Education & Outreach Operations. This effort should be coordinated with all Gulf of Mexico Program committees.
Initiation Date: 1994

In Closing...

We intend this document to be a beginning, not an end. Our hope is that this Action Agenda will serve as an inspiration and a call to action for the millions who live and work in the Gulf of Mexico region. Together, our coordinated actions can make a difference and reduce the harmful ecological effects of toxic substances and pesticides in the Gulf of Mexico system.

The Gulf of Mexico Program
Toxic Substances & Pesticides Committee

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FEDERAL LEVEL

U.S. Environmental Protection Agency (USEPA)

USEPA administers nine comprehensive environmental protection laws; water quality is protected by nearly all of these laws. Air pollution controls, for example, keep harmful pollutants from entering the atmosphere, and subsequently from reaching the waters. Laws governing toxic substances and pesticides also address special pollution problems that affect water quality. The statutes and programs that USEPA administers are discussed below.

- **Toxic Substances Control Act of 1976 (TSCA).** This Act empowers USEPA to regulate chemical substances and mixtures that present an unreasonable risk to human health or the environment, and to address chemical substances and mixtures that pose imminent hazards. TSCA also authorizes USEPA to gather information on chemical risks from those who manufacture or process chemicals. USEPA can require companies to test selected existing chemicals for toxic effects and USEPA must review new chemicals before they are manufactured. To prevent unreasonable risks, USEPA may select from a broad range of control options under TSCA, from requiring hazard-warning labels to outright bans on the manufacture or use of especially hazardous chemicals. USEPA may regulate a chemical at any stage in its lifecycle. Under §6(a) of TSCA, "Any requirement or combination of requirements imposed under this subsection may be limited in application to *specific geographic areas*." Under §7 of the Act, USEPA may commence civil action for temporary or permanent relief from any unreasonable risks posed by an imminently hazardous chemical substance, mixture, or article. USEPA may require remediation of sediments contaminated by use or disposal of material after the effective date of USEPA's regulation. If the contamination occurred before the regulation, USEPA's authority under this law may be limited.

- **Federal Insecticide, Fungicide, and Rodenticide Act of 1982 (FIFRA).** This Act, originally passed in 1972, empowers USEPA to restrict, suspend, or cancel the registration of pesticides that pose significant threats to human health or the environment. As a result of FIFRA, USEPA has canceled the registration of some persistent pesticides (*e.g.*, DDT, dieldrin, endrin, and chlordane) that had widespread use in the 1950s and 1960s. A pesticide product must be registered by USEPA before it can be sold within the U.S. Use of a pesticide in a manner inconsistent with its label is a violation of the law. USEPA may suspend or cancel the registration of a pesticide if information indicates that use of the pesticide would pose unreasonable risks.

  Pesticide registration decisions are primarily based on USEPA's evaluation of test data provided by pesticide applicants. USEPA can require up to 70 different kinds of specific tests. This testing is needed to determine the effects a pesticide may have on humans, wildlife, fish, and plants, including endangered species.

Laboratory tests may be used to identify potential human risks, including acute toxic reactions, such as poisoning and skin and eye irritation, as well as potential long-term effects, such as cancer, birth defects, and reproductive system disorders. As part of the testing, USEPA evaluates data on fate--how the chemicals react in the environment.

Pesticides that were registered prior to 1978 must be reregistered under current, more stringent, standards of toxicology. Registration lasts for five years, at which time the registration expires, unless reregistration has been requested, but not necessarily carried out, by a registrant. Registration may authorize only certain uses, and a pesticide may be registered with conditions, as experimental, or for restricted use. Reregistration may also be denied.

A state may regulate the sale or use of a federally registered pesticide only if that regulation does not permit a sale or use that is prohibited under FIFRA. A state may impose more stringent standards than FIFRA; and a state may register a pesticide for additional uses, if those additional uses are limited to the issuing state.

A state cannot issue registration for food/feed uses unless a tolerance has been set under FFDCA that permits the residues of the pesticides on the food. A state's ability to issue special local needs registration is dependent upon the Administrator's approval.

Since 1978, when USEPA began requiring more extensive data on pesticides than it did previously, over 130 new chemical active ingredients have been registered (10-15 new pesticide active ingredients each year). Under re-registration of old chemicals, USEPA has issued 194 registration standards that represent about 350 individual active ingredients that account for 85 to 90 percent of the total volume of pesticides used in the U.S.

USEPA is working with state and local governments to develop integrated pest management plans (IPM), guidance documents, and research papers on IPM technology for home lawns, golf courses, and urban areas. USEPA annually issues the Consolidated Pesticide Agreement Guidance, which outlines the national enforcement priorities and the activities that every state, tribe, and territory must address under its cooperative enforcement agreement.

USEPA as of 1989 published Health Advisories for 55 pesticides to assist government officials in their response to the contamination of drinking water. USEPA has set standards that regulate 17 pesticides in drinking water, and it has initiated a National Pesticide Survey of drinking water wells. USEPA also is preparing to publish a final Pesticides in Groundwater Strategy based on analysis and consultation with farmers, other business organizations, environmentalists, and government officials.

- **Federal Water Pollution Control Act of 1972 (FWPCA).** The U.S. Congress in 1972 significantly amended the Federal Water Pollution Control Act of 1948 and produced further amendments in 1977, 1981, and 1987. These amendments are also commonly known as the **Clean Water Act (CWA).** The objective of the Act is to restore and maintain the quality of the nation's water resources to protect the health of humans, fish, shellfish, and wildlife from harmful pollutants. The Act establishes national water quality goals and creates a national permit system with minimum standards for the quality of the discharged waters (effluent).

  The Act directs USEPA to examine the effects of specific pollutants on plankton, fish, shellfish, wildlife, plant life, aesthetics, and recreation in any body of water. The results of these examinations are "water quality criteria." They help states determine the levels of pollutants that can exist in the water column and the sediment without harming human and aquatic life. States are required to establish standards based on the designated uses of their respective water bodies, and these state-imposed standards are subject to USEPA approval.

  Conventional pollutants, toxic or "priority" pollutants, and non-conventional pollutants are all regulated under the Act. Section 304(l) addresses toxic contaminants. States are required to identify point sources that discharge toxicants into waterways, develop control strategies for these sources, and adopt numeric water quality standards for toxic pollutants that have USEPA criteria documents.

  The Act requires that direct point source dischargers obtain National Pollutant Discharge Elimination System (NPDES) permits and maintain effluent standards. Specific waste water dischargers into rivers and storm water drainage systems also must obtain permits. Pretreatment of specified discharges from point sources is the mechanism used to control toxic and non-conventional pollutants discharged into the sewage treatment system. The pretreatment program is intended to reduce the total discharge of priority pollutants from indirect dischargers to roughly the amount of direct point source dischargers.

  Municipal waste water treatment plants (called Publicly-Owned Treatment Works or POTWs) are required to meet standards different from those of direct industrial dischargers. However, both municipal and industrial dischargers are required to meet the same ambient water quality standards. Technology-based regulation of POTW discharges focuses almost exclusively on conventional pollutant control by requiring POTWs to achieve "secondary" levels of treatment--85 percent removal of suspended solids and biochemical oxygen demand.

  The Act also establishes a program to manage contaminated runoff from nonpoint sources of pollution. Each state must identify all water body segments that fail to meet water quality standards for designated uses due to runoff, boating wastes, faulty septic systems, and other sources of nonpoint pollution.

The states must submit a four-year management program for controlling the pollutant sources. Each plan is subject to USEPA approval and may be eligible for grants (up to 60 percent of costs, excluding construction) to assist in implementation.

Dredged sediments may be contaminated by industrial or municipal wastes and can pose a threat to marine life. Section 404 permits are designed to protect water quality and habitat by regulating discharge of dredged and fill materials. The U.S. Army Corps of Engineers (USACE) and USEPA jointly develop guidelines for permit applications. These permits are managed by USACE and are subject to review by USEPA, which has veto power over §404 permits if discharge of dredge materials would adversely affect water quality or habitat. Usually, USACE works with USEPA during the review process to ensure that concerns are resolved through interagency consultation. These permits require state water quality and coastal zone management certifications where applicable.

Under §309, USEPA can obtain sediment clean-ups in its actions against parties that violate permit limits. Under §311, USEPA may remove or order removal of an actual discharge or address a threatened discharge of oil or hazardous substance into waters of the U.S. Under §311, USEPA can also recover its costs. Section 504 permits USEPA to use emergency powers to stop discharges that imminently threaten public health.

Sections 317 and 320 as amended in 1987 established the **National Estuary Program (NEP)**, which is administered by USEPA. The program is intended "to promote long-term planning and management in nationally significant estuaries threatened by pollution, development, or overuse...and to promote the preparation of comprehensive conservation and management plans (CCMP) to ensure their ecological integrity." At present, twenty-one estuaries are participating in NEP, including five in the Gulf of Mexico (Galveston Bay, Tampa Bay, Sarasota Bay, Corpus Christi Bay, and the Barataria-Terrebonne Estuarine Complex). Each of the Gulf NEPs are addressing pollution problems, from point and/or nonpoint sources.

- **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or "Superfund").** Superfund authorizes USEPA to respond immediately or provide remedial action when a release or threatened release of any hazardous substance, pollutant, or contaminant poses a danger to human health or the environment. The agency has the authority to take both immediate removal and long-term cleanup actions and to seek damages from responsible parties. Although there is no determination on how to apply this legislation to submerged marine lands, this law was applied to portions of Commencement Bay in Puget Sound and has paid for research there.

- **Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA).** EPCRA is part of the **Federal Superfund Amendments and Reauthorization Act of 1982 (SARA).** EPCRA is based on the premise that citizens have a "right-to-know" about hazardous and toxic chemicals in their communities. This Act requires states to establish State Emergency Response Commissions (SERC) and Local Emergency Planning Committees (LEPC) that will collect detailed information about toxic and hazardous chemicals in local facilities in order to prepare procedures for possible chemical accidents and emergency situations.

  EPCRA §313 requires owners and operators of designated manufacturing facilities to report the presence and release of certain toxic chemicals to local, state, and federal governments so that USEPA may establish the Toxic Release Inventory (TRI). The facilities that must submit reports are those that manufacture, process, or otherwise use a listed toxic chemical in excess of specified threshold quantities. The TRI includes names, locations, chemicals used, amounts of the toxic chemical present at any one time, quantity of the chemical entering the air, land or water, and offsite locations for waste, waste treatment, and waste disposal.

- **The Clean Air Act of 1970 and 1977 (CAA).** Under this Act, USEPA must control air pollution by specifying maximum acceptable levels for pollutants in outdoor air; limiting the release of hazardous substances; developing standards for new stationary and motor vehicle emissions; and requiring states to develop and enforce state implementation plans that specify measures that will be taken to achieve acceptable air quality. Pesticides may be subject to regulation established under this statute.

  Pesticides may also be regulated under §112 of the CAA. This section addresses hazardous air pollution--"air pollution to which no ambient air quality standard is applicable and which in the judgment of the Administrator causes, or contributes to, air pollution which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible or incapacitating reversible, illness." USEPA has developed a list of hazardous air pollutants for which regulations establish stationary sources emission standards, but has not yet developed a corresponding list for pesticides.

- **Federal Food, Drug, and Cosmetic Act (FFDCA).** This Act, as amended (21 U.S. C. 301 *et seq.*), authorizes USEPA to establish tolerance limits for pesticide residues in foods. Any pesticide proposed for food or feed use must have a tolerance (or an exemption) established for those foods/feeds. Tolerance limits are set by USEPA (usually when petitioned by registrant) and enforced by the U.S. Food and Drug Administration.

- **Resource Conservation and Recovery Act of 1976 (RCRA).** RCRA empowers USEPA to regulate the transportation, treatment, storage, and disposal of solid and hazardous waste in the U.S. Many toxic and pesticide wastes fall under the

RCRA definition: "A solid waste, or combination of solid wastes, which because of its quantity, concentrations, or physical, chemical, or infectious characteristics may: cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human heath or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

Under §3004(u) of the Act, USEPA must permit treatment, storage, and disposal facilities that require corrective action to address all releases of hazardous waste from any solid waste management unit. Corrective action may address contaminated sediments. §3004(v) allows USEPA to require corrective action for releases that have migrated beyond the boundaries of a facility (*e.g.*, off-site sediments). Under §3008(a), USEPA may issue administrative orders or take civil action for appropriate relief, including a temporary or permanent injunction. Other sections allow USEPA to issue orders that require interim status facilities to take corrective action or other response measures and bring suit against persons whose past or present handling, storage, treatment, transportation, or disposal of solid or hazardous waste substantially threatens health or the environment.

- **Pollution Prevention Act of 1990 (PPA).** Pollution prevention can be accomplished through increased efficiencies in the use of raw materials, energy, water or other resources, or through conservation. These objectives can be met through changes in equipment or technology; process or procedural changes; reformulation or redesign of products; raw material substitution; or operational improvements in housekeeping, maintenance, training or inventory control. USEPA is encouraged to work across program and regional boundaries to apply multimedia responses to intractable problems like toxic contamination. USEPA's waste management hierarchy focuses on preventing or reducing pollution at the source. At the top of the hierarchy is source reduction, followed by recycling, treatment, and, as a last resort for waste management, disposal.

  USEPA's approach in implementing the Pollution Prevention Act and its 33-50 toxics reduction program (started in February 1991) is aimed at voluntary compliance in the reduction of 18 targeted chemicals. Using 1988 as a baseline year, USEPA's 33-50 program aims for 33 percent reduction of the 17 targeted chemicals by 1992, and a 50 percent reduction by 1995. The 17 targeted chemicals are: 1,1,1-trichloroethane and 1,1,2-trichloroethane, benzene, cadmium and cadmium compounds, carbon tetrachloride, chloroform, chromium and chromium compounds, cyanide compounds and hydrogen cyanide, dichloromethane, lead and lead compounds, mercury and mercury compounds, methyl ethyl ketone, methyl isobutyl ketone, nickel and nickel compounds, tetrachloroethylene, toluene, trichloroethylene, and xylene.

- **Marine Protection, Research and Sanctuaries Act (MPRSA).** USEPA, in consultation with USACE, establishes environmental impact criteria to assist in

evaluating proposed projects that involve transporting and dumping dredged material in coastal waters and in the ocean. USEPA has the primary responsibility for choosing ocean dumping sites. Under §105 of this Act, USEPA can assess civil penalties and seek injunctive relief if contaminated sediments are dumped in the ocean illegally.

- **Environmental Monitoring and Assessment Program (EMAP).** EMAP is a long-term, interagency monitoring activity designed to evaluate the status and trends of U.S. ecological resources and the effectiveness of pollution control. EMAP conducts annual surveys to assess the health of plants and animals, the quality of their surroundings, and the presence of pollutants by examining key indicators at designated sites. The indicators are representative of the general condition of a site's estuarine resources. The indicators address three areas of concern: 1) estuarine biotic integrity; 2) aesthetic appeal for public use of the estuarine resources; 3) and exposure of biota to pollutants.

  EMAP is structured on a regional scale by dividing all of the nation's coastal waters, bays, and estuaries into regions for study; the Louisianian Province corresponds to the Gulf of Mexico area. The information collected is used to address large areas such as the Gulf of Mexico, rather than smaller systems like Galveston Bay. An intense study of every bay and estuary would be too costly. Within each region, scientific measurements will be made every year at randomly selected stations. From July-August 1991, the Estuaries component of EMAP sampled 183 sites between Anclote Anchorage, FL, and the Rio Grande, TX. All sampling is conducted during the summer months because summer is when plants and animals generally are most active and when the effects of pollution are most severe.

U.S. Department of Commerce (USDOC)

National Oceanic and Atmospheric Administration (NOAA)

NOAA's research programs aim to increase current knowledge of the physical processes of estuaries, the natural and human-induced factors affecting the productivity and health of fishery resources, and the effects of habitat loss and of chemicals and pathogens on edible fish and shellfish. NOAA collects, archives, and synthesizes a variety of oceanographic, climatic, fisheries, and pollution data. NOAA conducts research and development to provide alternatives to ocean dumping. NOAA also develops sound national policies in the areas of ocean mining and energy.

- **National Coastal Pollutant Discharge Inventory (NCPDI).** This program assesses levels of pollutants entering marine waters. The Agricultural Pesticide Use Project is an evolving program and data base within the NCPDI Program It is designed to assess the use of pesticides in coastal areas and the impacts of these

pesticides on the living resources of the nations estuaries and coastal rivers. The data base has recently been updated to a base year of 1987 and expanded to include estimates for 35 pesticides on approximately 70 crops. A unique feature of the data base is the incorporation of an environmental rating system that integrates several physical and toxicological properties of the pesticides with use estimates to produce a pesticide use estimate normalized to relative environmental hazard. The hazard normalized estimates can then be used to target those estuarine systems that may be most affected by the application of the pesticides in the inventory. In addition, extensive background information also has been collected on the seasonal application of the pesticides, their use in areas upstream of the coastal study area, and the environmental impact of the pesticides on aquatic resources.

- **National Estuarine Inventory (NEI).** This program inventories estuaries around the nation, which allows comparisons of their use and health.

- **National Status and Trends Program (NSTP).** This program documents the current status and long-term trends in the quality of estuaries and coastal waters. It provides data on concentrations of pollutants in finfish, shellfish, and sediments and measures the effects of environmental degradation by toxic chemicals in finfish, shellfish, and sediments. It also measures biological parameters that reflect stress associated with human-induced perturbations, assesses marine environmental quality, and recommends federal responses. Under this program, NOAA conducts sampling throughout the Gulf of Mexico.

- **National Status and Trends Mussel Watch Program (NSTMWP).** The Mussel Watch Program has consisted of sampling and analyzing bivalves from U.S. coastal areas since 1986. Sampling sites include coverage of the Gulf Coast from southernmost Texas to southernmost Florida.

- **Benthic Surveillance Program (BSP).** The Benthic Surveillance Program collects samples of sediment, bottom-dwelling mollusks, and bottom-feeding fish from numerous sites throughout the country. Samples are analyzed for substances such as toxic metals, polynuclear aromatic hydrocarbons, and chlorinated organic chemicals.

- **Consequences of Contaminants Program (CCP).** This program develops techniques to determine how pollutants in marine water can affect marine fish and shellfish and human health. Recent activities have emphasized: evaluating indicators that signal the risk of shellfish contamination; documenting exposure to pollutants that results when fishermen eat their catches; and quantifying the relationship in fish between exposure to pollutants and reproductive impairment.

- **National Shellfish Register (NSR).** The Register contains information on shellfish contamination incidents and provides important indicators of the

extent to which shellfish in U.S. waters are contaminated. The Register uses a classification system based on concentrations of coliform bacteria and natural marine biotoxins. Productive shellfish waters can be classified as approved, prohibited, conditionally approved, or restricted. The Register provides limited information on the current status of shellfishing areas and still less on past trends, in part because the classification scheme is not used consistently by the states. The register has been issued periodically since 1966 and was last published in 1985.

- **Coastal Zone Act Reauthorization Amendments of 1990 (CZARA).** CZARA §6217 requires states to establish coastal nonpoint programs, which must be approved by both NOAA and USEPA. Once approved, the coastal nonpoint programs will be implemented through changes to the state nonpoint source pollution program approved by USEPA under §319 of the CWA and through changes to the state coastal zone management program approved by NOAA under §306 of the Coastal Zone Management Act (CZMA). Beginning in fiscal year 1996, states that fail to submit an approvable coastal nonpoint program to NOAA and USEPA face statutory reductions in federal funds awarded under both §319 of the CWA and §306 of the CZMA.

  The central purpose of §6217 is to strengthen the links between federal and state coastal zone management and water quality programs in order to enhance state and local efforts to manage land use activities that degrade coastal waters and coastal habitats. This is to be accomplished primarily through the implementation of 1) management measures in conformity with guidance published by USEPA under §6217(g) of the CZARA and 2) additional state-developed management measures as necessary to achieve and maintain applicable water quality standards.

  The §6217 program guidance identifies and explains provisions state coastal nonpoint programs must include in order to be approved by USEPA and NOAA. Five of the many requirements for state programs are: 1) identify critical coastal areas adjacent to coastal waters which are impaired or threatened by nonpoint source pollution; 2) implement additional management measures for land uses or critical coastal areas as necessary to achieve and maintain water quality standards; 3) establish mechanisms to improve coordination among state and local agencies responsible for land use programs and permitting, water quality permitting and enforcement, habitat protection, and public health and safety; 4) modify coastal zone boundaries as the state determines is necessary to implement NOAA's recommendations under §6217(e) of the CZARA; and 5) implement management measures in the defined coastal area. (This section requires NOAA and USEPA to determine whether the landward coastal zone of each coastal state extends far enough inland to control significant upland sources of nonpoint source pollution.)

U.S. Department of the Interior (USDOI)

U.S. Fish & Wildlife Service (USFWS)

The U.S. Fish & Wildlife Service focuses attention on nonpoint source pollution problems in a number of areas. USFWS has conducted research to define the scope and effect of pollutants from urban and agricultural runoff, mining, silviculture, and hydromodification on fish and wildlife species and their habitats. USFWS has also conducted special information and education efforts to encourage farm owners to participate in the USDA Conservation Reserve Program and worked with the Agricultural Extension Service to develop a pamphlet emphasizing the benefits of riparian vegetation in reducing nonpoint source pollution.

Under the Irrigation Drainwater Program (IDP), USFWS is determining the causes and degree of problems associated with excessive levels of micronutrient (*e.g.*, selenium, boron) in irrigation wastewaters. Controls and alternatives to help mitigate these problems are under development.

USFWS has recognized that dioxin, primarily from pulp and paper mills, is a major problem within the Southeast Region. It is recognized that dioxin is contributing to the contaminant load in many rivers and streams flowing into the Gulf of Mexico. USFWS will seek support in identifying the extent of this problem and initiating remedial activity.

USFWS routinely provides recommendations on BMPs to control nonpoint source pollution when reviewing permit/license applications, federal project construction and operation plans, resource management plans, conservation easements, and other types of land management activities. Measures to mitigate damage to fish and wildlife resources or their habitats are included in these recommendations.

Minerals Management Service (MMS)

MMS studies the potential impact of offshore activities, including the placement and construction of petroleum pipelines, on coastal wetlands and resources. MMS also funds research through state geoscience agencies for identifying mineral resources in the coastal zone.

U.S. Geological Survey (USGS)

The mission of the U.S. Geological Survey (USGS), Water Resources Division, is to provide the hydrologic information and understanding needed for the optimum utilization and management of the nation's water resources for the overall benefit of the people of the U.S.

U.S. Department of Defense (USDOD)

U.S. Army Corps of Engineers (USACE)

- **Clean Water Act (CWA).** USACE has the primary responsibility for the permit program and federal projects under §404 of the CWA for the discharge of dredged and fill material. The USACE evaluation of a §404 permit application is a two part test which involves determining whether the project complies with the §404(b)(1) guidelines and conducting a public interest review. Federal projects are reviewed in the same manner. USEPA has veto power over §404 permits.

  Applicants must demonstrate that the discharge, which may be released to the aquatic environment during dredging and disposal operations, will not have an unacceptable adverse impact on the aquatic ecosystem. Furthermore, applicants must discuss possible alternatives, extent and permanence of beneficial and/or detrimental aspects, and the probable cumulative impacts of the proposed activity. Discharges can be permitted only if all appropriate steps are taken to mitigate the adverse impacts of the discharge on the ecosystem, including compensating for unavoidable impacts.

  The public interest review is a balancing test in which the public and private need for and benefits of a project are weighed against that project's adverse impact to the environment, as measured by criteria developed by USEPA in conjunction with the USACE. These criteria generally consider aesthetics, recreation, historic values, economics, water supply, water quality, energy needs, and flood damage prevention. In addition, the USACE conducts an environmental assessment under NEPA to determine whether the project has significant environmental impacts.

  USACE can deny permits to those applicants whose projects it determines are not in the public interest. Generally, USACE permits will not be issued where the necessary state or local authorizations have been denied. Under CZMA, objection by Gulf States to a project may also preclude the USACE from issuing §10/404 permits.

- **Marine Protection, Research and Sanctuaries Act (MPRSA).** Under §103 of MPRSA, USACE must evaluate proposed projects that involve the transportation and dumping of dredged material in most coastal waters and in the open ocean. The evaluation of these activities is based on environmental impact criteria developed by USEPA in consultation with USACE; these criteria generally contain all the constraints set forth in the London Dumping Convention. Non-federal projects that are approved receive an ocean dumping permit from USACE. Federal projects performed by USACE are evaluated in the same manner, but do not receive permits. USACE may designate disposal sites, but USEPA has the primary responsibility for designating ocean disposal sites.

All permits must undergo a public review period, that includes receiving comments from USEPA, NMFS and USFWS.

U.S. Department of Agriculture (USDA)

Soil Conservation Service (SCS)

The Soil Conservation Service (SCS) is USDA's primary technical agency in the areas of soil and water conservation and in water quality. SCS focuses its assistance on non-federal land. It works with private landowners, planning and applying measures to reduce soil erosion, conserve water, improve water quality, and protect other renewable natural resources like plants, animals, and air. SCS works to preserve, protect, and restore wetlands and to develop wildlife and fisheries habitat. The guiding principle is the use and conservation treatment of the land and water in harmony with its capabilities and needs. SCS also performs soil surveys and operates a system of some twenty-seven Plant Material Centers for selecting, developing, testing, and releasing plants for use in conservation programs.

SCS has an office in almost every county in the U.S. where it works closely with local subdivisions of state government called Soil and Water Conservation Districts. The conservation districts are governed by local people and typically have legislative mandates to plan and implement comprehensive soil and water conservation programs within their boundaries. These boundaries usually coincide with county lines.

SCS's basic authorities were created by PL (74) - 46, PL (83) -566, and PL (78) - 534. Program authorities were added under various Farm Bills including those enacted in 1961 (Resource Conservation and Development Program), 1985 (Swampbuster, Sodbuster, Conservation Compliance, and Conservation Reserve Program), and 1990 (Wetlands Reserve Program and others). Under the Swampbuster provisions, SCS assists landowners to identify and protect wetlands. Loss of USDA benefits and severe economic consequences can result for agricultural producers who convert wetlands to make possible the production of agricultural commodities.

Agricultural Stabilization and Conservation Service (ASCS)

The Agricultural Stabilization and Conservation Service (ASCS) administers the following programs: Agricultural Conservation Program, Conservation Reserve Program, Wetland Program, as well as others. In addition, ASCS administers various agricultural commodity production programs designed to balance production of those commodities which are in demand. Commodities affected include cotton, rice, corn, wheat, peanuts, tobacco, and others. Commodity Program decisions dramatically affect land use and nutrients applied to land. ASCS also has an office in essentially every county in the U.S. SCS and ASCS work closely on implementation of conservation programs.

The 1990 Farm Bill passed by the 101st Congress provided significant water quality initiatives to reduce the impacts of agriculturally applied pesticides on the aquatic environment. These incentives, in the form of payments, are provided to farmers who implement agricultural practices that reduce surface or groundwater contamination. In addition, the 1990 farm Bill strengthens the Conservation Reserve Program, which sets aside highly erodible land that, if put to production, could affect water quality.

U.S. Food and Drug Administration (USFDA)

USFDA is responsible for establishing safe levels for poisonous or deleterious substances (other than pesticide residues which USEPA establishes) that contaminate food.

- **Federal Food, Drug, and Cosmetic Act (FFDCA).** Under ideal conditions, USFDA will attempt to establish a formal tolerance or maximum permissible level. But when toxicological data are scanty or conflicting, when additional data are being developed, or when other conditions are rapidly changing, §306, §402(a) and §406 of the FFDCA allow the use of action levels. Action levels meet the same criteria as tolerances except they are intended for interim periods and can be instituted and changed more quickly than tolerances. Enforcement actions for toxic constituents are based upon USFDA action levels--the only available criteria on contaminants in fisheries products. Indeed, specific action levels have been developed for several contaminants in seafood products. Action levels have been established for some residual chemical contaminants, including pesticides.

U.S. Department of Transportation (USDOT)

U.S. Coast Guard (USCG)

USCG is responsible for enforcing the Clean Water Act prohibitions on discharges of oil, hazardous substances, and sanitary wastes from marine vessels and for enforcing the provisions of the MPPRCA regarding disposal of garbage from ships. USCG establishes regulations for marine sanitation devices (MSDs) to meet federal performance standards.

- **Oil Pollution Act of 1990.** This Act is intended to reform the nation's spill prevention and response system. It specifies measures to prevent or treat large oil or chemical spills in U.S. waters. The law requires that shipping companies transporting oil or chemicals on offshore and tidal waters demonstrate the ability to contain and cleanup a spill should one occur. Vessel owners and operators are liable for the cost of cleanup and the environmental damage resulting from a spill. This legislation provides limited national immunity for oil spill responders.

Facilities must develop national contingency plans that outline procedures for the containment, dispersal, and removal of a worst-case spill on-site. The Act does not preempt state law and thereby preserves the authority of the states to maintain or create their own oil spill plan.

The Act also establishes a $5 billion Oil Spill Liability Trust Fund, financed by a five cent per barrel tax on oil, to pay removal costs, compensate individuals, and restore natural resources damaged by a spill. In addition, the Act mandates the use of a double-hull design on all new tankers operating in U.S. waters.

The Act requires the President to take charge of any spill of size or character that poses a threat to public health or the country's welfare. This action is taken through the On-Scene Coordinator, who is the Coast Guard in tidal and coastal waters.

STATE LEVEL

Alabama

The Alabama Department of Environmental Management (ADEM) is responsible for most environmental programs in Alabama. The Department's Water, Land, Air, Field Operations, and Permits and Services Divisions regulate, permit, enforce, monitor, and respond to facilities, actions, and incidents affecting the water, land, and air media, including toxics and misapplication of pesticides. The Alabama Department of Agriculture and Industry is responsible for the registration of pesticides, their applications, and the certification of applicators.

Waste Reduction /Minimization and Pollution Prevention. In 1987, the Alabama Legislature amended the "Hazardous Waste Management Act," changing its name to the "Hazardous Waste Management and Minimization Act" to encourage waste minimization. While the Act did not create specific waste minimization programs, it paved the way for the development of such programs by recognizing the importance of waste minimization.

In the development of pollution prevention programs, the State of Alabama has focused on voluntary cooperation among industry, government, educators, and the general public. ADEM proposed the development of a voluntary Waste Reduction and Technology Transfer (WRATT) program to serve Alabama's industries. In 1989, the program began to utilize retired engineers and scientists to provide free non-regulatory waste reduction opportunity assessments upon request from Alabama industries.

Over $416,000 in program funding has been received or pledged to date from public and private sources. In addition to actual funding, the program has received volunteer in-kind services with an estimated value of over $400,000. Over 100 waste reduction opportunity assessments have been completed to date, and six to eight additional requests for assessments are received monthly.

A unique feature of Alabama's WRATT program is outreach to other states and organizations. The program offers assistance in recruiting, training, marketing, and general program development and implementation. Since the program's inception, states and organizations throughout the U.S. have issued inquiries and requests and WRATT has provided them with assistance.

Toxics Release Inventory. ADEM has primary state responsibility for all Toxic Release Inventory (TRI) in Alabama. ADEM is responsible for collecting the Form R's, and ADEM's Field Operations Division is currently the repository for this information. Requests for information from Form R's should be made through ADEM at 205/260-2700.

Monitoring. ADEM currently maintains 32 water quality trend monitoring stations in coastal Alabama. Many of the tributary stations were established in the mid-1970s, and the remaining open-water coastal stations were established in the past five years. Water samples are analyzed monthly for routine water quality parameters. A quarterly record of water column metals is available, though sampling for metals is not currently being conducted. Sediments are analyzed for mercury from 18 sampling stations located in the Mobile River delta once every three years. Sediment monitoring data for toxins and pesticides are evaluated for toxicity by using site-specific criteria coupled with professional judgment and appropriate testing.

Fish tissues from two sites in the coastal area are assayed for metals and organics of interest once every three years. ADEM also conducts routine macroinvertebrate sampling at 32 sampling stations, seven of which are located in estuaries. Additional sampling and special studies are scheduled as needed.

Florida

The Department of Environmental Protection (DEP) is the agency responsible for most environmental programs in Florida. Permitting, monitoring, enforcement, emergency response, pollution prevention, land, water, and natural resource management are all housed in a recently created merger of the previous Environmental Regulation and Natural Resource agencies. The Freshwater Fish and Game Commission retains some aquatic life management responsibilities, the Department of Agriculture and Consumer Services regulates and certifies pesticides and manages forestry lands, and the Department of Health and Rehabilitative Services issues health advisories.

Pollution Prevention. Florida initiated a pollution prevention program in the 1988 solid waste bill passed by the Florida legislature. Included were goals for recycling 30 percent of solid waste by 1994, grants to local governments for "amnesty days" for the collection of household hazardous wastes, and directives for use of state agency purchases of recycled content goods. A commission has examined barriers to the sale of recycled content goods, recycling programs are now common, and an advanced disposal fee on certain commodities that have not achieved recycling goals goes into effect in October 1993. Efforts to further restrict the use of certain toxicants in various industrial processes are under consideration.

A voluntary program utilizing retired engineers to render assistance to industry in waste reduction programs has been quite successful. This program is funded with the interest generated from the trust fund for penalty moneys collected in the state.

Most programs now look for pollution prevention opportunities when negotiating enforcement case settlements or mitigation proposals.

Toxic Release Inventory. The Florida Department of Community Affairs has primary responsibility for all Toxic Release Inventory compliance data in Florida. A state data base is available to assist emergency response personnel and community disaster planning personnel in locating sources of toxic material.

Monitoring. A number of ambient monitoring strategies are now in use in Florida. The Department of Environmental Protection conducts sampling in a Community Bioassessment Network, a Chemistry Status Network, and a Chemistry Trend Network. Most of the regional water management districts conduct ambient monitoring with laboratory support from the state, and several of the larger counties have ambient programs. Compliance and enforcement monitoring, intensive survey data generated primarily for determining permit effluent or load reduction limits, and special studies are also conducted by state, regional, and local governments. Quality assurance plans are reviewed by DEP, and all data are assigned to STORET or other appropriate computer data inventory system.

Florida has developed a sediment evaluation technique comparing metal to aluminum ratios. Not surprisingly, urban estuaries are showing enrichment of heavy metals over less developed estuaries. A University of Florida study conducted on behalf of the Department indicated certain groundwater contamination sites had not been sufficiently managed to keep runoff or groundwater seepage from affecting adjacent surface waters. PAH contamination was also identified as a chronic problem, probably due to the large amount of area devoted to roads, parking lots, and other automobile-related infrastructure.

By far the greatest toxic pollutant problem identified to date is the widespread contamination of fish with mercury. All other toxicants identified have been in limited areas with known sources under compliance schedules to eliminate the source of the toxicant.

Louisiana

Permitting & Enforcement. The Louisiana Department of Environmental Quality (LADEQ) is responsible for the permitting and enforcement of all point source discharges, including the release of toxic substances and pesticides. The Louisiana Department of Agriculture and Forestry is responsible for the enforcement of pesticides including the regulation of pesticides for agricultural uses.

Pollution Prevention & Waste Reduction Programs. The LADEQ, Office of the Secretary, Technical Program Support Section currently coordinates activities on pollution prevention and waste reduction programs. These programs include the following:

- Income Tax Credits for Recycling Equipment. Act 1052 of 1991 authorizes applicants with qualified recycling equipment to be eligible for 20 percent state five year income tax relief.

- Sales Tax Refund for Pollution Control Equipment. Act 1019 of 1991 sets forth the qualification criteria and application procedures for three percent state sales tax relief provided to companies purchasing pollution control devices and systems.

- "Corporate Response Challenge '92" Outreach Program. Annually, a cross section of industry is surveyed to ascertain what is being accomplished toward achieving pollution reductions in media such as air, water, and land (including underground injection). The survey includes thirty Corporate Response Challenge companies addressing 38 facilities. The report informs the public and LADEQ staff on the progress of Louisiana's regulatory programs in answering reduction goals set forth by the agency.

- Louisiana Environmental Leadership Program. USEPA Region 6 will partially fund a joint industry/LADEQ/USEPA 33/50 reductions program for the Baton Rouge-New Orleans Mississippi River Corridor, as well as state-wide. This will solicit over 300 industrial clients to join a voluntary reductions program extending five years. The project is currently in development and will be recommended for continued development in 1993.

- Louisiana Toxic Release Inventory. The Louisiana Toxic Release Inventory (TRI) is responsible for making the Emergency Planning and Community Right-to-Know's (EPCRA) §313 (Toxic Chemical Release Inventory) information available to the public. The information is collected from facilities covered by the §313 release-reporting requirements. Information is collected on facility identification, chemical specific information (*i.e.*, amount on-site, any releases to the environment), off-site transfer locations of toxic chemical wastes, source reduction, and recycling activities. LADEQ recently published the fourth annual Toxic Release Inventory report presenting 1991 data submitted by chemical manufacturers reporting releases and/or transfers of chemicals designated by USEPA as being toxic.

- Source Reduction and Recycling. The original USEPA pollution prevention grant received March 15, 1989, is in its fourth year of funding. This grant funds many of the pollution control and prevention activities (*e.g.*, Corporate Response Challenge, Louisiana Environmental Leadership Program).

- Louisiana Gulf Coast Waste Exchange. The Louisiana State University's Institute for Recyclable Materials has initiated and maintains a waste exchange program.

- Nonpoint Source Pollution Control Program. This program will be jointly developed and implemented by the LADEQ and the Department of Natural Resources-Coastal Management Division. The program will meet the requirements of the Coastal Zone Act Reauthorization Amendments of 1990.

- Gulf of Mexico Program Partnership for Action. In December 1992, all governors of Gulf of Mexico states and heads of federal agencies signed a document that outlines actions for protecting, restoring, and enhancing the Gulf of Mexico and adjacent lands. Among its many goals, this program will attempt to protect human health and food supply by reducing input of nutrients, toxic substances, and pathogens to the Gulf.

Monitoring/Sampling Programs. There are 146 sampling stations in Louisiana's monitoring program, with approximately 31 stations located in estuaries. The program began in 1958 and was revised in 1978. At each of these sampling stations, water samples are routinely collected and analyzed. These samples are assayed for seven metals and 17 conventional water quality parameters. No analyses for organic compounds are conducted, and no routine samples of sediments and fish are collected although special studies have been conducted where sediment and fish are analyzed for toxicants and pesticides. However, since 1991, water samples are collected monthly from two of the water quality stations located on the Mississippi River and are analyzed for all priority pollutants. Toxicity testing according to USEPA methods is performed.

Special studies conducted for the last five years have monitored the concentrations of chlorinated organics in fish fillets from the Mississippi River and Calcasieu estuary and selected compounds in water, biota, and sediment from the Calcasieu estuary. The Louisiana Department of Wildlife and Fisheries also has a sediment monitoring program assessing metals and organics in the vicinity of the offshore LOOP marine terminal.

A 1990 LADEQ study and a more recent Louisiana University Marine Consortium study both used caged oysters to demonstrate the ability of these organisms to accumulate radium 226 and hydrocarbon (PAHs) contaminants in tissues from produced water discharges. The study should fully document the effects of petrogenic pollutants on the biota of waters which are now receiving, or have received, produced water effluents. The study should specifically address the possible human health impacts of consuming seafood contaminated with petrogenic radium 226, radium 228, polynuclear aromatic hydrocarbons, and aromatic hydrocarbons such as benzene, ethylbenzene, xylene, and toluene.

Legislation/Statutes. Act No. 185--Solid Waste Recycling and Reduction Law. Provides a comprehensive solid waste recycling and reduction program.

Title 33--Environmental Quality, Part VII--Solid Waste, Subpart 2--Recycling Awareness Program. Designed to assist local governments in educating the citizens on the energy conservation, environmental, and economic benefits to be gained from recycling.

Act No. 664--Waste Tire Management Fund

Title 33--Environmental Quality, Part VII--Solid Waste, Subpart 2--Recycling Waste Tires. Provides for the removal of certain materials from the solid waste stream going into landfills in order to protect the environment; prevent nuisances; protect the public health, safety, and welfare; extend the usable life of the facilities; aid in the conservation and recovery of valuable resources; and to conserve energy by efficient reuse of these products, thereby benefiting all citizens of the state.

Citizen Participation. Earth Week -- LADEQ sponsored the following Earth Week activities in Baton Rouge, April 27 through May 3, aimed at educating the community on environmental issues and stimulating environmental awareness and action: Air Quality Day, Household Hazardous Materials Collection Day, Earth Day Festival, and Recycling Fair.

Annual High School Lab Waste Collection Program -- Thousands of pounds of laboratory waste from school science programs across Louisiana are collected annually for disposal. The public service project is sponsored jointly by LADEQ, Dow U.S.A., and C.E.T. Packaging supplies.

Mississippi

The Mississippi Department of Environmental Quality (MDEQ) is the agency responsible for most environmental programs in Mississippi. Permitting, monitoring, enforcement, emergency response, and pollution prevention for various programs, including air, surface water, ground water, solid waste, and hazardous waste are all responsibilities of MDEQ. The Mississippi Department of Agriculture, Division of Plant Industry, has responsibility for the regulation and certification of agricultural and residential pesticides. These two agencies share proceeds from the registration of these chemicals to conduct an extensive monitoring effort of drinking water wells near agricultural areas of the state, including all coastal counties and watersheds.

Waste Reduction/Minimization & Pollution Prevention. Mississippi has a comprehensive, multimedia Waste Reduction/Waste Minimization/Pollution Prevention Program. Established in 1989, and implemented through the Waste Reduction/Waste Minimization Division of the Mississippi Department of Environmental Quality, the Program addresses both hazardous and non-hazardous wastes discharged into the air and waters or placed on the lands of the state. The program includes the following components: 1) statewide administration and planning; 2) technical assistance; 3) research and development; 4) outreach and

education; and 5) waste exchange. The technical assistance and research components are carried out through two programs funded within the Chemical Engineering Department at Mississippi State University, the Mississippi Technical Assistance Program for Industry (MISSTAP), and the Mississippi Solid Waste Reduction Assistance Program (MISSWRAP). The Mississippi Waste Reduction/Waste Minimization Program provides industry waste assessments, seminars, workshops, conferences, demonstration projects, and an informational clearinghouse for both hazardous and non-hazardous waste reduction, minimization, and pollution prevention. The Program serves industry, business, local governmental entities, schools, universities, community colleges, and the general public.

Toxics Release Inventory. The Mississippi Emergency Management Agency (MEMA) has primary state responsibility for all Toxic Release Inventory (TRI) compliance data in Mississippi. MDEQ's Waste Reduction/Waste Minimization Program (MDEQ WR/WM) has been awarded a grant to construct and make available to specified state programs as well as the general public the Mississippi Toxic Release Inventory (TRI) data base. The initial data base will reflect all of the data reported on the 1991 Toxic Release Inventory Form R's.

MEMA is responsible for collecting the Form R's, and is currently the repository for this information. MEMA is working in conjunction with MDEQ WR/WM to compile portions of the data for use in the state's data base. Currently, requests for information from the Form R's should be made through MEMA at 601/960-9975. Upon completion of the Mississippi TRI data base, TRI data will be made available through the MDEQ WR/WM Program 601/961-5321, or through MISSTAP at Mississippi State University 601/325-8067.

It is anticipated that the data base will be available in hard copy for the cost of reproduction plus shipping and handling. The data can also be accessed through the use of magnetic media (MS-DOS compatible personal computers).

Typical data that can be accessed through the data base will include: facility name, county, SIC code, facility identification numbers, chemical name and CAS number, releases to the environment, transfers to off-site locations, and pollution prevention information.

Copies of the database will be provided to the State Emergency Response Commission and Local Emergency Planning Committees. Availability of the database will be announced through the MISSTAP monthly newsletters, as well as through the MISSTAP computerized information exchange.

Pilot Projects & Citizen Participation. Several Mississippi pilot projects have been undertaken to minimize the contribution of toxic substances and pesticides into the environment. One of the most successful projects began as a national pilot project to recycle used pesticide containers. The project began in 1989 with the support of

interested farmers, Mississippi Department of Agriculture, Cooperative Extension Service, Farm Bureau, National Agricultural Chemicals Association, and Dupont. The "Pesticide Container Recycling Program," which began in Washington County, encourages farmers to turn in empty, rinsed pesticide containers; thus eliminating not only the possibility of contamination but also the added burden on landfills. These are collected by the county from one of several collection points. Plastic containers are recycled into new pesticide containers; metal containers are taken to a local scrap metal company. Sixty thousand containers were collected and recycled the first year. Since that first year, the program has spread to several counties and through 1992, nearly 362,880 kg (800,000 pounds) of plastic containers (approximately 1,200,000 individual containers) have been recycled. In 1992, nearly 30 percent of all plastic pesticide containers used in Mississippi were recycled, and for the first time recycled containers are now being recycled. Mississippi has the most successful program of this kind in the nation, and it is now used as a model for other programs across the country.

Another project is an outreach program to the generators of small quantities of hazardous waste. The "Technical Assistance For Very Small Hazardous Waste Generators in the State of Mississippi" program is in its third year. This program is a joint effort by MDEQ's Ag-Chem Unit, Underground Injection Control Unit, and the Technical Assistance Program MISSTAP at Mississippi State University, to identify and inventory the generators of small quantities of hazardous waste. The generators are then assisted in developing best management practices for the use, handling, and disposal of their hazardous waste. Not only are the generators getting this technical assistance, but also the inventory of these generators is being accumulated for future action by MDEQ.

The Hazardous Waste Division of MDEQ is in charge of a new program, "Right Way To Throw Away" which is the state's program for amnesty days to handle hazardous waste statewide. Local governments and organizations can apply for financial support and technical assistance through MDEQ to conduct "Amnesty Days." MDEQ has worked with the City of Jackson on a very successful Amnesty Day for hazardous waste and is anxious to work with other communities. Additionally, the 1993 legislature passed a statewide Pesticide Disposal Program. This program provides a mechanism and funding for "Amnesty Days" to allow for the disposal of canceled, suspended, and unused pesticides. This is a multi-agency program with the Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry as lead agency.

Monitoring. There are 61 established sampling stations in the state's monitoring program, of which 11 are located along the Mississippi coast. Water samples are analyzed for conventional water quality parameters and metals. Fish are analyzed for pesticides and metals. Sediments are not sampled on a routine basis; however, several special studies have been and are currently looking at coastal sediment contamination. MDEQ measures pesticides, PCBs, metals, etc. on special programs (*i.e.*, metal treaters, rocket motor test facilities). Mississippi determines toxicity

using USEPA or USACE test methods, comparison to standards and criteria, and through appropriate toxicity testing.

Coastal waters are evaluated biologically using fish diversity, health, and assessment, as well as algal biomass population and diversity. MDEQ biologists hope to begin work standardizing rapid bioassessment for estuarine waters in the near future. A number of special studies have been and are being conducted by MDEQ to evaluate coastal waters, including a major study of Back Bay, Biloxi, and the ongoing dioxin monitoring of fish tissue in the Escatawpa and Pascagoula Rivers.

There is currently a "limit consumption" advisory for catfish, smallmouth buffalo, and striped mullet on the lower 16 km (10 miles) of the Escatawpa River. MDEQ biologists collect multiple species of fish and shellfish from six stations 2-3 times per year for dioxin level monitoring. This aggressive monitoring has demonstrated a reduction in dioxin levels since it began in 1988. The most recent study began in February of 1991 and examined dioxin (2, 3, 7, 8-TCDD) levels in fish and shellfish three times in 1991 and twice in 1992.

Texas

Waste Reduction/Minimization & Pollution Prevention. Texas has an ongoing waste reduction program.

Texas is implementing a $2.7 million project to demonstrate innovative methods for controlling nonpoint source pollution, from several primary causes, namely erosion and sedimentation from new construction or existing development, silviculture, and animal waste runoff.

The Lower Colorado River Authority (LCRA) is an agency of the State of Texas charged with preserving and maintaining water quality throughout their statutory district, which includes Matagorda Bay. LCRA is concerned about the potential detrimental impacts of the current and future toxic substance and pesticide pollutants to the Matagorda Bay system. LCRA has programs for the lower Colorado River System that address areas such as nonpoint source pollution, integrated pest management, and household chemical collection sites.

Monitoring. LCRA maintains an ambient water quality monitoring network including sites in the zone of tidal influence on the mainstream. LCRA has also implemented an nonpoint source ordinance to the Lake Travis watershed and in the near future intends to expand the ordinance to all of their statutory districts.

Texas has a statewide trends monitoring program that includes 15 sampling stations in estuaries along the Gulf Coast. At these sampling stations, metals and organics including pesticides are measured in water, sediment, and biota at least once a year.

Water and sediment samples are analyzed for 17 metals, 21 organic compounds, and the conventional water quality parameters. Additional water or sediment samples are taken for analysis of metals or organics. Sediment concentration is compared with historical data. Follow-up bioassay or elutriate testing is conducted if a problem is defined. A problem is defined to exist if the sediment concentration exceeds 90 percent of the state's historic data or 85 percent of the data maintained by USEPA. Whole-body samples of fish are routinely analyzed for seven metals and 15 organic compounds. The Natural Resource Conservation Commission has recently completed special studies in nine bays and estuaries. The water, sediment, and biota trends monitoring program has changed in recent years, with more emphasis on special studies and less emphasis on long-trend monitoring.

ADEM	Alabama Department of Environmental Management
AET	Apparent Effects Threshold
AL	Alabama
ALCOA	Aluminum Company of America
ASCS	Agricultural Stabilization & Conservation Service
ATSDR	Agency for Toxic Substance & Disease Registry
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BSP	Benthic Surveillance Program
CAA	Clean Air Act
CAC	Citizens Advisory Committee--Gulf of Mexico Program
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act (Superfund)
CCMP	Comprehensive Conservation & Management Plan
CCP	Consequences of Contaminants Program
CO	Compliance Order
CSI	Contaminated Sediments Inventory
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
DEP	Department of Environmental Protection--Florida
DHH	Department of Health & Hospitals--Louisiana
EMAP-E	Environmental Monitoring & Assessment Program-Estuaries
EPCRA	Emergency Planning & Community Right-to-Know Act
FFDCA	Federal Food, Drug & Cosmetic Act
FIFRA	Federal Fungicide, Insecticide & Rodenticide Act
FL	Florida
FWPCA	Federal Water Pollution Control Act
GCRL	Gulf Coast Research Lab
GCWDA	Gulf Coast Waste Disposal Authority
GIS	Geographic Information System
GMP	Gulf of Mexico Program
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HSWA	Hazardous & Solid Waste Amendments
IDP	Irrigation Drainwater Program
IPM	Integrated Pest Management
ITOL	Industrial Task Force on Offshore Lightering
LA	Louisiana
LADEQ	Louisiana Department of Environmental Quality
LCRA	Lower Colorado River Authority
LEPC	Local Emergency Planning Committee
LOOP	Louisiana Offshore Oil Port
MARPOL	International Convention for the Prevention of Pollution from Ships

MC	Management Committee--Gulf of Mexico Program
MEMA	Mississippi Energy Management Agency
MDEQ	Mississippi Department of Environmental Quality
MISSTAP	Mississippi Technical Assistance Program for Industry
MISSWRAP	Mississippi Solid Waste Reduction Assistance Program
MMS	Minerals Management Service
MPPRCA	Marine Plastic Pollution, Research & Control Act
MPRSA	Marine Protection, Research & Sanctuaries Act
MS	Mississippi
MSD	Marine Sanitation Device
NAS	National Academy of Science
NASA	National Aeronautics and Space Administration
NCPDI	National Coastal Pollutant Discharge Inventory
NEI	National Estuarine Inventory
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NSR	National Shellfish Register
NSTMWP	National Status & Trends Mussel Watch Program
NSTP	National Status & Trends Program
OCS	Outer Continental Shelf
OPC	Office of Pollution Control--Mississippi
OTA	Office of Technology Assessment
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
POTW	Publicly-Owned Treatment Works
PPA	Pollution Prevention Act
PRB	Policy Review Board--Gulf of Mexico Program
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation & Recovery Act
RRT	Regional Response Teams
SAB	Strategic Assessment Branch--NOAA
SARA	Federal Superfund Amendments & Reauthorization Act
SCS	Soil Conservation Service
SERC	State Emergency Response Commission
SMN	Statewide Monitoring Network
TAC	Technical Advisory Committee--Gulf of Mexico Program
TNRCC	Texas Natural Resource Conservation Commission
TRI	Toxic Release Inventory
TS&P	Toxic Substances & Pesticides
TSCA	Toxic Substances Control Act
TSWQS	Texas Surface Water Quality Standards

TX	Texas
UDS	Ulcerative Disease Syndrome
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOE	U.S. Department of Energy
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U. S. Environmental Protection Agency
USFDA	U.S. Food & Drug Administration
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
WRATT	Waste Reduction & Technology Transfer--Alabama
WR/WM	Waste Reduction/Waste Minimization Program--Mississippi

algae	Any of a group of aquatic plants, including phytoplankton and seaweeds, ranging from microscopic to several meters in size.
ambient	Referring to average concentrations of substances in the surrounding media (water, air, or sediment).
anoxia	Absence of dissolved oxygen in water (<0.1 mg oxygen/L).
atmospheric deposition	The accretion of chemicals including nitrogen and phosphorus, attached to dust materials during dry weather or as part of raindrops, sleet, snow, hail, etc. during wet weather, which are deposited onto the land or water surfaces from the air.
bacteria	(Singular: bacterium) Microscopic organisms that are an important, natural component of the environment. Many forms are instrumental in the breakdown of organic matter, releasing nutrients to the environment where they can be used by primary producers. They can also aid in pollution control by consuming or breaking down organic matter in sewage or by similarly acting on oil spills or other water or soil pollutants. Disease-causing bacteria in soil, water, or air can also cause health problems for humans, animals, and plants.
benthic organism	A form of aquatic plant or animal life that is found on or near the bottom of a stream, lake, or ocean.
best management practices (BMPs)	Pollution control techniques developed by farmers, scientists, and administrators for managing nonpoint source nutrient discharges. BMPs cover two broad areas of management: 1) constructing facilities to contain nutrients, and 2) employing farming practices that decrease the use and/or runoff of fertilizers and manure.
bioaccumulation	The uptake of substances (*e.g.*, metals) leading to elevated concentrations of those substances within plant or animal tissue.
bioassay	Using living organisms to measure the effect of a substance, factor, or condition by comparing before-and-after data. Often used to test toxicity of sediments and water that may be contaminated with toxic substances.
bioconcentration	Concentration of contaminants by an aquatic organism through its digestive tract or gill tissues.
biomonitoring	(1) The use of living organisms to test ambient environmental conditions, often to check the impact of effluents on receiving waters. (2) Analysis of blood, urine, tissues, etc., to measure chemical exposure in humans.
biota	Plants and animals inhabiting a given region.
cadmium	A heavy metal that may be toxic in the environment at or above certain concentrations. Cadmium is used in a number of ways; among them, the most important use being for anti-corrosion protective electroplating of iron and steel. Today, the only continued use of cadmium is in batteries. Cadmium exhibits several toxic effects. Classified as a teratogen, carcinogen, and a probable mutagen, it has been implicated as the cause of severe deleterious effects on fish and wildlife.

carcinogen — Any substance that can cause or contribute to the development of cancer.

chlordane — A chlorinated organic insecticide having both stomach poison and fumigant properties. Like DDT, it has a high degree of persistence in the environment and a tendency to be concentrated in the food chain. USEPA completely banned the use of chlordane in 1988.

chlorinated hydrocarbons — These include a class of persistent, broad-spectrum insecticides that linger in the environment and accumulate in the food chain. Among them are DDT, aldrin, dieldrin, heptachlor, chlordane, lindane, endrin, mirex, hexachloride, and toxaphene. Other examples include TCE, used as an industrial solvent.

chlorination — The application of chlorine to drinking water, sewage, or industrial waste to disinfect or to oxidize undesirable compounds.

chromium — A trace element essential to humans; at high levels of exposure it is known to be toxic to humans. Chromium produces inflammation of the skin and, if inhaled, damages the nose. People exposed to chromium fumes have a greater risk of developing lung cancer.

chronic effects — Lethal response or debilitating damage to an organism(s) resulting from prolonged exposure to a toxicant(s). Exposure time may be several days, weeks, months, or even years.

coastal zone — Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or inversely, whose uses and ecology are affected by the sea. Legally, the definition varies from state to state.

combined sewer overflows — Discharges from a sewer system that carry both sewage and storm water runoff. Normally, its entire flow goes to a wastewater treatment plant but, during a heavy storm, the storm water volume may be so great as to cause overflows. When this happens, untreated mixtures of storm water and sewage may flow into receiving waters. Storm water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.

contaminant — Any physical, chemical, biological, or radiological substance or matter that has an adverse affect on habitats or organisms.

conventional pollutants — Pollutants typically discharged by municipal sewage treatment plants and a number of industries. The category includes wastes with a high biochemical oxygen demand (BOD), total suspended solids, fecal coliform, pH, grease and oil.

copper — A metal that has many industrial uses. Uses include plumbing, electrical products, metal plating, brass, pesticides, fungicides, paint, and wood preservatives. Sewage sludge is enriched in copper.

criteria — Acceptable limits in various media (*e.g.*, water, sediments) for pollutants derived by USEPA. When issued by USEPA, the criteria provide guidance to the states on how to establish their standards.

cumulative impacts — Combined effects resulting from more than one action.

DDT The first chlorinated hydrocarbon insecticide (chemical name: Dichloro-Disphsdyl-Trichloromethane). It has a half-life of 15 years and can collect in fatty tissues of certain animals. USEPA banned registration and interstate sale of DDT for virtually all but emergency uses in the U.S. in 1972 because of its persistence in the environment and accumulation in the food chain.

designated uses Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act. Uses can include cold water fisheries, public water supply, agriculture, etc.

direct discharger A municipal or industrial facility that introduces pollution through a defined conveyance or system; a point source.

dissolved oxygen (DO) Concentration of oxygen in water, commonly employed as a measure of water quality. Low levels adversely affect aquatic life. Most finfish cannot survive when DO falls below 3 mg/L for a sustained period of time. SEE ANOXIA AND HYPOXIA

diversity A statistical measurement that generally combines a measure of the total number of species in a given environment with the number of individuals of each species. Species diversity is high when there are many species with a similar number of individuals; low when there are fewer species and when one or two species dominate.

drainage basin The land area drained by a river or stream and its tributaries.

dredging Mechanical removal of sediment from the bottom of waterbodies. This disturbs the ecosystem and causes silting that can have adverse impacts on aquatic life.

dredged sediments Bottom sediments associated with coastal/estuarine waters which are removed, usually for navigational purposes, by mechanical means such as a bucket or hydraulic dredge. The disposal of dredged sediments may occur on either upland or in coastal or estuarine waters. State and federal permit programs only allow sediments to be disposed at designated sites and only in a manner that will not cause adverse effects on organisms.

ecological impact The effect that a human or natural activity has on living organisms and their non-living (abiotic) environment.

ecosystem An ecological community consisting of living organisms and their physical and chemical environment.

effluent Discharge or emission of a liquid or gas, usually from a point source (*e.g.*, pipe or stack), into the environment.

emission Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

estuary A semi-enclosed body of water, connected to the open sea, in which sea water is measurably diluted with fresh water from inland sources.

eutrophication The process by which a body of water becomes overly rich in dissolved nutrients.

fertilizer	Materials such as nitrogen and phosphorus that provide nutrients for cultured plants. Commercially sold fertilizers may contain other chemicals or may be in the form of processed sewage sludge.
freshwater	Water that generally contains less than 1,000 milligrams-per-liter of dissolved solids.
Geographic Information System (GIS)	A computerized database of land use, land cover, and many other types of information that can be statistically analyzed and graphically displayed using maps.
ground water	Subsurface water saturating soil or porous rock which often returns, with its nitrogen loads, to surface streams during dry periods.
habitat	The place where a population (*e.g.*, human, animal, plant, microorganism) lives and its surroundings, both living and non-living.
hydrocarbons (HC)	Chemical compounds that consist of carbon and hydrogen.
hypoxia	Low levels of dissolved oxygen in water, defined as less than 2 mg/L.
indicator	In biology, an organism, species, or community whose characteristics define the presence of specific environmental conditions.
indirect discharge	Introduction of pollutants from commercial and industrial facilities into a sewage treatment plant.
land use	Refers to the ways in which a community or area makes use of its natural resources.
lead	A heavy metal that is hazardous to health if breathed or swallowed. Its use in gasolines, paints, and plumbing compounds has been sharply restricted or eliminated by federal laws and regulations.
Louisianian Province	A biogeographic area of the country within the Estuaries component of USEPA's Environmental Monitoring and Assessment Program. The area includes the coastline of the Gulf of Mexico between and including Rio Grande, TX, and Anclote Anchorage, FL.
marine sanitation device (MSD)	Any equipment installed on board a vessel to receive, retain, treat, or discharge sewage and any process to treat sewage.
metals	Metallic elements that can cause harm to living organisms and can accumulate in the food chain. Often divided into common metals (*e.g.*, zinc, iron, copper) and trace metals (*e.g.*, chromium, cadmium, arsenic). Elements of primary concern in the environment are the heavy metals.
mercury	A heavy metal that can accumulate in the environment and is highly toxic if breathed or swallowed. Industrial uses of mercury include manufacture of thermometers, mirrors, pharmaceutical products, mercury vacuum pumps, agricultural fungicides and germicides. Mercury can enter the environment via combustion of fossil fuels since mercury is a trace element in both coal and tar. Mercury is a significant element in terms of its potential toxicity.

microorganism	Unicellular living organisms so small that individually they can usually only be seen through a microscope, some of which cause diseases (*e.g.*, bacteria, viruses).
modeling	An investigative technique using a mathematical or physical representation of a system or theory, usually on a computer, that accounts for all or some of its known properties. Models are often used to test the effect of changes of system components on the overall performance of the system.
monitoring	Observing, tracking, or measuring some aspect of the environment to establish base line conditions and short or long-term trends.
National Pollutant Discharge Elimination System (NPDES)	A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the U.S. unless a special permit is issued by USEPA, state, or (where delegated) a tribal government on an Indian reservation.
nickel	An element that is considered relatively non-toxic to man. The concentrations tolerated by most marine organisms appear to be high. The sources of nickel include stainless steel, nickel-plating, storage batteries, spark plugs, and electrical contacts.
nitrate	A compound containing nitrogen and oxygen (NO_3) that can exist in the atmosphere or as a dissolved gas in water and that can have harmful effects on humans and animals. For example, high concentrations of nitrates in drinking water can cause severe illness in infants.
nitrogen	A nutrient essential for life. May be organic or inorganic (ammonia, nitrate, nitrite). Elemental nitrogen constitutes 78 percent of the atmosphere by volume.
nonpoint source pollution	Toxicants, other contaminants, nutrients, or soil entering a waterbody from sources other than discrete discharges, such as pipes. Includes pollution on the land which originates as atmospheric deposition, as well as farm and urban runoff.
nutrients	Chemicals required for growth and reproduction of plants. Excessive levels of the nutrients nitrogen and phosphorus can lead to excessive algae growth.
oil spill	An accidental or intentional discharge of oil that reaches bodies of water; can be controlled by chemical dispersion, combustion, mechanical containment, and/or adsorption.
organic	(1) Referring to or derived from living organisms. (2) In chemistry, any compound containing carbon.
organic chemicals/ compounds	Animal or plant-produced substances containing mainly carbon, hydrogen, and oxygen.
organic matter	Carbonaceous waste contained in plant or animal matter and originating from domestic or industrial sources.
organism	Any living thing.

outfall	The place where an effluent is discharged into receiving waters.
oxygen demand	Consumption of oxygen by bacteria to oxidize organic matter.
PAHs	Polynuclear aromatic hydrocarbons (PAHs) comprise a group of petroleum derived hydrocarbon compounds that are found in the water and fish tissue of aquatic organisms. PAHs have a tendency to bioaccumulate and many are known or suspected carcinogens.
pathogens	Microorganisms that can cause disease in humans, animals, or plants. They may be bacteria, viruses, or parasites and are found in sewage, in runoff from animal farms or rural areas populated with domestic and/or wild animals, and in water used for swimming. Fish and shellfish contaminated by pathogens, or the contaminated water itself, can cause serious illnesses.
PCBs	A group of toxic, persistent chemicals (polychlorinated biphenyls) used in transformers and capacitors for insulating purposes and in gas pipeline systems as a lubricant. Further sale or new use was banned by law in 1979.
permit	An authorization, license, or equivalent control document issued by USEPA or an approved state agency to implement the requirements of an environmental regulation, *e.g.*, permit to discharge from a wastewater treatment plant or to operate a facility that may generate harmful emissions.
persistence	Refers to the length of time a compound, once introduced into the environment, stays there. A compound may persist for less than a second or indefinitely.
phytoplankton	Microscopic plants that live in water such as algae.
point source	A stationary location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, *e.g.*, a pipe, ditch, ship, ore pit, factory smokestack.
pollutant	Generally, any substance introduced into the environment that adversely affects the health of plants and animals, or the usefulness of a resource.
pollution	Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, and radiological integrity of the water.
pretreatment	Processes used to reduce, eliminate, or alter the nature of wastewater pollutants from non-domestic sources before they are discharged into publicly-owned treatment works.
primary waste treatment	First steps in wastewater treatment; screens and sedimentation tanks are used to remove most materials that float or will settle. Primary treatment results in the removal of about 30 percent of carbonaceous biochemical and oxygen demand from domestic sewage.
priority pollutant	A pollutant that is listed by USEPA as a pollutant of concern.
publicly-owned treatment works (POTW)	A waste-treatment works owned by a state, unit of local government, or Indian tribe, usually designed to treat sewage and other domestic wastewaters.

qualitative Pertaining to the non-numerical assessment of a parameter.

quality assurance/ quality control (QA/QC) A system of procedures, checks, audits, and corrective actions to ensure that research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

quantitative Pertaining to the numerical assessment of a parameter.

receiving waters A river, lake, ocean, stream, or other watercourse into which wastewater or treated effluent is discharged.

residual Amount of a pollutant remaining in the environment after a natural or technological process has taken place, *e.g.*, the sludge remaining after initial wastewater treatment, or particulates remaining in air after the air passes through a scrubbing or other pollutant removal process.

restoration The act of returning something such as habitat or water quality to its condition prior to human disturbance. Measure taken to return a site to natural conditions.

resuspension Lifting of in-place bottom sediments into the water column by waves, bottom currents, or other mechanical disturbance.

runoff Drainage of precipitation over the soil or a non-porous surface (*e.g.*, asphalt) to a stream, river, or other receiving body of water.

salinity Amount, by weight, of dissolved salts in 1,000 units of water (reported as parts per thousand).

sanitary sewers Underground pipes that carry only domestic or industrial waste, not storm water.

secondary treatment The second step in most sewage treatment plants in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment.

sediments The loose solids, (*e.g.*, soil from erosion or runoff) that settle to the bottom of a waterbody or its tributaries which can be sources of nitrogen and phosphorus.

septic tank An underground storage and treatment tank for wastes from homes having no sewer line to a treatment plant. The waste goes directly from the home to the tank, where the organic waste is decomposed by bacteria and the sludge settles to the bottom. The effluent flows out of the tank into the ground through drains; the sludge is pumped out periodically.

sewage The waste and wastewater produced by residential and commercial establishments and discharged into sewers.

sewage sludge Sludge produced at a sewage treatment plant, the disposal of which is regulated under the Clean Water Act.

sewer	A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream. Sanitary sewers carry household, industrial, and commercial waste. Storm sewers carry runoff from rain or snow. Combined sewers are used for both purposes.
sludge	A semi-solid residue from any of a number of air or water treatment processes. Sludge can be a hazardous waste.
species	A reproductively isolated aggregate of interbreeding populations of organisms.
standards	Prescriptive norms that govern action and actual limits on the amount of pollutants or emissions produced. USEPA, under most of its responsibilities, establishes minimum standards. States can issue stricter standards if they choose.
stressor	Any physical, chemical, or biological entity that can induce an adverse response.
storm sewer	A system of pipes (separate from sanitary sewers) that carries only water runoff from building and land surfaces.
storm water	Runoff caused by precipitation.
stream	A body of water, including brooks and creeks, that moves in a definite channel in the ground driven by a hydraulic gradient.
submerged aquatic vegetation (SAV)	Vegetation that grows underwater along the fringes and in shallow water.
surface water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.); also refers to springs, wells, or other collectors that are directly influenced by surface water.
toxic	Harmful to living organisms.
toxicant	A poisonous agent that kills or injures animal or plant life.
toxicity	The degree of danger posed by a substance to animal or plant life.
toxic pollutants	Materials contaminating the environment that cause death, disease, and/or birth defects in organisms that ingest or absorb them. The quantities and length of exposure necessary to cause these effects can vary widely.
tributary	A stream, creek, or river that flows into a larger stream, creek or river.
wastewater	The spent or used water that contains dissolved or suspended matter from individual homes, a community, a farm, or an industry.
wastewater treatment plant	A facility containing a series of tanks, screens, filters, and other processes by which pollutants are removed from water.

water column A vertical extent of water reaching from the surface to the bottom substrate of a waterbody.

water quality standards State-adopted and USEPA-approved ambient standards for water bodies. The standards cover the use of the water body and the water quality criteria that must be met to protect the designated use or uses (*e.g.*, drinking, swimming, fishing).

watershed Land area from which precipitation drains into a given body of water.

wetlands An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in soil conditions. Examples include: swamps, bogs, fens, and marshes. Often defined based on soil characteristics.

zinc An essential trace element to living organisms. It is toxic when present in high concentrations and can act synergistically to increase the toxicity of other metals and contaminants. Uses of zinc-based chemicals include wood preservatives, pigments, metallurgical operations, dry cell batteries, and its most important use as a catalyst in vulcanizing rubbers. Major point sources of atmospheric zinc are smelters, galvanizing operations, and waste incinerators.

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From Highest Toxicity To Lowest Toxicity:

Ammonium sulfates Ammonium sulfates are released in the manufacturing of ammonia, and used in freezing mixtures, flame-proofing fabrics and paper, tanning, and galvanizing iron. The commercial grade is used as fertilizer.

Chlorine Chlorine is the commonest of the four halogens which are among the most chemically reactive of all the elements. Gaseous chlorine is a bleaching agent in the paper and pulp and textile industries for bleaching cellulose for artificial fibers. It is used in the manufacture of chlorinated lime, inorganic and organic compounds such as metallic chlorides, chlorinated solvents, refrigerants, pesticides, and polymers (synthetic rubber and plastic). It is used as a disinfectant, particularly for water and refuse, and in detinning and dezincing iron. Chlorine reacts with body moisture to form acids. It is extremely irritating to skin, eyes, and mucous membranes. The recommended disposal method for chlorine is to introduce it to large volumes and solutions of reducing agents to neutralize it and then flush to the sewer with water.

Ammonia The amount of ammonia produced every year by man is very small compared to that produced by nature yearly. However, when ammonia is found at a level that may cause concern, it is usually produced either directly or indirectly by man. Ammonia dissolves easily in water, and changes to ammonium (most common form in wells, rivers, lakes, and wet soils). Eighty percent of all man-made ammonia is used as fertilizer. A third of this is applied directly as pure ammonia. The remainder is used to make other fertilizers that contain ammonium. Ammonia is also used to manufacture synthetic fiber, plastics, and explosives. Many cleaning products also contain ammonia.

Chromium Chromium is a naturally occurring element that is found in continental dust and volcanic dust and gases. Most of the chromium and chromium compounds we use come from a naturally occurring ore. It is mainly used for making steel and other alloys. Chromium compounds are used in refractory brick for the metallurgical industry and in the chemical industry for metal finishing, manufacture of pigments, leather tanning, wood treatment, and water treatment. In the process of mining ores containing chromium, larger amounts of chromium are emitted into the environment than from natural processes. The two largest sources of chromium emission in the atmosphere are from the chemical manufacturing industry and combustion of natural gas,

oil, and coal. Other sources include the incineration of municipal refuse and sewage sludge, the emissions from cooling towers that use chromium compounds as rust inhibitors, and wastewaters from electroplating, leather tanning, and textile industries when discharged into surface waters.

Hydrazine Hydrazine is an animal positive carcinogen. Because of its strong reducing capabilities, it is used as an intermediate in chemical synthesis and in photography and metallurgy. It is also used in the preparation of anti-corrosives, textile agents, and pesticides, and as a scavenging agent for oxygen in boiler water. Hydrazine is widely used in pharmaceutical synthesis, and also as a rocket fuel.

Copper/ Copper Compounds Soluble copper compounds that are most commonly used in agriculture are more hazardous to health than insoluble forms. Occupational exposure forms of copper that are soluble or not strongly attached to dust or dirt would most commonly occur in agriculture, water treatment, and industries such as electroplating.

Zinc/ Zinc Compounds Zinc has many industrial uses, found in pure form or mixed with other metals to form alloys such as chlorine, in the same way that sodium is found in table salt. High levels of exposure to zinc can occur from drinking water or other liquids that are stored in galvanized metal containers, flow through galvanized pipes, or that are contaminated by waste zinc from industrial sources or toxic waste sites.

Cyanide/ Cyanide Compounds Cyanides are produced by certain bacteria, fungi and algae, and may be found in a number of foods and plants; however, most cyanide in the environment comes from industrial processes. Cyanide salts are used in electroplating metallurgy, production of organic chemicals, and photographic development.

Ethylbenzene Ethylbenzene occurs naturally in coal tar and petroleum, and manmade products including paints, ink and insecticides. In surface waters such as rivers and harbors, it breaks down by reacting with other compounds naturally present in the water.

Sulfuric acid Sulfur dioxide in solution is a common solvent used as a disinfectant in breweries and food factories, and bleaching textile fibers, straw, and wicker.