U. S. DEPARTMENT OF ENERGY
STRATEGIC PETROLEUM RESERVE
PROJECT MANAGEMENT OFFICE
NEW ORLEANS, LOUISIANA

STATEGIC PETROLEUM RESERVE PROJECT MANAGEMENT OFFICE

ANNUAL SITE ENVIRONMENTAL REPORT

CALENDAR YEAR 1992

Department of Energy
Strategic Petroleum Reserve Project Management Office
900 Commerce Road East
New Orleans, Louisiana 70123

August 2, 1993

Distribution:

ANNUAL SITE ENVIRONMENTAL REPORT FOR 1992 - STRATEGIC PETROLEUM RESERVE

Enclosed for your information is a copy of the Annual Site Environmental Report for Calendar Year 1992 for the U.S. Department of Energy's Strategic Petroleum Reserve. This report is prepared and published annually for distribution to local, state, and Federal government agencies, the Congress, the public, and the news media. The report was prepared for the Department of Energy by DynMcDermott Petroleum Operations Company.

To the best of my knowledge, this report accurately summarizes and discusses the results of the 1992 environmental monitoring program.

If you have any questions or desire additional information, please contact Melissa W. Smith of the Project Management Office Environmental, Safety and Health Division at (504) 734-4387.

Sincerely,

W. C. Gibson

William C. Gibson, Jr.
Project Manager

Enclosure

STRATEGIC PETROLEUM RESERVE

ANNUAL SITE

ENVIRONMENTAL REPORT

FOR

CALENDAR YEAR 1992

Document No. ASE5400.1AO

Prepared for the Department of Energy
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DYNMCDERMOTT PETROLEUM OPERATIONS COMPANY
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New Orleans, Louisiana 70123

June, 1993

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ABBREVIATIONS AND ACRONYMS

ac	acre
adj	adjacent
AFFF	aqueous film forming foam
ARCO	Atlantic Richfield Company
AST	above ground storage tanks
avg	average
bbl	barrel(s) (1 bbl = 42 gallons)
BC	Bayou Choctaw
BH	Big Hill
BM	Bryan Mound
bldg	building
BOD_5	five day biochemical oxygen demand
CAA	Clean Air Act
CAP	corrective action plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	conditionally exempt small quantity generator
Ci	Curies
COD	chemical oxygen demand
cm	centimeter
COE	United States Army Corps of Engineers
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	dissolved oxygen
DOE	United States Department of Energy
DOT	United States Department of Energy
DPRP	Discharge Prevention and Response Plan
EA	environmental assessment
EIS	environmental impact statement
EPA	United States Environmental Protection Agency
ERT	Emergency Response Team
ESA	Endangered Species Act
F&WS	United States Fish and Wildlife Service

ABBREVIATIONS AND ACRONYMS

(continued)

FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FRP	Facility Response Plan
ft	feet
GLO	General Land Office
gpd	gallons per day
ICW	Intracoastal Waterway
in	inch
ha	hectacre
kg	kilogram
km	kilometers
LA	Louisiana
lab	laboratory
lbs	pounds
LDEQ	Louisiana Department of Environmental Quality
LDHHR	Louisiana Department of Health and Human Resources
LDNR	Louisiana Department of Natural Resources
LDOTD	Louisiana Department of Transportation and Development
LDWF	Louisiana Department of Wildlife and Fisheries
m/sec	meters per second
m	meters
m^3	cubic meters
MACT	maximum available control technology
maint	maintenance
max	maximum
mCi	millicuries
mg/l	milligrams per liter
mi	miles
min	minute
MMB	million barrels
NE	northeast
NEPA	National Environmental Policy Act

ABBREVIATIONS AND ACRONYMS

(continued)

NESHAPS	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NORM	naturally occurring radioactive material
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NW	northwest
O&G	oil and grease
OPA	Oil Pollution Act
Ops	operations
OSPRA	Oil Spill Prevention and Response Act
P&A	plug and abandon
PCB	polychlorinated biphenyls
pCi	picocuries
pH	negative logarithm of the hydrogen ion concentration (acidic to basic on a scale of 0 to 14, 7 is neutral)
PMO	Project Management Office
ppm	parts per million
ppt	parts per thousand
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RCT	Railroad Commission of Texas
RQ	reportable quantity
RWIS	raw water intake structure
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SE	southeast
SJ	St. James
SM	Sulphur Mines
SPR	Strategic Petroleum Reserve
sq	square
SQG	small quantity generator
stn	station

ABBREVIATIONS AND ACRONYMS
(continued)

STP	sewage treatment plant
S.U.	standard units
SW	southwest
TACB	Texas Air Control Board
TDH	Texas Department of Health
TDH&PT	Texas Department of Highways and Public Transportation
TDS	total dissolved solids
TOC	total organic carbon
tpy	tons per year
TSCA	Toxic Substance Control Act
TSD	treatment, storage, and disposal
TSS	total suspended solids
TTA	Tiger Team Assessment
TWC	Texas Water Commission
TX	Texas
UIC	Underground Injection Control
UST	underground storage tank
USCG	United States Coast Guard
VOC	volatile organic compound
WH	West Hackberry
WI	Weeks Island

EXECUTIVE SUMMARY

This report, provided annually in accordance with DOE Order 5400.1, summarizes monitoring data collected to assess Strategic Petroleum Reserve (SPR) impacts on the environment. The report serves as a management tool for mitigating such impacts, thus serving the public interest by ensuring environmentally sound operation of the SPR.

Included in this report is a description of each site's environment, an overview of the SPR environmental program, and a recapitulation of special environmental activities and events associated with each SPR site during 1992. The active permits and the results of the environmental monitoring program (i.e., air, surface water, ground water, and water discharges) are discussed within each section by site. The quality assurance program is presented which includes results from laboratory and field audits and studies performed internally and by regulatory agencies.

In general, no significant adverse environmental impact resulted from any SPR activities during 1992. Environmental areas of concern, such as potential ground water contamination, are fully addressed in the applicable section by site. The SPR continues to maintain an overall excellent environmental record.

1. INTRODUCTION

The creation of the Strategic Petroleum Reserve (SPR) was mandated by Congress in Title I Part B of the Energy Policy and Conservation Act (P.L. 94-163), of December 22, 1975. The SPR provides the United States with sufficient petroleum reserves to minimize the effects of an oil supply interruption.

The SPR consists of five active Gulf Coast underground salt dome oil storage facilities (three in Louisiana and two in Texas), a marine terminal facility (in Louisiana), and an administrative facility (in Louisiana). A sixth storage facility, Sulphur Mines, has been decommissioned. Figure 1-1 is a regional map showing the relative location of SPR facilities.

Four of the six storage sites were acquired with existing solution mined caverns, three of which have had additional solution mining. The fifth site is a room and pillar salt mine, previously created by mechanical underground mining techniques and converted by the SPR to storage. The sixth storage site was created entirely by solution mining. Two sites (Bayou Choctaw and Big Hill) are being expanded by solution mining to offset the storage space lost on the decommissioning of Sulphur Mines. The smallest of the SPR sites, Sulphur Mines transferred its crude oil to Big Hill and West Hackberry in preparation for the decommissioning and planned sale of the site in early 1993. Real property was transferred to other sites where needed, or excessed. The site will remain in its "caretaker" status until the Act of Sale.

The pipeline terminals currently used by the SPR are the ARCO Terminal (Texas City, Texas), the Phillips Docks and Jones Creek Tank Farm (Freeport, Texas), the Sunoco Pipeline Terminal (Nederland, Texas), the Capline Pipeline Terminal (St. James, Louisiana), and the LOCAP Pipeline Terminal from LOOP.

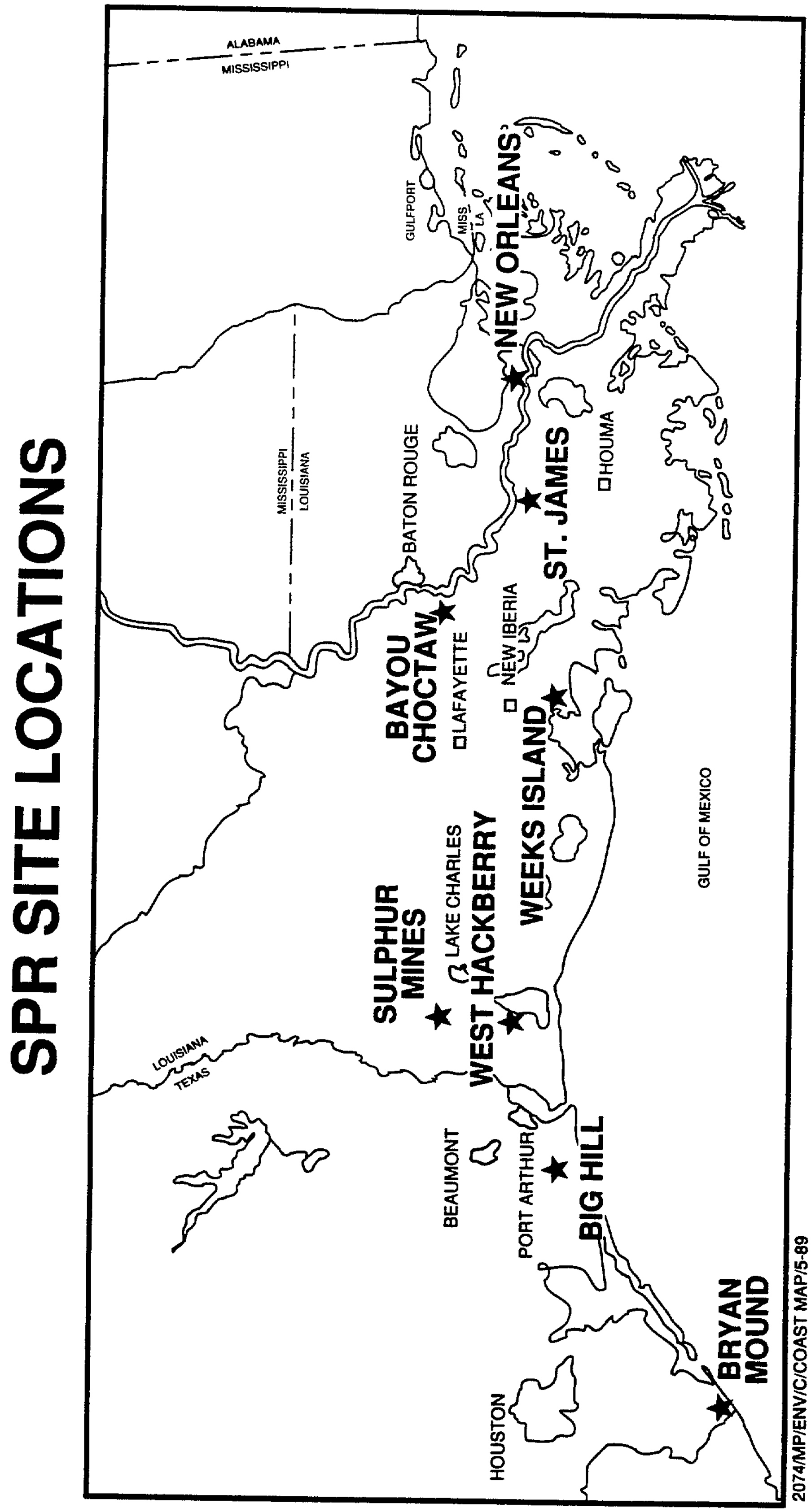

Figure 1-1. SPR Site Locations

The sites are also capable of distributing crude oil via tankships. The ARCO pipeline connecting the Bryan Mound site with the Texas City, Texas, docks and area refineries was completed in 1987. A second pipeline connecting the West Hackberry site to refineries in Lake Charles, Louisiana, and Beaumont - Port Arthur, Texas areas via the Texas 22 pipeline was completed in 1989. Access to adjacent commercial dockage was completed in 1988 for the St. James Terminal with the installation of a short segment of pipeline connecting the nearby Shell Capline facility. An additional tie-in to the Koch pipeline has also been completed.

The SPR has beem authorized to expand from 750 million barrel (MMB) storage capacity to 1 billion barrels. The draft Environmental Impact Statement (EIS) addressing various alternatives and the impacts of each was distributed for review and comment. Public hearings were held at five Gulf Coast locations in three states. In addition, conceptual designs have been initiated.

Descriptions of the individual sites with photographs (Figures 1-2 through 1-8), follow. Figures 5-1 through 5-7 provide the site specific configurations.

1.1 BAYOU CHOCTAW

The Bayou Choctaw (BC) site is located on the west side of the Mississippi River 19.3 km (12 mi) southwest of Baton Rouge in Iberville Parish, Louisiana (Figure 1-2). The site consists of a primary operational area and a brine disposal area occupying approximately 69 and 81 ha (168 and 200 ac) respectively. The area surrounding the site is rural, with a number of people living in small settlements

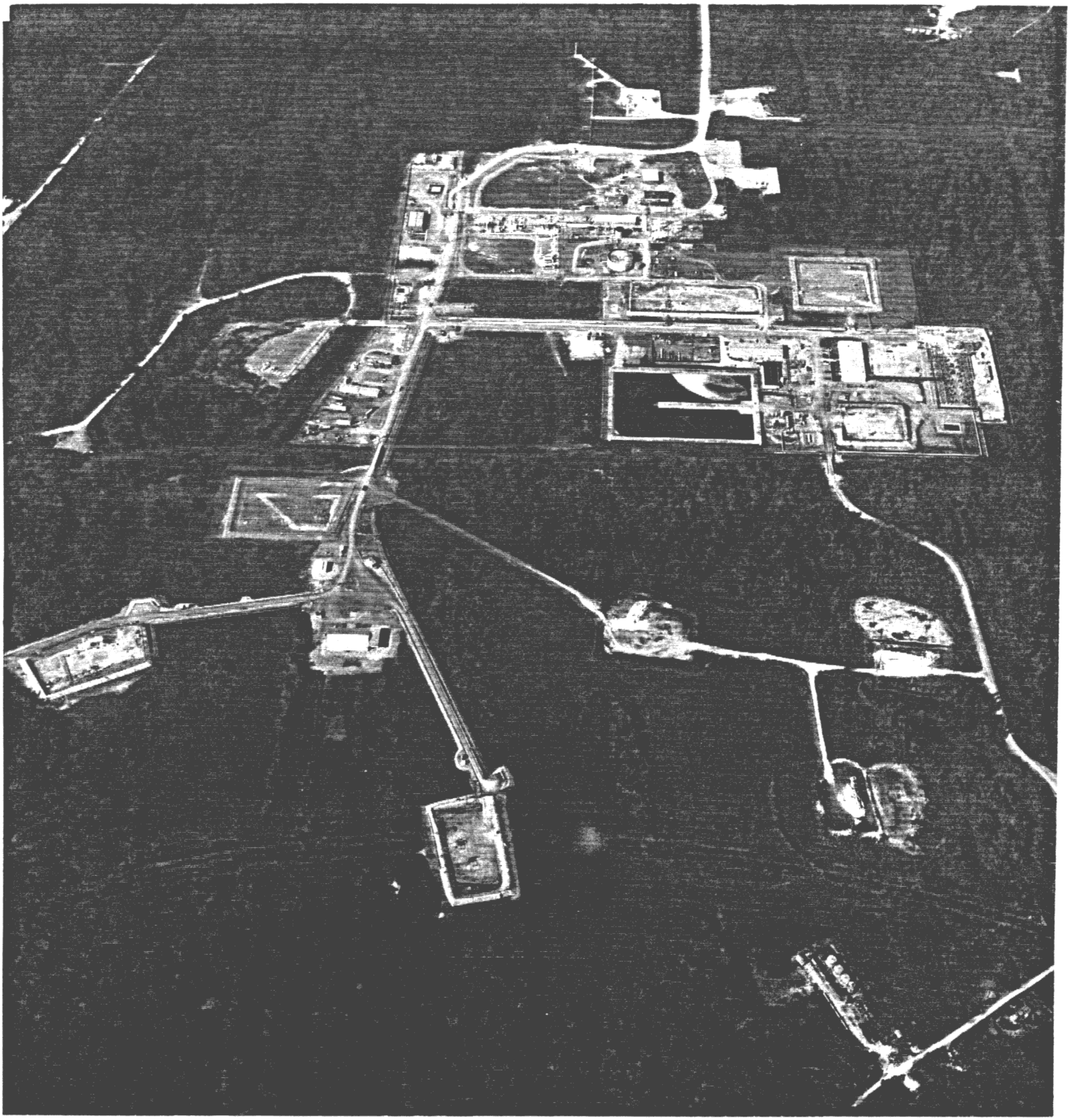

Figure 1-2. Bayou Choctaw SPR Site

along the nearby highways. The nearest communities are Addis, to the northeast, and Plaquemine, to the southeast. Baton Rouge, the Louisiana State Capitol and the major source of housing and services for the site, is within easy commuting distance.

The habitat surrounding the site is a freshwater swamp. Elevation ranges from approximately 1.5 to 3.0 m (five to ten ft) above sea level. Although there are no clear topographic expressions in the area, major surface subsidence has occurred creating substantial areas of bottomland hardwoods and swamp with interconnecting waterways. The site proper is normally dry and protected from spring flooding by the site's flood control levees and pumps. The collapse of a solution-mined cavern in 1954 resulted in the formation of a 4.9 hectare (12 acre) lake (Cavern Lake) on the north side of the site.

Bottomland hardwood forest and deciduous swamps are predominant at the Bayou Choctaw site. The vegetation at the site includes bald cypress, sweetgum, tupelo (characteristic of lowland areas), bulltongue, and spikerushes. Water oak is also present but not abundant. The deciduous swamp is the most widespread habitat type found at the site. It provides resources for a large number of wildlife. Bird species common at Bayou Choctaw are herons, ibis, egrets, woodpeckers, wood duck, thrushes, American anhinga, and American woodcock. One or more of the endangered species of these assemblages may occasionally appear in the wetlands in this area. Raptors are commanly observed huring in the area. Other endangered species of raptors may occasionally appear near the Bayou Choctaw facility or along its pipeline right-of-way. Inhabitants of the bottomland forest and swamp include opossum, squirrels, nutria, mink, river otter, raccoon, swamp rabbit, white-tailed deer, and snakes. The American alligator, threatened by similarity of appearance, is frequently found in and adjacent to the site. The southern bald eagle has one nest within one mile of the

Bayou Choctaw - St. James crude oil pipeline, and a second has been identified within the regional area.

The site is located near the intersection of several major bayous and waterways. The Intracoastal Waterway (Port Allen Canal) passes in a north-south direction one km (0.6 mi) west of the site. The Intracoastal Waterway extends to the north and then turns eastward through the Port Allen Canal to enter the Mississippi River at Baton Rouge. In the area of the site, the Intracoastal Waterway is part of Choctaw Bayou, a natural waterway. Smaller canals and bayous, such as Bayou Bourbeaux, the North-South Canal and the East-West Canal, enter the site area and continue to Bull Bay and the Intracoastal Waterway.

The Bayou Choctaw site will be used to store 11.4 million m^3 (72 MMB) of crude oil. Currently, there are six solution-mined caverns at this storage site. An existing cavern, Number 18, was expanded (solution mined) to enhance the overall storage capacity of the Bayou Choctaw SPR site. Raw water is provided from Cavern Lake. Brine is transported via pipeline to 12 brine disposal wells located approximately two miles south of the site. There is a 58 km (36 mi), 91 cm (36 in) crude oil pipeline connecting the site to the St. James Terminal.

1.2 BIG HILL

The Big Hill (BH) site is located in Jefferson County, Texas, approximately 109 km (68 mi) east of Houston, 37 km (23 mi) southwest of Port Arthur, and 14 km (9 mi) north of the Gulf of Mexico. Only small unincorporated communities are located near the site. The rural area around the site (Figure 1-3) is used primarily for rice farming, cattle grazing, and oil and gas production. The permanent work force is supplied in small part

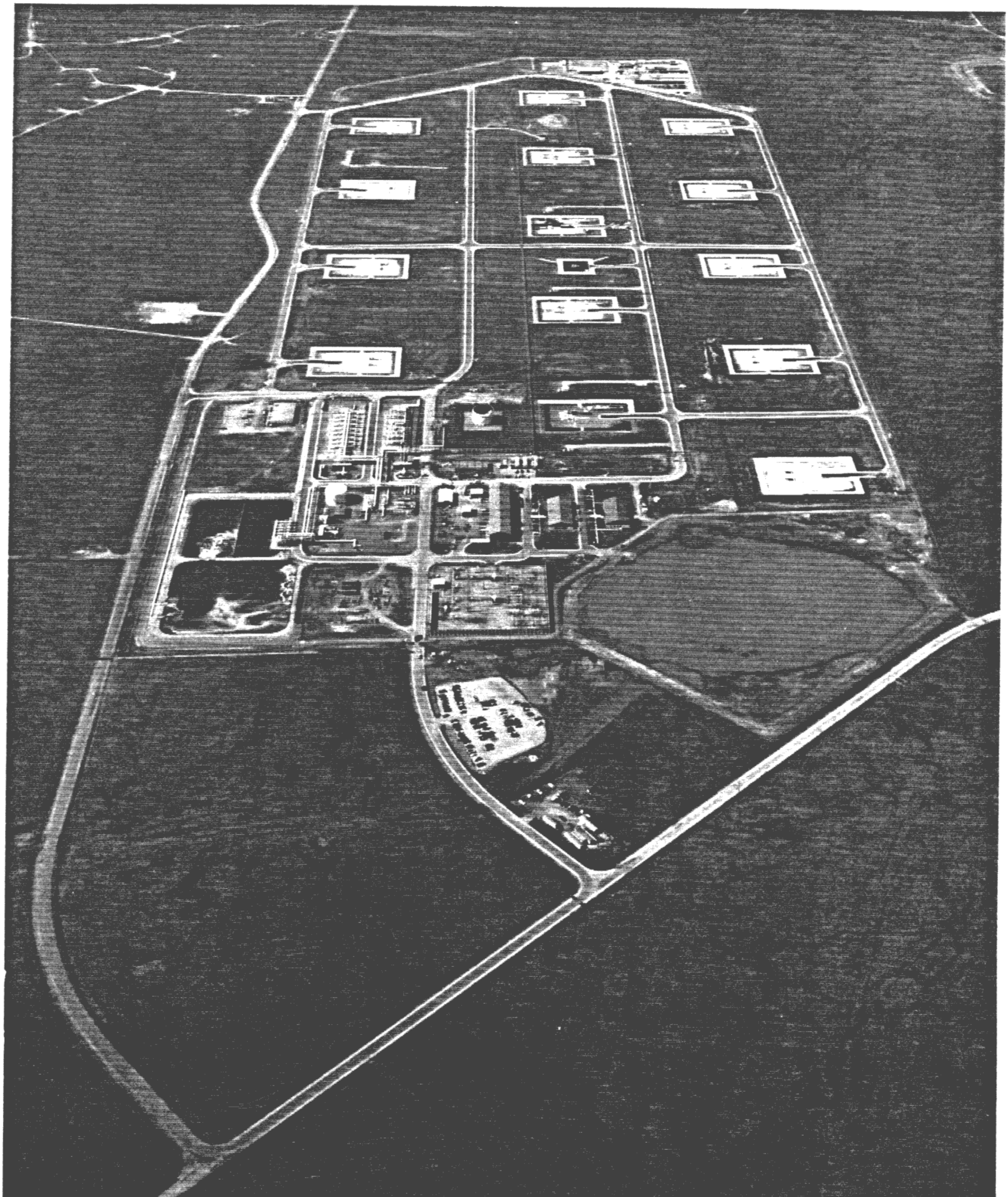

Figure 1-3. Big Hill SPR Site

from the local area, with the remainder moving into the area or commuting from Beaumont or Port Arthur. During the construction phase, much of the transient skilled labor was brought in from Houston, Galveston, or Lake Charles. The site is situated on approximately 111 ha (275 ac) of land on the Big Hill salt dome. Surface elevations reach 10 m (35 ft) above sea level, the highest elevations in the region. The agricultural and pasture land uses around Big Hill are typical of the region.

Approximately one km (0.6 mi) south of the dome is the northern boundary of fresh to intermediate marsh which grades into brackish and saline marsh towards the Gulf of Mexico. The nearby waterways include Spindletop Ditch approximately five km (three mi) south of the site, which connects to the Intracoastal Waterway located three km (two mi) further south and oriented in a northeast to southwest direction. Freshwater impoundments are located south of the site. Numerous sloughs, bayous, and lakes, including Willow Slough Marsh, Salt Bayou, Star Lake, and Clam Lake, connect with the Intracoastal Waterway. Natural ridges (cheniers) paralleling the coastline isolate the marsh from the Gulf of Mexico.

Existing habitats in the vicinity of the site are related to agricultural use. There are petroleum-related industrial operations on and off the salt dome which have altered land use. There are two ponds present on the eastern edge of the dome, one of which is located on the northeast corner of the site and the other just north of the site.

The upland habitat, which comprises the majority of the site, consists of many tall grasses such as bluestem, indiangrass, switchgrass, and prairie wildgrass. A few 150 year old live oak trees are present on site. Identified bird concentrations and rookeries are about five miles south and west of the site.

No established waterway conects the Big Hill site with these bird habitats or the wildlife management areas. No rare, threatened or endangered species habitat is identified in the vicinity of the Big Hill site on the Texas Water Commission Coastal Regional Spill Response Map. The paddlefish, a state regulated species, has been identified in Taylor Bayou in the vicinity of the oil pipeline crossing. Fauna typical in the area include coyote, rabbits, raccoon, rodents, snakes, turtles, and numerous upland game birds and passerines. The nearby ponds and marsh south of the site provide excellent habitat for the American alligator, threatened by similarity of appearance. No other known species that frequent the site are endangered or threatened. An eastern cougar has been sighted in the J. D. Murphree Management Area several miles to the east of the site. The McFaddin National Wildlife Refuge located south of the site provides important habitat for overwintering waterfowl. Taylor Bayou is habitat for the bowfin, a state endangered species.

The Big Hill site is planned for the storage of 25.6 million m^3 (160 MMB) of crude oil in 14 caverns. Appurtenant facilities include a raw water intake structure on the Intracoastal Waterway with a 107 cm (48 in) pipeline extending to the site, a 107 cm (48 in) brine disposal pipeline extending eight km (five mi) offshore in the Gulf of Mexico, and a 91 cm (36 in) pipeline for transporting crude oil between the site and the Sunoco Terminal in Nederland, Texas. The brine pipeline has a series of brine diffuser nozzles which disperse and mix brine with receiving seawater.

Drilling and construction commenced in 1983 at the site. Actual leaching (solution mining) of the oil storage caverns began in October 1987 and was completed in 1991.

1.3 BRYAN MOUND

The Bryan Mound (BM) site is located in Brazoria County, about 105 km (65 mi) due south of Houston, Texas, and five km (three mi) south of Freeport, Texas, on the east bank of the Brazos River Diversion Channel, near the Gulf of Mexico. The area is highly industrialized, and includes several petrochemical related facilities. Approximately 50 percent of the area's population work in the local area, although many commute to work from outside the immediate vicinity.

The site occupies 237 ha (586 ac) in the southwest apex of a triangle formed by the Brazos River Diversion Channel, the old Brazos River, and the Intracoastal Waterway. A U.S. Army Corps of Engineers silt gate controls the flow of water between the Intracoastal Waterway and the Diversion Channel. Levees, protecting the town of Freeport, form a second 5.5 square km (3.5 sq mi) triangular pattern within the triangle formed by the rivers. A levee parallels the Diversion Channel in a southern direction from Freeport until due west of the site. The levee then turns east, bisecting the site.

Figure 1-4 shows the major water bodies near the site, Blue Lake to the north, and Mud Lake to the southeast. These water bodies generally define the mounded aspect of the Bryan Mound dome, which creates a surface expression in the terrain by rising approximately five m (15 ft) above the surrounding wetlands. Although Blue Lake is within the protective triangle formed by the levee system (with excess rain water drained off by two large pump stations operated by the city of Freeport) there is some drainage through culverts southward into the Intracoastal Waterway. Mud Lake, on the other hand, is connected by a slough to the Intracoastal Waterway.

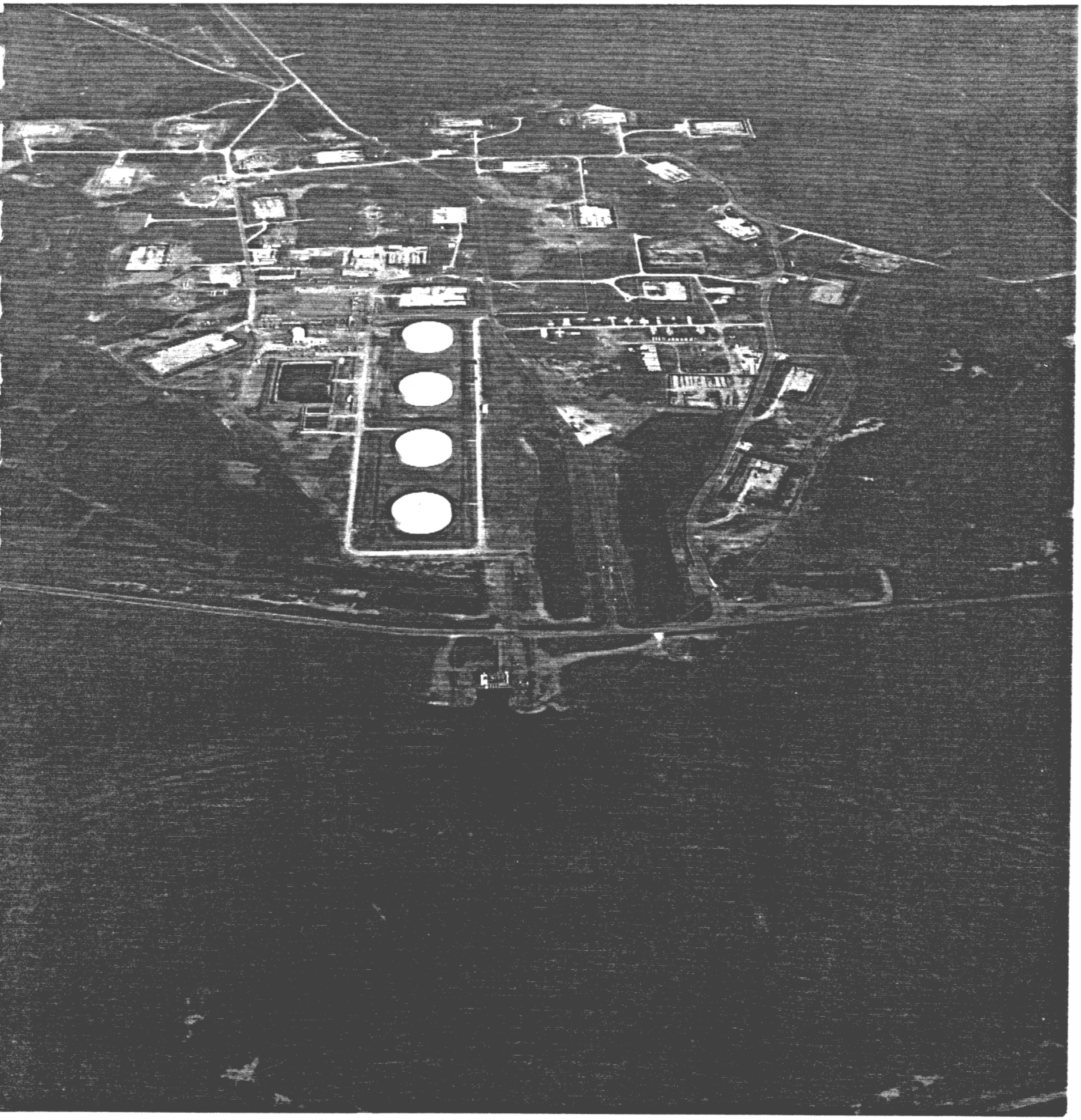

Figure 1-4. Bryan Mound SPR Site

The marsh and prairie areas surrounding Bryan Mound are typical of those found throughout this region of the Texas Gulf Coast. Brackish marshland dominates the low-lying portions of the site in all but the northern area, where the coastal prairie ecosystem extends along the levee paralleling the Brazos River Diversion Channel. The coastal prairie is covered with medium to very tall grasses which form a moderate to dense cover for wildlife. These grasses also occur in unmowed "natural" site areas. Those areas periodically inundated by seawater are dominated by cordgrass.

A diverse range of habitats is created by water bodies surrounding Bryan Mound. Marshes and tidal pools, such as Mud Lake and Bryan Lake, which connect with the Gulf of Mexico by way of the Intracoastal Waterway or the Brazos River, are ideal habitats for a variety of birds, aquatic life, and mammals. Migratory waterfowl, common egret, snowy egret, great blue heron, killdeer, least tern, and black-necked stilt (the latter two are Texas state-protected species), as well as nutria, raccoon, skunk, rattlesnakes, turtles, and frogs can be found on and in the area surrounding Bryan Mound. No federally endangered or threatened species are found on site; however, brown pelican, piping plover, and peregrine falcon inhabit nearby areas. Whooping cranes have been recorded to occur just across the Brazos River Diversion Channel.

Shrimp, crabs, trout, flounder, and redfish are abundant in Mud Lake during various seasons of the year. Black drum, mullet, gar, and blue crab are found in Blue Lake.

A total storage capacity of 35.9 million m^3 (226 MMB) of crude oil in 20 solution-mined caverns is planned for Bryan Mound. Appurtenant facilities include a 91 cm (36 in) brine disposal pipeline extending 20.1 km (12.5 mi) into the Gulf of Mexico, a raw water intake structure adjacent to the site on the Brazos River Diversion Channel, two 76 cm (30 in) crude oil pipelines connecting the site to the Jones Creek Tank Farm 4.8 km (3 mi) northwest of the site, the Phillips docks 6.4 km (4 mi) northeast of the site, and the 102 cm (40 in), 73.6 km (46 mi) crude oil pipeline from the site to the ARCO Refinery in Texas City. A series of brine diffuser nozzles, located at the end of the brine pipeline, disperse brine into the receiving seawater.

1.4 ST. JAMES TERMINAL

The St. James Terminal (SJ) consists of six aboveground storage tanks (total capacity 0.3 million m^3 or two MMB) and two tanker docks, as seen in Figure 1-5. The tank farm area occupies 42.5 ha (105 ac) and the docks occupy 19.4 ha (48 ac). The terminal has separate crude oil pipelines connecting it with Weeks Island and Bayou Choctaw. The site is located on the west bank of the Mississippi River, approximately halfway between New Orleans and Baton Rouge, Louisiana, and 3.1 km (1.9 mi) north of the town of St. James, on Louisiana Highway 18. The area around the site is rural with a number of people living in small settlements along Highway 18, the major thoroughfare in the area. Although some of the work force may commute from New Orleans or Baton Rouge, the majority of the workers are from local labor pools.

The terminal is bounded by the Texas and Pacific Railroad to the west, commercial facilities to the north and south, and the Mississippi River levee on the east between Louisiana Highway 18 and the river. The area adjacent to the Mississippi River

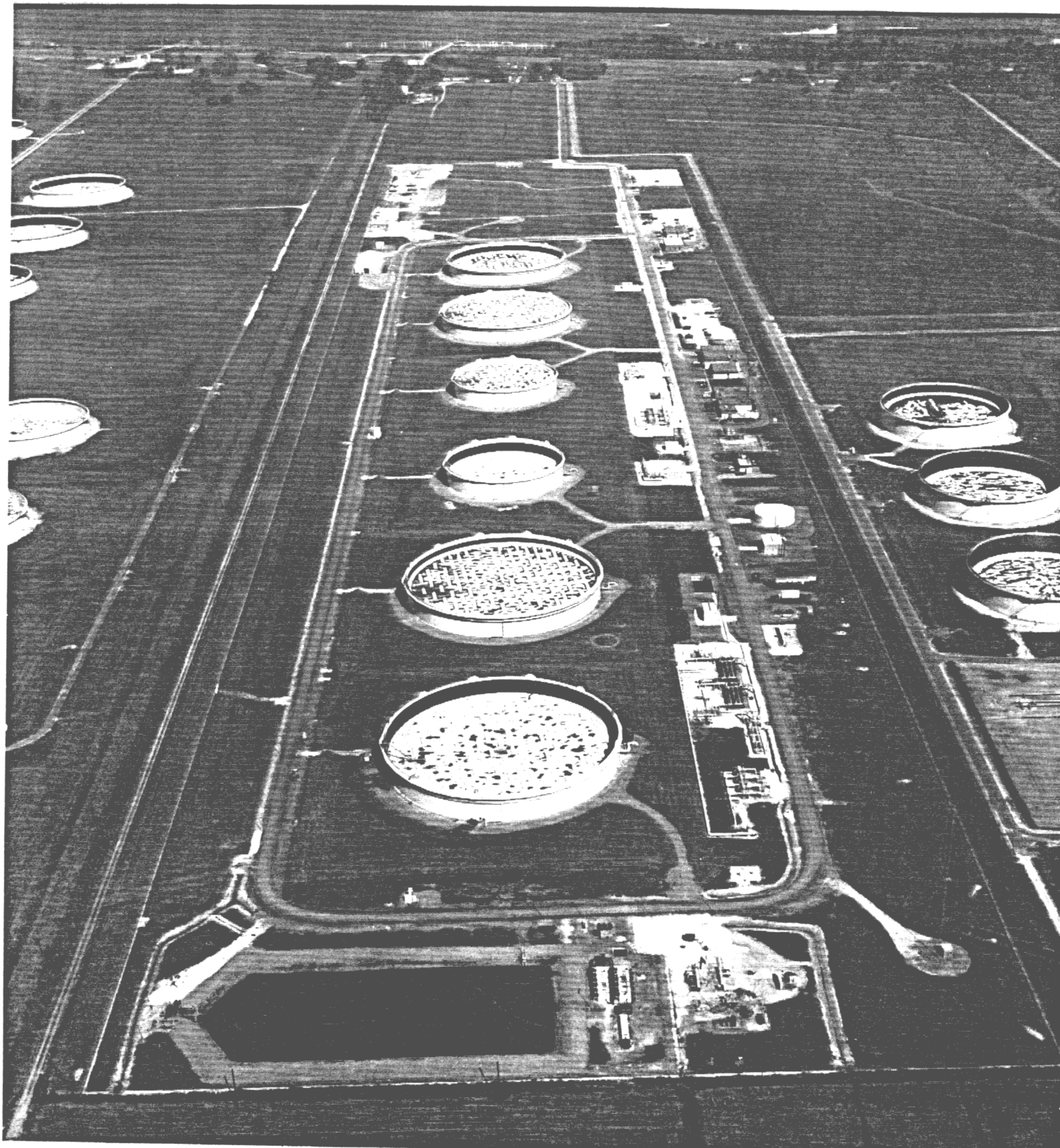

Figure 1-5. St. James SPR Terminal

at the St. James docks (the batture) is a freshwater wetland that is inundated during high water periods. Much of the land area surrounding the terminal is used for pasture and sugar cane cultivation. Per the Threatened and Endangered Species of Louisiana, Parish List (January 25, 1993), it is possible that the following species could be present: 1) sturgeon, pallid - endangered, 2) falcon, artic pergrine - threatened Frogs, snakes, turtles, rabbits, raccoon, armadillo, muskrat, opossum, nutria, squirrels, egrets, ibis, and herons can be found on the site and in the surrounding areas. No federally endangered or threatened species are found on site, however, a southern bald eagle was reported flying along the Mississippi River.

1.5 SULPHUR MINES

The Sulphur Mines (SM) site, approximately 71 ha (175 ac), is located in Calcasieu Parish, 2.4 km (1.5 mi) west of the town of Sulphur, Louisiana (Figure 1-6). There has been considerable industrial activity on and near the site since the late 1800's. The greater part of the work force came from the town of Sulphur, with the remainder from outlying communities and the major urban area of Lake Charles. Four brine disposal wells are located on property owned by the Pittsburgh Plate Glass Company approximately 3.5 km (2.2 mi) southwest of the main site.

Due to the area land contours and differing terrain types, the site is divided into two operational areas, primary (administrative) and secondary (caverns). The secondary site area is bordered on the west, northeast, and north by water bodies. Most of these bodies of water are interconnected and drained by one creek flowing eastward from the site to Bayou

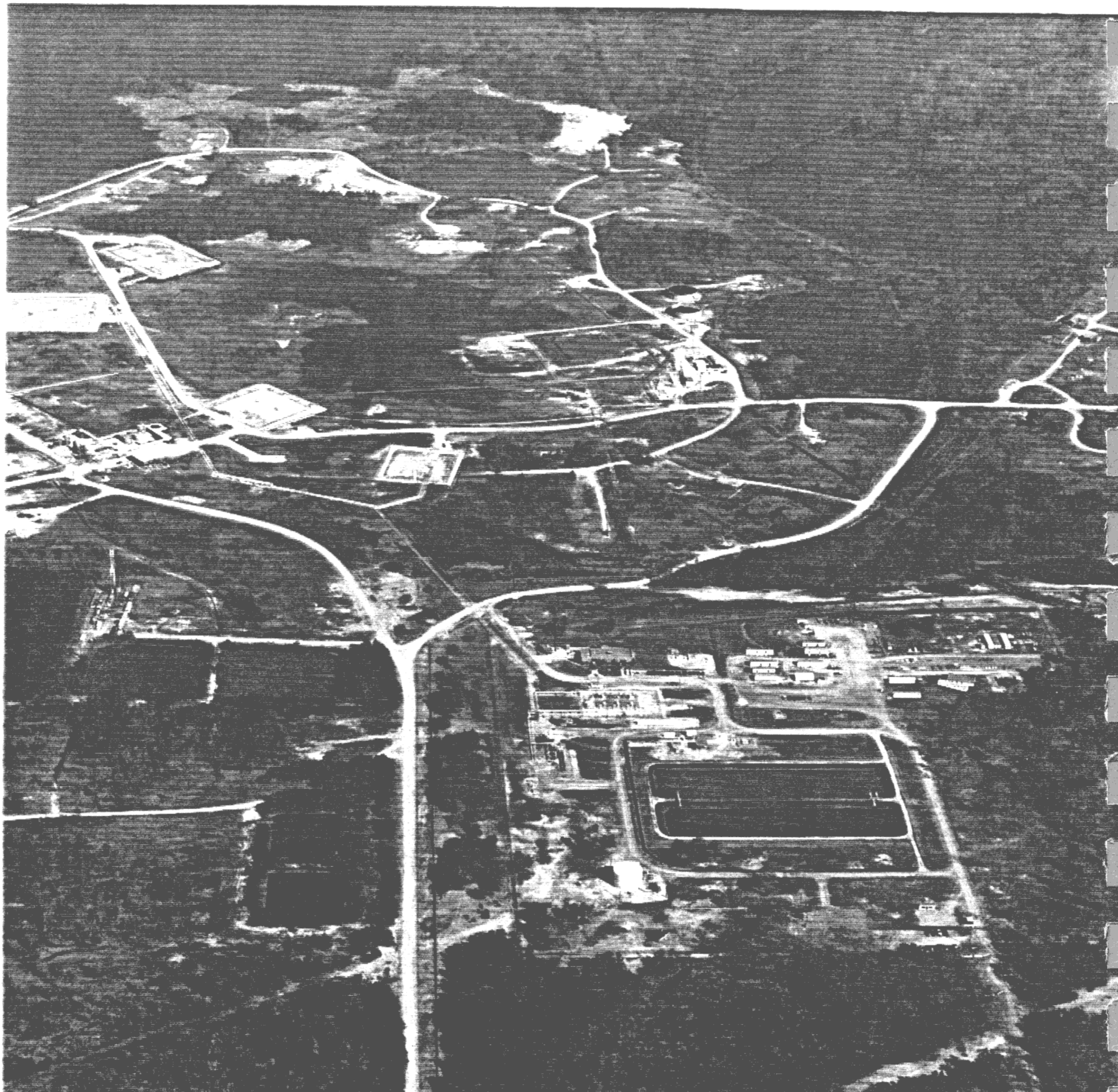

Figure 1-6. Sulphur Mines SPR Site

D'Inde. A floodwater canal is located 0.4 km (0.25 mi) east of the site. Changes in elevation throughout the site are minor, with most of the site four to six m (15 to 20 ft) above sea level. The site proper is normally dry except in the spring season or during heavy rains when high waters sometimes flood portions of it. The lowest elevations are over the center of the dome, where subsidence has occurred as a result of prior sulfur mining activity. Much of the surrounding area is covered with a mixed pine/hardwood forest.

Mammals on site and in the surrounding area include white-tailed deer, raccoon, fox squirrel, cottontail rabbit, opossum, striped skunk, armadillo, nutria, southern flying squirrel, white-footed mouse, and bobcat. Snakes, turtles, frogs, and toads can also be found. Crappie, largemouth bass, sunfish, gar, carp, bowfin, and catfish inhabit shallow ponds on the site. Many bird species including egrets, killdeer, herons, and migratory waterfowl are present. The American alligator, threatened by similarity of appearance, may be found on site. No other federally endangered or threatened species are found on site.

Sulphur Mines stored 4.1 million m^3 (26 MMB) of crude oil in five existing solution-mined caverns three of which form a single gallery. The site was connected to the Sunoco Terminal in Nederland by a 41 cm (16 in), 25.6 km (16 mi) crude oil pipeline which connected to the West Hackberry 107 cm (42 in) line at the Gulf Intracoastal Waterway. The Sulphur Mines pipeline has been decommissioned from the West Hackberry pipeline as part of decommissioning the Sulphur Mines facility. Brine disposal was via injection into four brine disposal wells located approximately two miles (3.2 km) southwest of the site. Transfer of the oil in storage began December 1990 and was completed in early 1992. All other real property was transferred to other SPR sites or distributed as excess property in accordance with Federal guidelines. Abandonment of

Sulphur Mines will improve the efficiency and cost effectiveness of oil storage on the SPR.

1.6 WEEKS ISLAND

The aboveground facility, shown in Figure 1-7, occupies approximately three ha (seven ac) and is located in Iberia Parish, Louisiana, about 22 km (14 mi) south of New Iberia. The surrounding area is sparsely populated. New Iberia, the closest major urban center, supplies the greater part of the labor force. The major employment sectors within the parish are mineral production, manufacturing, construction, and agriculture.

The Weeks Island (WI) salt dome borders Vermilion Bay, which opens to the Gulf of Mexico. The Weeks Island salt mine, developed in the early 1900's by room-and-pillar mining, operated continuously until 1981, at which time operations were moved to another part of the same dome. The land surface over the salt dome forms an "island" caused by domal upthrusting and includes the highest elevation, 52 m (171 ft) above sea level, in southern Louisiana. The area surrounding the island is a combination of marsh, bayous, manmade canals (including the Intracoastal Waterway), and bays contiguous with the Gulf of Mexico.

The Weeks Island site consists of a large mechanically excavated (room and pillar type) salt mine with 11.6 million m^3 (73 MMB) of crude oil storage capacity. In addition to normal site facilities, there is a 91 cm (36 in) 108 km (67 mi) long crude oil pipeline connecting the site to the St. James Terminal.

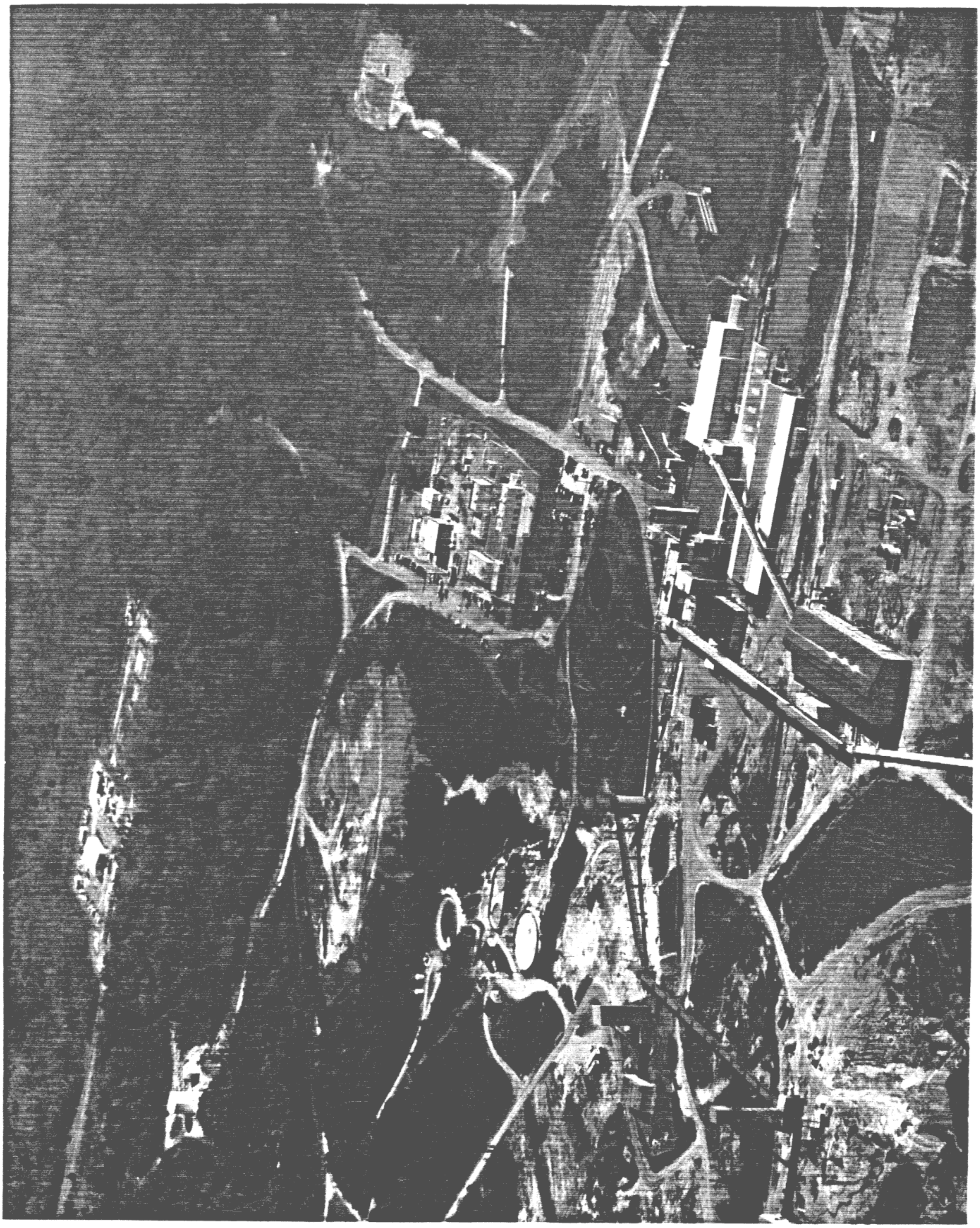

Figure 1-7. Weeks Island SPR Site

The vegetation communities on Weeks Island are diverse. Lowland hardwood species proliferate in the very fertile loam soil common at the higher elevations. The predominant tree species are oak, magnolia, and hickory, which extend down to the surrounding marsh. Pecan trees are also present. Gulls, terns, herons, and egrets are common in the marsh area. Mink, nutria, river otter, and raccoon are the most common inhabitants of the intermediate marshes. Other mammals found at Weeks Island are opossum, bats, squirrels, swamp rabbit, bobcat, white-tailed deer, and coyote. Weeks Island is the home of one of the densest breeding populations of the Louisiana black bear, which has been listed a threatened species by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act. The endangered red wolf has been sighted in Vermilion Parish about 30 miles west. Weeks Island and the surrounding wetlands are also populated by a variety of endangered avian species, including the brown pelican, white pelican, bald eagle, osprey, peregrine falcon, American kestrel, roseate spoonbill, the piping plover, and least tern. The wetlands to the southwest of Weeks Island is a breeding area for least terns. The American alligator occurs in the marshes adjacent to the site.

The water bodies surrounding Weeks Island provide a vast estuarine nursery ground for an array of commercially and recreationally important finfish and shellfish.

1.7 WEST HACKBERRY

The West Hackberry (WH) site is located in Cameron Parish 29 km (18 mi) southwest of Lake Charles, Louisiana, and 26 km (16 mi) north of the Gulf of Mexico. Cameron Parish is the largest and least populous parish in Louisiana. The local economy consists of fishing, shrimping, rice farming, and petroleum production. The work force at the site is derived from local residents of the Hackberry community, the towns of Sulphur and Lake Charles, in Calcasieu Parish, and from recent arrivals to the area.

The site is situated on 229 ha (565 ac) of land on top of the West Hackberry salt dome (Figure 1-8). The dome is covered by a distinct mounded overburden on its western portion, with elevations up to 6.5 m (21 ft), the highest point in Cameron Parish. The majority of the dome is approximately 1.5 m (five ft) above sea level. Two brine disposal well pads occupying approximately 2.5 ha (six ac) are located three km (1.9 mi) south of the site.

Waterways near the site include Calcasieu Lake and the Calcasieu Ship Channel approximately five km (three mi) to the east, and the Intracoastal Waterway approximately six km (four mi) north of the site. Black Lake, a brackish water lake, borders the dome on the northern and western sides. Numerous canals and natural waterways, including Black Lake Bayou, connect Black Lake to Alkali Ditch and then to the Intracoastal Waterway on the eastern side of the site. Black Lake Bayou, referred to locally as Kelso Bayou, continues wandering in a generally easterly direction from Black Lake, eventually connecting with the Calcasieu Ship Channel northeast of the town of Hackberry.

The western part of Cameron Parish consists of marshland with natural ridges extending in a generally east-west direction. These ridges, or cheniers, are stranded former beach lines which affect water flow through the marshes. The cheniers typically support grasses and trees. In many areas, lakes, bayous, and canals are concentrated so that the marsh may not

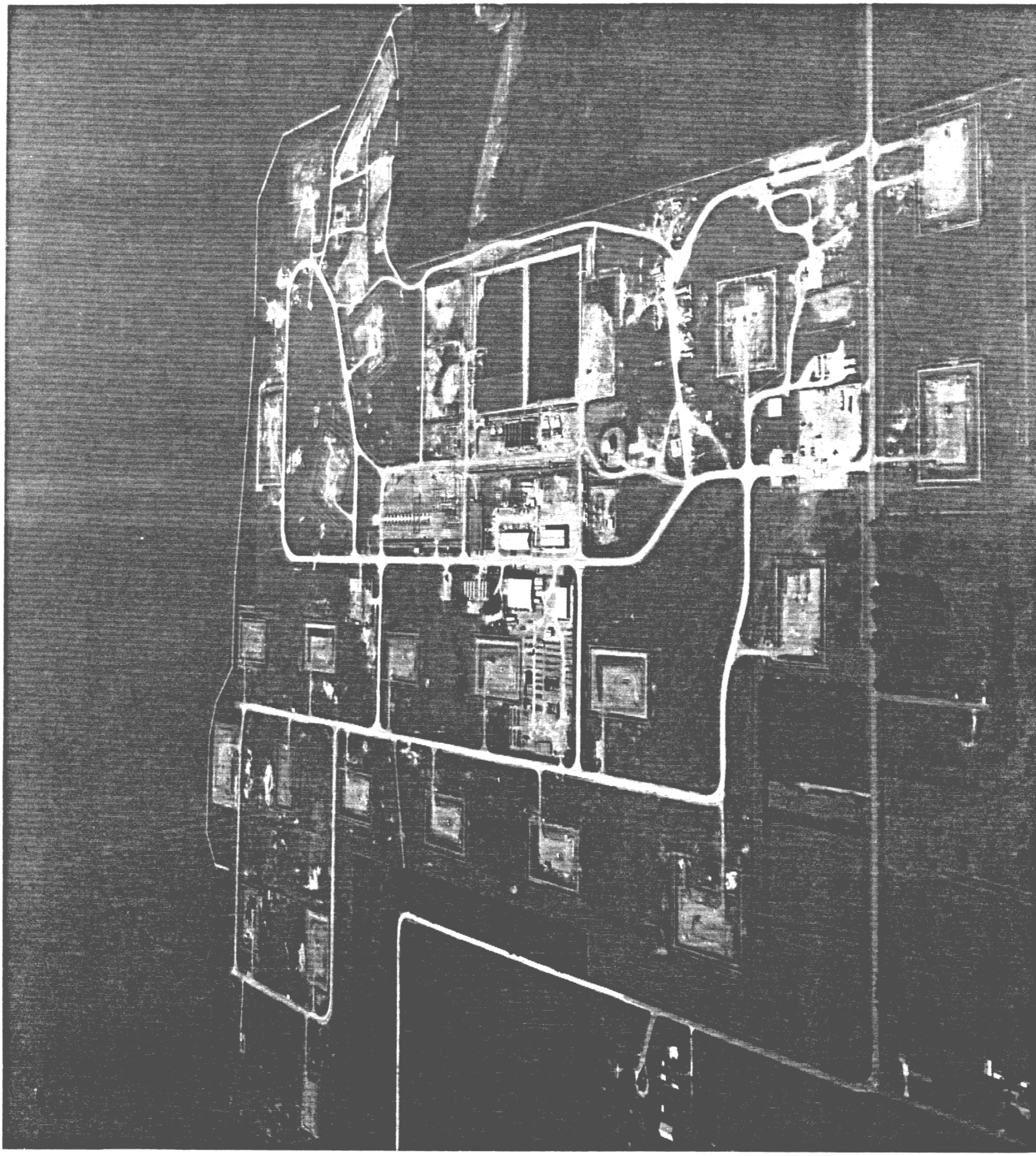

Figure 1-8. West Hackberry SPR Site

seem to be a land mass, but rather a large region of small islands. Marshland closest to the coast generally has the highest salinity levels and lowest species diversity. Vegetation found on site and in the surrounding area of the West Hackberry facility is dominated by Chinese tallow, willow, various oak species, and numerous species of marsh and upland grasses. The marsh lands surrounding West Hackberry and its appurtenant facilities provides excellent habitat for a variety of wetland species. This area is predominantly salt marsh with areas of submerged vegetation. Many wading birds, waterfowl, shore birds, seabirds, and diving birds frequent the area, in many cases breeding and nesting here. The American alligator is extremely common, breeding nesting in this area. A variety of other reptiles, fish, shellfish, and mammals also frequent this area, in many cases breeding and reproducing. Oyster reefs occur in Calcasieu Lake with large concentrations in West Cove. Sport and commercial fishing takes place throughout this area for a variety of species, including fresh water and marine fish and shellfish.

Several species that are protected by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act occur in the West Hackberry area. These include the raptors such as the bald eagle, osprey, and peregrine falcon; wading birds such as the roseate spoonbill and white-faced ibis; and diving birds such as the brown and white pelicans. These species also inhibit the lands through which the SPR pipeline pass.

Also inhibiting the area surrounding the West Hackberry site are snakes, egrets, herons, migratory waterfowl, red-tailed hawk, red fox, raccoon, nutria, opossum, rabbits, and white-tailed deer inhabit the area surrounding the West Hackberry site. Aquatic inhabitants of Black Lake include crabs, shrimp, drum, croaker, spot, sheepshead, mullet, gar, redfish, and catfish. No endangered or threatened species other than the alligator (threatened by similarity of appearance) have been identified on site.

The West Hackberry site will store 34.8 million m^3 (219 MMB) of crude oil in 22 solution-mined caverns. Brine is transported and disposed either by injection into eight active brine disposal wells, or through a 91 cm (36 in), 42 km (26 mi) pipeline to an area 11 km (seven mi) south of Holly Beach, Louisiana in the Gulf of Mexico. A series of brine diffuser nozzles disperse and mix brine into the coastal marine waters. Raw water is brought to the site via pipeline from the Intracoastal Waterway and crude oil is transported between the site and the Sunoco Terminal in Nederland, Texas, via a 107 cm (42 in), 66 km (42 mi) crude oil pipeline.

2. COMPLIANCE SUMMARY

General

The Strategic Petroleum Reserve (SPR) operates in conformance with requirements established by a number of Federal and state statutes and regulations, Executive Orders and Department of Energy (DOE) Orders. The SPR is largely responsible for implementing compliance with the above reference (award fees). The M&O contractor who operated the SPR during 1992 and the first quarter of 1993 which this compliance summary covers was Boeing Petroleum Services, Inc. Effective April 1, 1993, DynMcDermott Petroleum Operations Company will begin as the SPR's new M&O contractor. Compliance status in this year's report therefore reflects compliance activities conducted by DOE personnel and Boeing Petroleum Services, Inc.

Regulatory

Several Federal, state, and local agencies are responsible for enforcing environmental regulations at SPR facilities. The principal regulatory agencies are the Environmental Protection Agency (EPA) Region VI, the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Natural Resources (LDNR), the Railroad Commission of Texas (RCT), The Army Corps of Engineers (COE), and the Texas Water Commission (TWC). These agencies issue permits, review compliance reports, inspect facilities and operations, and oversee compliance with applicable regulations.

DOE Orders/Directives

Expanded baseline ground water surveillance field work was conducted in 1992 at all SPR sites. Additional ground water monitoring wells will be installed for verification where brine (saltwater) contamination is suspected in accordance with the ground water management and inspection program plan.

In 1992, the SPR implemented a new FE requirement for the Safety and Health Five Year Budget Plan by including environmental as part of the budget planning process. This was an extensive task which was accomplished with limited staff resources and will allow for increased emphasis for meeting environmental budgetary needs.

2.1 COMPLIANCE STATUS FOR JANUARY 1, 1992 THROUGH APRIL 1, 1993

Much of the SPR's compliance program deals with meeting regulations under the Clean Water Act. The SPR sites have a total of 73 wastewater and stormwater discharge monitoring stations. The SPR is also required to meet many of the requirements under the Clean Air Act and the Safe Drinking Water Act. Site waste management activities are conducted in accordance with requirements of Section 105 (National Contingency Plan) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). The SPR sites do not generate large quantities of hazardous waste matter and are therefore either Conditionally Exempt Small Quantity Generators (CESQG) in Texas, or Small Quantity Generators (SQG) in Louisiana. The SPR does not treat, store, or dispose of hazardous wastes, and therefore is not a RCRA permitted facility. Each site is identified by an EPA generator number which is used to track the manifesting of hazardous waste for off-site treatment or disposal. The SPR is not a National Priority Listing (NPL) site under CERCLA. No polychlorinated biphenyls (PCBs) contaminated oils or friable asbestos is in use at SPR sites.

The following sections highlight compliance activities at the seven SPR sites by environmental statute.

Clean Water Act (CWA)

In 1992, the seven SPR sites reported five oil spills and nine brine spills in quantities greater than the one barrel (42 gallons) (see Section 3.4 for more details). Total volume of oil spilled in 1992 was 12 barrels and the total volume of brine spilled was 302 barrels. Oil spills are reported to the

National Response Center if they cause a film or sheen and discharge into or upon navigable waters. State agencies require notification if an oil spill exceeds one bbl (LA) or five bbls (TX). Brine spills are reported if they may affect water quality. All spills were immediately cleaned up and no long term impacts were observed.

During the first quarter of 1993 three oil spills and two brine releases occurred, all of which were immediately corrected when discovered. The oil spills ranged from 2 gallons (Big Hill raw water intake structure) to 200 barrels into the Bryan Mound brine pond. Containment and cleanup was accomplished in accordance with the SPCC plan with no observable impacts to the spill area.

The brine spills occurred at Bryan Mound and West Hackberry. The brine spill at Bryan Mound involved a leak on the brine line of an estimated 134 bbls occurring just outside the site property line. Verbal agency notification with written follow-up was provided and continued area monitoring is underway. The West Hackberry incident was a release of an estimated 600 gallons of brine to the ground water via an inadvertent siphon from the brine pond between recovery cycles.

The SPR sites each have a "Spill Prevention, Control and Countermeasures Plan" which addresses prevention and containment of oil spills. All the SPR Spill Prevention, Control, and Countermeasures Plans were updated in 1991 and 1992 in accordance with 40 CFR 112.

Thirty one National Pollutant Discharge Elimination System (NPDES) permit noncompliances occurred out of a total of 8796 permit related analyses performed in 1992 (see Section 5.3 for more detail). These noncompliances involved permit exceedences at the brine discharge, sewage treatment plant, and stormwater outfalls, or were caused by sampling error, mechanical failures, and operator error. Thirty-nine percent of the noncompliances were the result of a single action of disposing 12 samples prior to completing all analyses. A reporting oversight at West Hackberry (exceedence of BOD_5 average) was identified and corrected internally. Noncompliances were of short duration and immediately resolved, causing no adverse environmental impact.

Nine noncompliances have been experienced during the first quarter of 1993. Five of the nine noncompliances experienced during this period were procedural (failure to obtain a sample prior to discharge). The remaining four were excursions of effluent limits. One was an oil and grease value received from a commercial laboratory for a stormwater discharge at Big Hill (thought to have been caused by contaminated glassware). The other three were biochemical oxygen demand (BOD_5) limit and fecal coliform count exceedences at the West Hackberry and Big Hill sewage treatment plants.

Direct supervision of the four SPR laboratories has been transferred from the O&M contractor's management office in New Orleans to the site manager of those sites having laboratories. This delegation of oversight to the field is expected to improve laboratory efficiency.

Clean Air Act (CAA)

Quarterly sampling of all valves and pump seals in service continues to be performed at Big Hill and Bryan Mound as required by the Texas Air Control Board (TACB). Semi-annual inspections of secondary seals for floating roof storage tanks in Texas and annual in Louisiana, and reporting of other emission sources continues to be accomplished at all sites.

During 1992, two SPR sites received modified air permits. St. James Terminal, which is in a nonattainment area for ozone, received a modified LDEQ air permit. The modified permit added new sources such as the emergency generators and air eliminators and reflected actual normal operating conditions during stand-by which result in emissions of less than 100 tpy (tons per year) of volatile organic compounds. However, the St. James site is allowed to emit more than 100 tpy during emergency drawdown of the SPR sites. The Weeks Island facility permit was modified to include the new sources on site such as emergency generators and operational changes during standby.

The LDEQ Form Order received in August 1990 continues to remain under discussion. In 1990, DOE requested a hearing with LDEQ to clarify that MACT (maximum achievable control technology) would not be cost effective or practical because emissions exceeding 100 tpy will occur infrequently (only during SPR drawdown and during emergency/national need). A schedule for the hearing has not been scheduled to this date. A review of all other air permits were conducted 1992. Necessary updates will be performed in 1993 as needed.

All monitoring and reporting requirements have been conducted in accordance with the permit requirements. Review and update of the Big Hill air permit was scheduled for the first quarter of 1993 but subsequently slipped to later in 1993 due to higher priority tasks.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The SPR has not needed or been required to conduct emergency response activities pursuant to this act. DOE Order 5480.14 required all DOE-owned sites to evaluate compliance with CERCLA. DOE Phase I & II reports (similar to CERCLA's Preliminary Assessment and Site Investigation process) were completed in 1986 and 1987 respectively. The reports assessed each site for the potential presence of inactive hazardous waste sites, and recommended no further action under CERCLA. The DOE Phase I & II reports were submitted to EPA, resulting in St. James Terminal, Sulphur Mines, and Bryan Mound sites being listed under Federal Facility Docket. The SPR has coordinated with the EPA this period and relisted all SPR sites as No Further Remedial Action Plan sites to reflect the findings in the reports. All SPR sites are classified as generators (small quantity or conditionally exempt small quantity) and have never operated hazardous waste treatment, storage, or disposal facilities. No hazardous substance releases have occurred.

Superfund Amendments and Reauthorization Act (SARA)

Reporting requirements under the Superfund Amendments and Reauthorization Act (SARA) (Title III, Tier Two) do apply and were completed. The 1991 SARA Title III, Tier Two report was completed and distributed, as required, by March 1, 1992. All the 1992 Title III, Tier Two reports were distributed prior to March 1, 1993, as required, to the various state and local emergency planning committees, and local fire departments.

Safe Drinking Water Act (SDWA)

The SPR oil storage caverns and brine disposal wells are regulated by the SDWA. The SPR operates 25 salt water disposal wells in Louisiana. The Louisiana Department of Natural Resources (LDNR) issued a single Compliance Notice in 1992 regarding a saltwater disposal well permitted in Louisiana. The notice required a resurvey of the cement bond log of a saltwater disposal well at the Sulphur Mines site. The resurvey was completed in 1992 to LDNR's approval.

The West Hackberry facility negotiated a corrective action plan for a leaking brine pond with LDNR in February 1992. The CAP requires submission of quarterly groundwater monitoring reports. LDNR has requested a conference with DOE, scheduled for April 1993, to discuss recurring recovery pump failures.

Bryan Mound, St. James, and West Hackberry are on local municipal water supply. West Hackberry completed site piping modifications, similar to other sites with municipal water supplies, to prevent the backflow of fluids into the local water system. Sulphur Mines, and Weeks Island have on-site ground water wells for nonpotable use and bottled water. Bayou Choctaw has potable well water that has been permitted for potable use by the state, with distribution piping to all water fountains in process. Big Hill uses bottled water but has its own non-community, non-transient water supply. In March 1990 Big Hill's water supplies received Texas Department of Health (TDH) approval to operate. when wells are fully operational. The SPR and TDH are currently coordinating new sampling and reporting requirements for the Big Hill system. Funding (fiscal year 1993) has been provided to tie both the Big Hill and Weeks Island sites to the local potable water systems in Winnie, TX, and Lydia, LA, respectively, reducing the testing requirements and eliminating the need for bottled water. No drinking water upgrades are planned for Sulphur Mines because the site has been decommissioned.

Resource Conservation and Recovery Act (RCRA)

In 1992, the SPR manifested hazardous waste from all SPR sites for offsite treatment/disposal. The wastes consisted primarily of spent paint solvent, paint still bottoms, solvent contaminated oils, out-of-date chemicals, and aerosol cans. The SPR submitted notification forms of regulated waste activity to the EPA for all SPR sites. In 1992, accumulated monthly waste volumes exceeded the SQG generator threshold once at the Weeks Island SPR site. Subsequent to that single exceedence, the site applied for and received reinstatement of

SQG status. The SPR is operating under existing permits and continues to coordinate actions with appropriate regulatory authorities. No site has exceeded their SQG or CESQG status in 1993 to date.

The SPR has USTs which are used for the storage of diesel and unleaded gasoline. There are two USTs at Bayou Choctaw, three at Big Hill, two at St. James, and two at Weeks Island, and are all registered under the UST program as required. Plans are underway to remove all USTs and replace them with above ground storage tanks.

UST leak detection began at Weeks Island in December 1992, based on the age of the USTs. The leak detection program consists of monthly product inventory control and annual tank and pipe tightness testing.

USTs at Weeks Island and Big Hill were tightness tested in December 1992, as required by state and Federal regulations; however, pressurized piping on USTs only at Big Hill was not tightness tested as required. Piping will be tested in 1993 at Big Hill, and all USTs will be brought into a leak detection program by December 1993.

Toxic Substances Control Act Construction (TSCA)

PCB's and friable asbestos construction materials are not known to have been used at SPR sites. A recent laboratory inspection identified nonfriable asbestos in the Bryan Mound fume hood and acid storage cabinet. Exposed edges will be sealed to limit employee exposure. Tests have indicated that the limited asbestos present on the SPR is nonfriable. All nonfriable asbestos (gaskets, insulation) is disposed in accordance with applicable regulations as solid waste to local municipal landfills. All liquid-filled electrical equipment used on the SPR is PCB free due to Federal regulations prohibiting their use. As a result of a Tiger Team audit finding, SPR hydraulic equipment will be tested for presence of PCB as opportunity avails to assure its absence.

National Environmental Policy Act (NEPA)

The SPR has issued a draft Environmental Impact Statement (EIS) on the proposed expansion of the SPR to a one billion barrel reserve in 1992. Public hearings on the draft EIS were conducted at five locations (Freeport and Port Arthur, TX, New Iberia, LA, and Hattiesburg and Pascagoula, MS) and the public review period was extended to July 1993. The EIS will also cover SPR routine activities such as maintenance work orders and service orders, precluding individual NEPA environmental assessment and categorization of each activity (10 CFR 1022 will apply to non-routine).

The Environmental Assessment (EA) for the brine line replacement and diffuser relocation project at Bryan Mound was issued for public comment with comments received in 1992 and response to these comments in early 1993. As a result of the EA and these comments, a FONSI (Finding of No Significant Impact) is expected to be issued in 1993. An EA for the use of herbicides along the SPR crude oil pipeline rights-of-way was begun in December 1992. The determination is expected to be completed in January 1994.

One hundred thirty-three projects were submitted for NEPA review action in 1992. All but two resulted in either a categorical exclusion from further NEPA action or had previously been covered under existing NEPA documentation. The projects, proposed vegetation management by herbicidal spraying, and the development of a plan to extract the remaining 7.5 million bbls of oil from the Weeks Island mine during a drawdown, are being considered for EA preparation. Thirty-seven projects were submitted for NEPA review action in the first quarter of 1993, none of which required an EA or an EIS.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

All pesticides and herbicides were used in accordance with manufacturers recommendations. Restricted use pesticides were applied by licensed commercial applicators.

Endangered Species Act (ESA)

The SPR coordinated ESA requirements with the U. S. Fish & Wildlife Service (F&WS) and other appropriate state agencies in conjunction with the Bryan Mound brine line replacement project Environmental Assessment. There were no ESA issues requiring action, and the construction permit from the Corps of Engineers (COE) was issued.

National Historic Preservation Act (NHPA)

NHPA related activities were coordinated with appropriate State Historical Preservation Offices during NEPA activities. Onshore and offshore historical site surveys were conducted in conjunction with the Bryan Mound brine line EA. No historical or cultural sites were found.

Oil Pollution Act (OPA) of 1990

Final regulations from EPA, the U. S. Coast Guard (USCG), and the Department of Transportation (DOT) regarding development of the response plans and implementation of OPA were not promulgated as required. DOT issued an interim final rule effective January 5, the USCG issued an interim final rule February 5, just 13 days before the statutory deadline, and EPA issued a proposed rule with no effective date on February 17. Facility Response Plans (FRPs were therefore prepared in accordance with DOT regulations for pipelines; with NVIC 7-92 (Navigation Vessel Inspection Circular) which is acceptable under the interim final rule, for the USCG; and, in accordance with statutory requirements for EPA. The SPR wrote and distributed seven separate FRPs for the six active sites and the offsite crude oil pipelines. These plans were submitted as required to the EPA, DOT, and USCG on February 18, 1993.

Texas passed parallel legislation (Oil Spill Prevention Response Act) requiring operators in Texas to prepare Discharge Prevention and Response Plans (DPRPs) for each facility. DPRPs were written and submitted to the General Land Office in Texas for both Big Hill and Bryan Mound in August 1992.

Executive Order 11988, "Floodplain Management" and Executive Order 11990, "Protection of Wetlands."

The M&O contractor received a written commendation from the COE for an initiative taken at the Sulphur Mines site to remove third party, unpermitted fill in wetlands, during 1992.

Louisiana Administrative Code, Title 33 (LAC:33)

Surveys taken at all SPR facilities and the commercial facility in Houston storing SPR piping were submitted to LA in 1991 indicating that NORM (naturally occurring radioactive material) readings did not exceed action levels beyond background levels at any site. No other action is required by the state or DOE.

During 1992 and the first quarter of 1993 coordination with regulatory agencies was conducted in regards to CAA, CWA, CERCLA, RCRA, ESA, NHPA, and Executive Orders 11988 and 11990. No activity has been required relative to TSCA and FIFRA. Coordination activities involved information gathering and interpretation of regulations to assure proper compliance.

2.2 CURRENT ISSUES AND ACTIONS (JANUARY 1, 1992 THROUGH APRIL 1, 1993)

General

During 1992, the SPR has maintained a status of low risk to the environment. NOVs have declined significantly from 10 (all administrative) in 1990 to one (a request for resurvey of a cement bond log) in 1992. The 1992 NOV was satisfied by the submission of a new survey. Spills and releases have also declined significantly from 27 in 1990 to 13 in 1991 and 14 in 1992. No long-term adverse environmental impact resulted from any spill or release. There have been no NOVs in 1993 to date. The SPR was notified by LDEQ of nonpayment of NORM fees. The SPR has responded that the fees do not apply, based on the negative results of the NORM survey. LDEQ had not made a final determination on the NORM issue at the time of this report.

The quarterly "look ahead" program, initiated in 1991 to provide visibility and highlight upcoming permit requirements, such as integrity tests and reports to agencies, has been continued through 1992 and first quarter of 1993.

All stored crude oil at the Sulphur Mines site was transferred to Big Hill and West Hackberry. The site was officially decommissioned in the first quarter of 1992, and is awaiting sale or transfer. Information required for the transfer by 40 CFR 373 was provided, indicating that no known hazardous waste disposal areas exist on site.

For the first quarter of 1993 the major action on the SPR has been the preparation and delivery of six Facility Response Plans (FRPs) to EPA, one FRP to DOT and one FRP to the USCG for relevant SPR sites in accordance with the Oil Pollution Act of 1990.

Tiger Team Assessments/Environmental Audits

The DOE Tiger Team visited the SPR during 1992, assessing all environmental programs in accordance with established protocol. In their final report, 84 findings (72 compliance findings and 12 best management practice findings) were identified in environmental media. A Corrective Action Plan (CAP) was prepared and approved by headquarters. The actions identified in the CAP have been scheduled based on funding, and are tracked to completion. Three compliance findings were closed in 1992 and one compliance finding in the first quarter of 1993.

Prior to the Tiger Team assessment, the SPRPMO and the M&O contractor conducted a self assessment, which the SPRPMO completed in the fourth quarter of 1991 and the M&O contractor completed in the first quarter of 1992. The M&O contractor's yearly self-assessment was completed February 1993. Findings from each of the self-assessments are tracked to completion in the Consolidated Corrective Action Plan (PMO) and the Master Action Tracking System (contractor).

CAA

Due to changes in the CAA, the existing air permits at all SPR sites are being reevaluated to incorporate new requirements. Completion of the review and receipt of modified permits at two SPR sites was completed in 1992. Review and update, with revisions as necessary, of the remaining sites is expected in 1993.

LDEQ Air Quality Division performed an inspection of St. James's which included records and activities regarding tank seal gap measurements in 1992. There were no findings from this inspection.

CERCLA

A representative from LDEQ visited Bayou Choctaw under the misunderstanding that the site was inactive/ abandoned. The inspector was provided a guided tour and corrected the error.

CWA

Inspections in 1992 and the first quarter of 1993 were performed by LDEQ. The agency's previous recommendation, to have duplicate laboratory records available for inspection at the sample site(s), was closed by the reinspection. A site visit to Bryan Mound was made by the Railroad Commission of Texas (RCT) as follow-up to a spill notification in 1992. Renewal applications for the LA Water Discharge Permit System permits for the Bayou Choctaw, Sulphur Mines, and Weeks Island sites were prepared and forwarded to LDEQ. TWC and EPA did not perform water discharge permit inspections of any SPR site during this time period.

Preliminary site visits were made by DOE and BPS personnel to gather the information needed for the preparation of new stormwater permits required for industrial areas. Notices of Intent were submitted for each SPR site which resulted in the issuance of General Permits. In addition a Pollution Prevention Plan was also prepared for each site in accordance with the new stormwater regulations. The plans are to be implemented by October 1, 1993.

Delivery of routine compliance reporting (monthly and quarterly NPDES DMRs) and annual waste inventory and underground injection reports were submitted to appropriate agencies in accordance with deadlines.

SDWA

A single LDEQ inspection of the West Hackberry and Sulphur Mines sites' ground water monitoring program was conducted in

1992 with no violations. The single NOV from LDNR (see Section 2.1, SDWA) is being resolved.

Findings from the brine pond ground water studies at West Hackberry and Bryan Mound indicate that ground water contamination from leaking brine ponds or buried piping has occurred at varying levels at both sites. Additional monitoring and recovery wells to remove brine contamination from ground water were installed at West Hackberry. Field work to assist with CAP preparation to further identify, control, and/or remediate brine contamination at Bryan Mound was implemented in 1992. Results of the screening studies will be used to define subsequent actions. Affected ground waters at both sites are naturally brackish and not suited for domestic or agricultural use, this will be a significant factor in determining whether future action is needed.

Efforts continued on the ground water corrective action at West Hackberry, continued preparation of the laboratory sampling and analysis plan, and update of the permits manual.

NPDES

Routine environmental reports and notifications have been submitted as required by applicable codes and permits. Seven applications to renew NPDES permits controlling discharges from SPR sites are currently unsigned by the operator until the new M&O contractor is in place, scheduled for April 1, 1993.

ESA

The Weeks Island facility was visited by the U. S. Department of Agriculture (USDA), Animal Damage Control, to assess the Louisiana black bear issue. The site, along with neighboring facilities, is working with the USF&WS, USDA, LA Department of Wildlife and Fisheries, and the Louisiana Nature Conservancy to prevent harm to the bears and ensure worker safety.

As part of the agency coordination involved with the Bryan Mound brine line NEPA EA, a five and one-half month surveillance of the brine line right-of-way was conducted to determine the presence of piping plover. To date no sightings have been made on the right-of-way.

A southern bald eagle nest has been identified in the general area near Bayou Choctaw. Its exact location is being plotted to prevent any undue SPR activity near the nest. Piping plover, brown pelican, and peregrine falcon have been identified in the vicinity of Bryan Mound.

2.3 SUMMARY OF PERMITS (JANUARY 1, 1992 THROUGH APRIL 1, 1993)

Permits currently in effect include seven NPDES permits, seven CAA permits, 45 COE wetlands permits (Section 404 of CWA), and over 100 oil field pit, underground injection well, and mining permits. In addition, a number of corresponding state discharge and other state and local permits are in effect.

A construction permit for the Bryan Mound replacement brine line was issued for the project from the Galveston District COE. The SPR is awaiting a discharge permit from the RCT. General permits for stormwater associated with industrial activity were issued for each SPR facility and the warehouse located in New Orleans.

3. ENVIRONMENTAL PROGRAM OVERVIEW

The environmental program is implemented by a prime contractor for the SPR on behalf of the United States Department of Energy (DOE) (who holds the environmental permits). The environmental program is designed to support the SPR through tasks aimed at avoiding or minimizing adverse environmental effects from the SPR on surrounding lands and water bodies.

The monitoring and inspection program was originally developed under guidance of the SPR Programmatic Environmental Action Report, Site Environmental Action Reports, and DOE Orders. This program includes monitoring permitted National Pollutant Discharge Elimination System (NPDES) outfalls and air emissions, conducting other required Federal and state inspections, and regular sampling and analysis of site-associated surface and ground water quality. This makes possible the assessment of environmental impacts and early detection of water quality degradation that may occur from SPR operations.

The results of the individual program areas such as air quality monitoring and reporting, NPDES compliance, water quality monitoring, and ground water monitoring, for 1992 are discussed in sections 5 and 6.

3.1 ASSOCIATED PLANS AND PROCEDURES

Associated plans and procedures developed to support the SPR environmental program include group-specific Spill Contingency Plans with spill reporting procedures, site-specific Spill Prevention, Control, and Countermeasures Plans, the Environmental Programs and Procedures Manual that includes a Solid Waste Management Plan, an Underground Injection Control Plan, and a Fugitive Emissions Monitoring Plan. Plans and procedures for ground water protection, pollution prevention awareness, and waste minimization were prepared in 1990, and issued in early 1991. Compliance with Federal, state, and local laws, regulations, and permits has been accomplished in part by implementation of these plans and procedures and by performing routine reviews and updates of those plans.

3.2 TRAINING

Site Environmental and Emergency Response Team (ERT) personnel have received training in environmental plans and procedures. Site management personnel are knowledgeable of environmental procedures, spill reporting procedures, the group-specific Spill Contingency Plans, the site-specific Spill Prevention, Control, and Countermeasures Plans, and compliance awareness. Compliance awareness training is conducted by the individual site environmental specialists at each of the SPR sites. During this training, site personnel learn about applicable regulatory requirements. Several sessions of an environmental awareness course were provided to DOE and contractor management and staff in 1991.

ERT personnel from all sites participate in annual spill response refresher training by the Texas A & M University, Engineering Extension Service. Onsite training is also provided in spill cleanup and control. Site response personnel are trained to rapidly and effectively contain and cleanup oil, brine, and hazardous substance spills under the special circumstances unique to each SPR site.

3.3 REPORTING

Proper operation of the SPR with respect to the environment involves several types of reports and reporting procedures. The basic reports are summarized briefly in this section.

3.3.1 Spill Reports

The spill contingency plans include procedures for reporting spills to the SPR contractor, DOE, and appropriate regulatory agencies. Specific reporting procedures are dependent upon several key factors including the quantity and type of material spilled, immediate and potential impacts of the spill, and spill location (e.g., wetland or water body). Any spill considered significant at the site is first verbally reported to site management and then to the SPR contractor management in New Orleans and the onsite DOE representative. These procedures contained in contractor operating procedure 22OP-21 "Reporting of Spills," have been simplified and condensed to a credit card-like document for attachment to identification badges and to a laminated placard for handy desk reference. Verbal notification to the appropriate regulatory agencies follows when necessary. Final written reports from the site are submitted after cleanup, unless otherwise directed by the DOE or appropriate regulatory agency.

3.3.2 Discharge Monitoring Reports

Wastewater discharges from SPR sites are authorized by the Environmental Protection Agency (EPA) through the NPDES Program. Depending on site specific permit requirements, discharge sample analyses are reported to the state and EPA monthly (Big Hill, Bryan Mound, and West Hackberry), and quarterly (Bayou Choctaw, Saint James, Sulphur Mines, and Weeks Island). Included in the report is an explanation of the cause and actions taken to correct any noncompliance or bypass.

3.3.3 Other Reports

The SPR contractor provides several other reports to or on behalf of DOE. These reports include:

a. Fugitive Air Emissions for Bryan Mound (quarterly);
b. Emission Inventory Questionnaire Status update for Bayou Choctaw, St. James Terminal, Sulphur Mines, and Weeks Island (annually);
c. Air Quality Construction Status Report for West Hackberry (semi-annually);
d. Permit Tracking System review and update (annually and quarterly);
e. Monthly Noncompliance and Spill Report with an annual summary for all sites;
f. Environmental Audit Reports for each site (annually);
g. Water Usage for Bryan Mound and Big Hill (annually);

h. Raw Water Usage and Brine Discharge Data for Big Hill, Bryan Mound, and West Hackberry (monthly)
i. Louisiana Annual Generator's Hazardous Waste Report
j. Performance Indicator Program (quarterly)
k. OMB Circular A-106 Environmental Project Plan (semi-annually)
l. Louisiana Industrial Nonhazardous Waste Report
m. Environmental Protection and Implementation Plan DOE Order 5400.1 (annual revision)
n. Annual Monitoring Report (RCT:H-10)
o. Plug and Abandon Report (as needed)
p. Work Resume Report (LDNR as needed)
q. Texas Annual Waste Summary Report (if CESQG status is exceeded)
r. ES&H Five-Year Plan

3.4 OIL SPILLS: RECAPITULATION

In 1992, the total amount of oil moved (received and transferred internally or sold) was approximately 3.1 million m^3 (19.47 MMB). The total number of crude oil spills, total volume spilled, and the percent volume spilled of total volume moved are shown in Table 3-1 for each year from 1982 through 1992.

The oil spills involving quantities in excess of 0.16 m^3 (one barrel (bbl)) that occurred during 1992, both contained and uncontained, are presented in Table 3-2. Oil spills in excess of one barrel are comparable to 1985 to 1988 levels. All five of the spills were small. No spills of oil occurred during the months of January, February, March, May, July, September, October and December.

Each of the five spills experienced during 1992 had different causative factors. These factors varied from sump overflow during excessively heavy rainfall to failure of gaskets or loss of oil during routine valve maintenance. No trend is readily apparent from this year's data.

Table 3-1. Number of Crude Oil Spills

Year	Total Spills	Volume Spilled m^3 (barrels)	Percent Spilled of Total Throughput
1982	24	847.0 (5,328)	0.00704
1983	21	380.9 (2,396)	0.00281
1984	13	134.8 (848)	0.00119
1985	7	85.4 (537)	0.00122
1986	5	1232.5 (7,753)	0.01041
1987	5	2.5 (16)	0.00002
1988	6	8.8 (55)	0.00001
1989	11	136.4 (858)	0.00004
1990	14	74.8 (467)	0.00003
1991	6	37.9 (237)	0.0004
1992	5	1.9 (12)	0.00006

Table 3-2. 1992 Oil Spills

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
04/29/92	**WH**	**0.32 m^3 (2 bbls)**	**Excessive rainfall in a short duration caused the sump at the (2 bbls) High Pressure Pump Pad (HPP) to overflow. The oily water spread onto the grassy area north of the pad. The ERT was activated and the sheen was contained and then recovered. The rainfall event was 8" in 8 hours.**
06/08/92	**WH**	**0.32 m^3 (2 bbls)**	**A frac tank was being dewatered by a vacuum truck at the anhydrite pond and oil was allowed to enter the suction line. The oil was discharged to the anhydrite pond and subsequently recovered.**

Table 3-2. 1992 Oil Spills cont.

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
08/05/92	BC	0.0009 m^3 (0.006 bbls)	An estimated 1 quart of oil was lost from a temporary containment set up to collect spillage during valve maintenance on a remote pipeline. The oil produced a sheen on a navigable waterway but was contained and recovered. Because of the sheen the NRC was notified.
08/07/92	BH	0.32 m^3 (2 bbls)	An estimated 2 bbls of oil was lost from a valve seat and O-ring failure at a pressure relief valve. The valve was blocked in and repaired. Oil and contaminated soil were removed.
11/10/92	SJ	0.95 m^3 (6 bbls)	Failure of a check valve and mercoid pump switch allowed a sump to overflow into an adjacent ditch. The sump was receiving oil from a pig launcher at a rate faster than the pump-out capacity and the failed alarm did not sound to halt operations. The spill was contained and recovered. The switch and alarm were replaced.

3.5 BRINE SPILLS: RECAPITULATION

The SPR disposed of 1.78 million m^3 (11.11 MMB) of brine (mostly saturated sodium chloride solution, some discharges were of lower salinities than normally attributed to brine) during 1992. Approximately 39% of the brine was disposed in the Gulf of Mexico via the Big Hill (29.4% of the total), and Bryan Mound (9.6% of the total) brine disposal pipelines. The remainder was disposed in saline aquifers via injection wells at the Bayou Choctaw (33.3% of the total), West Hackberry (27.4% of the total) and Sulphur Mines (0.4% of the total) sites. In 1992, no disposal of saltwater occurred at the West Hackberry off-shore pipeline and less than 0.1% of the total was disposed at permitted offsite disposal wells.

The total number of spills, total volume spilled, and percent volume spilled of total volume disposed are shown in Table 3-3 for each year from 1982.

The brine spills involving quantities in excess of 0.16 m^3 (one bbl), both contained and uncontained, during 1992 are discussed in Table 3-4.

Corrosion/erosion has been the leading causal factor for brine spills over the past few years. Other types of failures (gasket/flange/other equipment) have contributed somewhat. The second major factor is operator error. However, during 1992 only one of the nine spills is attributable to operator error. The remaining spills were the result of equipment failures of pipes or valves and two incidents involving overflows from rainfall. Eight of the spills accounted for only 168 barrels of the brine released in 1992. The brine line failure at the Bryan Mound facility constituted the remainder of the spilled volume. As provided in Table 3-3, over the period 1982 to 1992 CY'92 produced the least spilled volume. This low total volume was realized even though the total spills increased over 1991 and one of the spills was a leak in a brine disposal line. The good record is probably reflective of quick site response.

Table 3-3. Number of Brine Spills

Year	Total Spills	Volume Spilled m^3	(barrels)	Percent Spilled of Total Disposed
1982	43	443.8	(2,792)	0.0005
1983	44	259.4	(1,632)	0.0002
1984	17	314.0	(1,975)	0.0003
1985	16	96,494.8	(607,000)	0.1308
1986	7	275.6	(1,734)	0.0017
1987	22	96.5	(608)	0.0003
1988	12	93.8	(586)	0.0001
1989	17	131,231.6	(825,512)	0.1395
1990	12	11,944.3	(74,650)	0.0170
1991	7	1,156.8	(7,230)	0.004
1992	9	48.0	(302)	0.003

No significant long term adverse environmental impact was observed from any SPR brine spills as evidenced by subsequent surveys and water quality monitoring.

Table 3-4. 1992 Brine Spills

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
1/15/92	BM	0.32 m^3 (2 bbls)	Excessive rainfall raised the level of the main pond sufficiently to cause a seep to form outside along the west side. An estimated 2 bbls. leaked before the pond level was dropped and the spillage recovered.
6/15/92	WH	8.75 m^3 (55 bbls)	A leaking gasket at a valve on the firewater pond released an estimated 55 bbls of salt water (65 ppt). The salt water flowed overland and into Black Lake. Salinities were monitored and the leak repaired.
6/22/92	WH	1.19 m^3 (7.5 bbls)	Excessive rainfall recieved over a short duration caused the excavation excavation for the firewater pond valve repair project (6/14/92) to overflow. The excavation contained salt water (49 ppt). Salinities were monitored in Black Lake. The valve repairs were completed and the excavation backfilled.
8/11/92	WH	3.26 m^3 (20.5 bbls)	A Post Indicator Valve (PIV) valve supplying fire water to an onsite fire fire monitor leaked an estimated 20.5 bbls of salt water (29 ppt). Heavy rain irrigated the spill site. The leaking valve was replaced.
8/20/92	WH	4.29 m^3 (27 bbls)	An estimated 27 bbls of salt water (53 ppt) was lost from a leaking Post Indicator Valve (PIV 131). The salt water was released to an area of grassy cover west of Cavern 9. The valve was replaced.

Table 3-4. 1992 Brine Spills cont.

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
9/17/92	WH	0.64 m^3 (4 bbls)	Fugitive salt water spray escaped through an open tanker truck top during routine required reconditioning of salt water disposal well 2B. The escaped fugitive spray affected the ground surrounding the parked truck at the well pad. No recovery was possible. The area was flushed with fresh water and vacuumed.
10/01/92	WH	7.95 m^3 (50 bbls)	An estimated 50 bbls of salt water (62 ppt) was lost to an excavation made to conduct repairs on a leaking PIV for the fire water system. The water was vacuumed and placed into the brine pond for disposal.
10/02/92	WH	0.32 m^3 (2 bbls)	An estimated 2 bbls of salt water (38 ppt) was lost from an underground break in a firewater line located adjacent to Cavern 11. PIVs were blocked in to isolate the the leaking portion of line and repairs were made. The surface area affected was flushed with fresh water and vacuumed.
11/23/92	BM	21.31 m^3 (133 bbls)	Evidence of a failure of the brine disposal pipeline was discovered during a reconnaissance survey below the BM site. Subsequent investigations found that two flows of brine to the Gulf occurred which could have leaked. An estimate of the combined leakage based upon the charactersistics of the repaired hole and flow durations and pressures indicate a volume of 134 bbls line were lost. The area impacts are being assessed and monitored.

3.6 WASTEWATER DISCHARGE COMPLIANCE

In 1992, a total of 8,796 analyses were performed to monitor wastewater discharge quality from the SPR in accordance with NPDES and corresponding state permits. Although 31 noncompliances were reported (Tables 5-2 through 5-8), the SPR was in compliance with permit requirements for approximately 99.6% of the analyses performed. During the calendar year (CY) 1992, 17 (55%) of the permit noncompliances experienced on the project were due to sampling or sampling related phenomena. These sampling related noncompliances were only 50% more numerous than the permit [parameter] excursions or exceedances. Combining these two categories of noncompliant events covers 97% of the noncompliances experienced in 1992.

In overview, 17 (55%) of the noncompliances were related to sampling, sample handling, or sample data management; 12 (39%) of the noncompliances represented limits being exceeded; three (9%) were bypasses of treatment devices and one (3%) was an event related to depleting oxygen in a brine flow to the Gulf (brineline operations).

Corrective actions implemented to mitigate noncompliance recurrence included developing or modifying applicable procedures, retraining and certifying personnel, initiating special studies, and repairing faulty equipment.

3.7 PIPELINES

The SPR owns 325 miles of pipelines for transporting either crude oil, raw water, or brine. The crude oil lines tie each site into a terminal for distribution during a drawdown to refineries by pipeline, tanker, or barges. These oil lines are to transport oil to the SPR for to fill with crude oil.

The raw water lines bring water to the sites for solution mining to create the caverns in the salt domes and during drawdown to displace the crude oil. The brine disposal pipelines either dispose of brine in saline underground aquifers or offshore in the Gulf of Mexico, as authorized by permit. Brine discharges occur during solution mining, fill-refill, and to relieve pressures from cavern creep.

The pipelines are routinely inspected by designated pipeline crews, periodic overflights, coupon monitoring, pigging, and various testing including integrity flow tests and ultrasonic testing.

3.8 WASTE MINIMIZATION PROGRAM

The waste minimization program was implemented to reduce the generation of all wastes including hazardous and nonhazardous sanitary wastes. The most significant SPR-wide waste minimization accomplishments during 1992 were:

- Sulphur Mines Decommissioning Activities
- Tracking Nonhazardous Waste Generation
- Initiation of WMin Interdepartmental Team
- Development of the Aerosol Products Handling Program
- Expansion of the Paper Recycling Program SPR-wide
- Development of the Qualified Products List
- Inspection of Recyclers and Disposal Sites

The SPR generated only RCRA hazardous and sanitary wastes. All SPR sites except Weeks Island generated less than 220 lbs of RCRA hazardous waste per month thus maintained Small Quantity Generator/Conditionally Exempt Small Quantity Generator status throughout 1992. RCRA hazardous waste generation declined by 1.2% from 1991 to 1992.

Sanitary waste (municipal, industrial, and oilfield) is disposed off-site. Generation of sanitary waste declined by 3.3 per cent from 1991 to 1992.

Paper, used oil burned for energy, antifreeze, and scrap metals are recycled off-site. The amount of paper recycled increased from 1991 to 1992.

The SPR hazardous waste generators handling training now includes compliance, waste handling, and waste minimization components. Topics covered include 40 CFR and 49 CFR regulations, DOE Orders, and hazardous waste characterization, quantification, handling, and documentation, including site-specific applications. The details of "What is Hazardous Waste?" are available in the lesson plans and the handout booklet. Training is provided annually.

The Environmental Control staff initiated nominating individuals for Team Player awards to recognize workers for extraordinary waste minimization activities. During 1992, eight recipients received U.S. Saving Bonds and were pictured in the ESPRIT.

SPR Waste Minimization Interdepartmental Team conducted SPR wide monthly conference calls to discuss waste minimization. All employees were provided with a copy of the booklet "Hazardous Products at Home" with an insert on recyclers in Louisiana and Texas on Earth Day. Waste minimization information appeared in "Wellspring" and ESPRIT, SPR-wide publications.

During the Sulphur Mines decommissioning, unused products were returned to the vendor, transferred to other SPR sites for use, redistributed for use through the federal excess property system, or donated for use to appropriate organizations. These products included paint, gasoline, diesel fuel, and crude oil.

Efforts continue to search for new methods of waste minimization.

3.9 SPECIAL ENVIRONMENTAL ACTIVITIES

Several examples of SPR environmental activities implemented during 1992 are discussed in this section. During 1992, audits and assessments, including a detailed tiger team inspection, were used to identify and prioritize needs. This process identified resource requirements necessary to achieving environmental excellence and provided a mechanism for incorporating these requirements into long range planning. Several new programs were developed and implemented in response to regulatory and legislative requirements at both the state and Federal level.

BPS conducted environmental audits of the of SPR site operations throughout the year. The objective of these audits was to establish an annual snapshot of operational compliance with federal and state regulations, DOE orders, and pertinent procedures.

A tiger team assessment of the SPR was performed in March and April, 1992. The tiger team identified 84 environmental findings, half of which were identified by the SPR DOE and M&O contractor self assessments. Key points made by the tiger team were that SPR activities do not pose an undo environmental risk, people are motivated to do the job right, and the ES&H culture has a foothold.

The SPR prepared discharge prevention and response plans for the Big Hill and Bryan Mound sites, and submitted them to the Texas General Land Office (GLO) in 1992, in accordance with the Texas Oil Spill Prevention and Response Act (OSPRA), a state equivalent to the Oil Pollution Act of 1990. These plans were accepted by the GLO as fulfilling the requirements of OSPRA, and related site inspections are expected in 1993. The SPR also began preparation of facility response plans (FRPs) for all SPR facilities and the pipelines, except the New Orleans office complex and the decommissioned Sulphur Mines facility.

Completed FRPs were submitted in February 1993 to the U.S. Department of Transportation Research and Special Programs Administration, the U.S. Coast Guard, and the Environmental Protection Agency for all off site SPR pipelines, the St. James dock facilities, and the tank farm and storage facilities at each site, respectively.

Ground water activities continued to receive attention during 1992. The SPR initiated a hydrogeological study of all sites for the purpose of establishing a ground water baseline at each site. The first phase of the study, which consisted of a conductivity survey to indicate potential salt contamination, and a soil vapor survey to indicate potential oil contamination, was completed. Based on this screening data the second phase, consisting of sampling to verify potential areas of contamination and installation of monitoring and recovery wells if necessary, will be initiated in 1993. Additional recovery and monitoring wells were installed at the West Hackberry brine pond contamination area in 1992 in order to enhance remediation efforts there. Considerable effort was also spent on attempting to maintain and enhance recovery efficiency of the existing recovery wells.

The Weeks Island site initiated product inventory monitoring for its two underground storage tanks (USTs) in 1992, as required based on their age. Tank tightness testing was conducted at this facility and the Big Hill facility as required by the state and federal UST regulations.

A disruption of food supplies caused by hurricane Andrew caused Louisiana black bears, a threatened species, to begin frequenting the Weeks Island facility, climbing fences and entering buildings. The SPR worked with other companies at Weeks Island, the Louisiana Department of Wildlife and Fisheries, U.S. Fish and Wildlife Service, and the Nature Conservancy, to implement an integrated approach to limit the nuisance. Actions taken included tight management of putrescible wastes, locking and moving dumpsters away from the facility, and application of cayenne pepper as a deterrent. Bear sightings declined at the end of 1992 as seasonal changes, coupled with the described actions, began to take effect.

A variety of waste minimization activities were undertaken in 1992. Procedures were developed and implemented to reclaim Freon from air conditioner maintenance activities, refill and recondition laser printer cartridges, expand the paper recycling program to include the sites, and depressure and empty spent aerosol containers in order to reclassify them as nonhazardous. While decommissioning the Sulphur Mines site in 1992, considerable effort was spent on placing the remaining inventory of products at other facilities for eventual use, and excessing materials not needed in order to avoid generation of waste material. Many materials for which no alternative use could be identified were recycled or reclaimed, rather than disposed. An interdepartmental waste minimization team, composed of representatives from each site and the project management office, was established during 1992. This group provides a communications conduit throughout the SPR and across disciplines, for funnelling waste minimization ideas to the project management office for program initiation, and for disseminating waste minimization programs, procedures, and ideas to each of the sites.

A product screening and approved inventory list was developed and implemented in 1992. This program screens SPR chemical and material purchase requests against EPAs list of 17 pollutants targeted for reduction, the list of extremely hazardous substances, hazardous substances and their reportable quantities, and the potential for resulting in production of hazardous wastes. Purchase requests which fail the initial screening process are evaluated for availability of acceptable substitute products. Where acceptable substitutes do not exist, less hazardous or limited quantities of products are authorized for purchase. The net effect of this program is expected to be a long term reduction in quantities of hazardous wastes generated, and hazardous materials stored and used on site.

National Environmental Policy Act (NEPA) actions included hearings at five locations on the draft environmental impact statements (EIS) for the SPR expansion to one billion barrels capacity. Potential expansion sites are located in Louisiana, Mississippi, and Texas. The final EIS should be published in 1993. A draft environmental assessment (EA) was prepared for the Bryan Mound brine disposal pipeline replacement and will be finalized in early 1993. Preparation of an EA for control of vegetation on the 240 miles of SPR crude oil pipeline right-of-ways was initiated in 1992 and is expected to be completed in 1993.

The SPR Environmental Advisory Committee (EAC) was renewed for up to four more years. Significant actions taken on by the committee in 1992 included a special session during which all tiger team environmental findings were reviewed and prioritized, and active participation in the SPR expansion environmental assessment process. The EAC has also provided significant input on operational areas such as emergency shutdown technology for SPR pipelines crossing environmentally sensitive areas, and planning for risks presented to the SPR by neighboring industries.

Several additional activities worth noting occurred during 1992. A study was initiated to determine the presence of the piping plover, an endangered shore bird with potential habitat along the Bryan Mound brine disposal pipeline right-of-way. The results of this study will be used to determine if the construction schedule for the brine disposal pipeline replacement needs to accommodate feeding and pairing activity critical to reproduction of this species. Use of pentachlorophenyl treated wood was banned due to its hazardous characteristics and classification as hazardous waste when spent. Copper chromium arsenate treated wood is being used as a less hazardous substitute. The Boeing Company conducted a corporate level audit of the SPR about six months after the tiger team. The Boeing audit identified the SPR as in concert with operating procedures and constituting a satisfactory method for ensuring environmental compliance, predicated on correction of nine deficiencies and full implementation of the environmental program. The SPR laboratories began acquiring new equipment, for certain oil tests, that use smaller samples and generates less hazardous waste than the previously used testing.

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4. ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

There are no radioactive process effluents from any SPR facility. The only radioactive materials at any SPR facility are sealed sources in certain field instruments.

4.1 SEALED SOURCES

A total of 90 nuclear density gauges (SGH Model Nos. 5190, 5191, and 5202) are located on pipelines within the Bayou Choctaw, West Hackberry, Sulphur Mines, and Bryan Mound sites. The gauges are used for monitoring fluid density changes (oil versus brine) in pipelines. Each gauge unit contains between 100 and 4000 millicuries (mCi) of cesium 137. Gauge wipe tests are performed every three years as required by the general license. The DOE is a general licensee under the manufacturer, Texas Nuclear. No radiation leakage has been detected to date.

4.2 NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM)

In 1989, LA amended its radiation regulations to require a survey to determine the locations and contamination levels of NORM in the oil and gas industry. The M&O contractor has contracted for each of its sites to be surveyed, especially in the laydown yards where pipe is stored. It is believed that radioactive material becomes bound with the pipescale and pipewall coatings that result from oilfield drilling activity. A cursory inspection using a geiger counter was conducted. This preliminary inspection revealed no NORM present. The contracted survey, conducted at all SPR sites and the commercial pipe yard where SPR piping is stored, was completed in early 1991. The results, no readings of elevated levels at any location, were submitted to the state as required. No future monitoring is anticipated due to the negative results of a NORM survey conducted in 1991.

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5. ENVIRONMENTAL NON-RADIOLOGICAL PROGRAM INFORMATION

A primary goal of DOE and the SPR contractor is to ensure that all SPR activities are conducted in accordance with sound environmental practices and the environmental integrity of the SPR sites, and their respective surroundings, is maintained.

Effective environmental monitoring (separate from discharge permit compliance monitoring) provides a mechanism for assessing the impact of SPR activity on air, surface water, and ground water (section 6). Site monitoring programs were developed as management tools to provide the information necessary for limiting unwarranted environmental impacts, thus serving the public interest by ensuring environmentally sound operation of the SPR.

5.1 AIR QUALITY

During 1992, air emissions were monitored primarily through measurements and calculations from operating data. Volatile hydrocarbons from valves, pumps, seals, storage tanks, tankers, and brine ponds are the predominant air emissions from SPR facilities. They are monitored for permit compliance at Big Hill and Bryan Mound using an organic vapor analyzer. The quantity of hydrocarbon emissions increases at several sources (tanks and brine ponds) with increases in oil throughput. Less emissions occur during periods of static storage. Small amounts of hydrogen sulfide are released from some crude oils handled and stored by the SPR. Estimated emissions associated with the SPR were generally lower between 1989 and 1992 as compared to 1982 through 1988 due to the reduction in fill activity. Emissions based on throughput was calculated for the Bryan Mound tanks only and is discussed in the Bryan Mound subsection. Dust emissions from most site roads are mitigated through paving or application of dust control agents.

5.1.1 Bayou Choctaw

During 1992, Bayou Choctaw, located in a nonattainment area for ozone, operated in accordance with air quality regulatory requirements. Total emissions from the facility were calculated using method AP-42 (EPA, 1985) to be less than nine metric tons/year(10 tons/year) (a "nonsignificant facility" as noted in the air quality regulations for Louisiana). Nonsignificant facilities are exempt from emissions monitoring requirements. There were some minor configuration changes which would result in minimal additional air emissions during 1992. No air quality monitoring using actual monitoring equipment was required or conducted during 1992.

5.1.2 Big Hill

The Big Hill facility, located in a nonattainment area for ozone, operated in accordance with applicable air quality regulatory requirements and all conditions of the air quality permit. This included wetting plant roads with water and dust abatement chemicals to control fugitive dust emissions. Annual hydrocarbon emission monitoring, as required by the permit, began in 1990 when crude oil fill was initiated. This monitoring involves testing for fugitive VOC emissions from valves and pump seals on a quarterly basis in accordance with EPA Method 21. There was one valve in 1992 that was considered to be leaking and was fixed. The secondary tank seals for the surge tank BHT-7, inspected annually in accordance with Federal and State regulations, were within required limits. Inspection of the secondary seals are now required semi-annually by TACB.

5.1.3 Bryan Mound

The Bryan Mound facility, located in a nonattainment area for ozone, operated in accordance with all air quality regulatory requirements throughout 1992. The ongoing fugitive emissions monitoring program, as required by the TACB, includes monitoring for fugitive VOC emissions from valves and seals on a quarterly basis using a VOC detector in accordance with EPA Method 21. The program also includes monthly calculations of emissions based on crude oil throughput for each storage tank. There was one valve in 1992 that was considered to be leaking and was fixed. Hydrocarbon emissions from surge tanks were calculated at 2.27 metric tons (2.5 tons) during 1992.

5.1.4 St. James Terminal

St. James Terminal, located in a nonattainment area for ozone, operated in accordance with all air quality permit and regulatory requirements during 1992. An application for modifying the air permit was submitted to LDEQ in July 1992. The modifications included operational changes to the site and the addition of other sources such as emergency generators and air eliminators. Approval for the permit modification was received August 17, 1992. The permitted emissions during stand-by are 27.2 metric tons per year of hydrocarbons (30 tons per year) with allowance to exceed 100 metric tons per year during drawdown. Secondary seal gap measurements were also taken and were within required limits. No air quality monitoring using actual monitoring equipment was required or conducted during 1992.

5.1.5 Sulphur Mines

Sulphur Mines operated in accordance with all air quality permit and regulatory requirements during 1992. Sulphur Mines was decommissioned in March 1992 with only a small amount of crude oil transferred during this period (<20,000 bbls). Hydrocarbon emissions, based on crude oil throughput, were well below levels cited in the Emissions Inventory Questionnaire (0.2 metric tons (440 pounds)/year for withdrawal mode of operation). No air quality monitoring using actual monitoring equipment was required or conducted during 1992. This SPR site is located in a nonattainment area for ozone.

5.1.6 Weeks Island

Weeks Island is one of two SPR sites in an attainment area for ozone. An LDEQ inspection of the site on May 4, 1992 revealed some minor deficiencies. Several new sources such as emergency generators and diesel storage tanks had not been identified in the air permit. Application for a modified air permit was submitted on August 12, 1993 and received approval On September 8, 1992. The modified air permit reflects the stand-by emissions at the site as 5.5 metric tons per year (6.1 tons per year) of hydrocarbons and 8.2 metric tons per year of nitrous oxides (9.03 tons per year). Air quality monitoring using actual monitoring equipment was neither required nor conducted during 1992.

5.1.7 West Hackberry

West Hackberry, located in an ozone attainment area, operated in accordance with all air quality permit and regulatory requirements during 1992. Hydrocarbon emissions were well below the 50.4 metric tons (55.4 tons) permitted for filling operations. Air quality monitoring using actual monitoring equipment was neither required nor conducted during 1992. There were no construction or configurational changes which would have resulted in additional emissions during 1992.

5.2 SURFACE WATER QUALITY MONITORING

During 1992, the surface waters of the Bayou Choctaw, Big Hill, Bryan Mound, Sulphur Mines, and West Hackberry SPR sites were sampled and monitored for general water quality. This monitoring is separate from, and in addition to, the water discharge permit monitoring program and is not required by any Federal or state regulatory agency. Surface water quality monitoring was not conducted at St. James Terminal or Weeks Island because of the low potential to impact surface waters on these two sites. Table 5-1 identifies frequency of specific parameters measured at each SPR site. Variations in the data are discussed by site following the water quality monitoring discussions.

5.2.1 Bayou Choctaw

Samples collected monthly at each monitoring station were used to monitor surface water quality. Specific monitoring stations are identified by letter in Figure 5-1. Parameters monitored in the Bayou Choctaw surface waters included pH, salinity, temperature, dissolved oxygen (DO), and oil and grease. A discussion of each parameter follows. Years without data are shown as blank in the following graphs.

5.2.1.1 Hydrogen Ion Activity (pH)

The hydrogen ion activity, or pH, remained essentially neutral (7.0) in most cases. The 1982 through 1992 data have remained relatively constant in terms of median pH and range. The slight fluctuations observed are attributed to a variety of environmental and seasonal factors, such as variations in rainfall or aquatic system flushing.

PHYSICO-CHEMICAL PARAMETERS	SAMPLE IDENTIFICATION AND FREQUENCY BY SITE																
	DAILY						WEEKLY			MONTHLY							QTR
	BC	BH	BM	SJ	SM	WH	BH	BM	SM	BC	BH	BM	SJ	SM	WI	WH	SJ
pH	15, 17-20 101 HPP SWD1 SWD2 SWD3	003	101-116 1,2 4,5 TX-001 002	001		001 6-9, 11 101-117 HPP SOT			001, 002 2,4, 6,7, HPP	001 002 A-F	001 002 004 A-G	001 A-J		A,B D-G	01A 01B 002	002 A-F 001 004	002 003
SALINITY		001	001			001 HPP			002	A-F	A-G	A-J		A,B D-G		A-F	
TEMP.		001	001			001				A-F	A-G	A-J		A,B D-G		A-F	
TOTAL DISSOLVED SOLIDS						001	001	001								A-F	
TOTAL SUSPENDED SOLIDS						001	001 002	001	004	001 002	004	002*			01B 002 003	002 A-F	002 003
DISSOLVED OXYGEN		001	001			001				A-F	A-G	A-J		A,B D-G	A-F		
BOD_5								001	004	001 002	004	002*			01B 002	002	002 003
COD			TX-001 1,2 4,5 101-116									A-J					
OIL & GREASE	15, 17-20 101 HPP SWD1 SWD2 SWD3	001 003	001 101-116 1,2 4,5 TX-001	001		001 6-9 11 101-117 HPP			2,4, 6,7, HPP						01A	004	
TOC		003		001		6-9 11 101-117 HPP SOT		001		A-F	A-G	A-J		A,B D-G	E	A-C E-F 004	
FECAL COLIFORM															01B 002	002	
RESIDUAL CHLORINE		004	TX-002														
FLOW	001 002 15, 17-20 101 HPP SWD1 SWD2 SWD3	001	TX-001, 001	001		001 HPP**	002 004**	TX-002*	001, 002, 2,4, 6,7, HPP			002*	002 003		01A 01B 002 003	002 004	

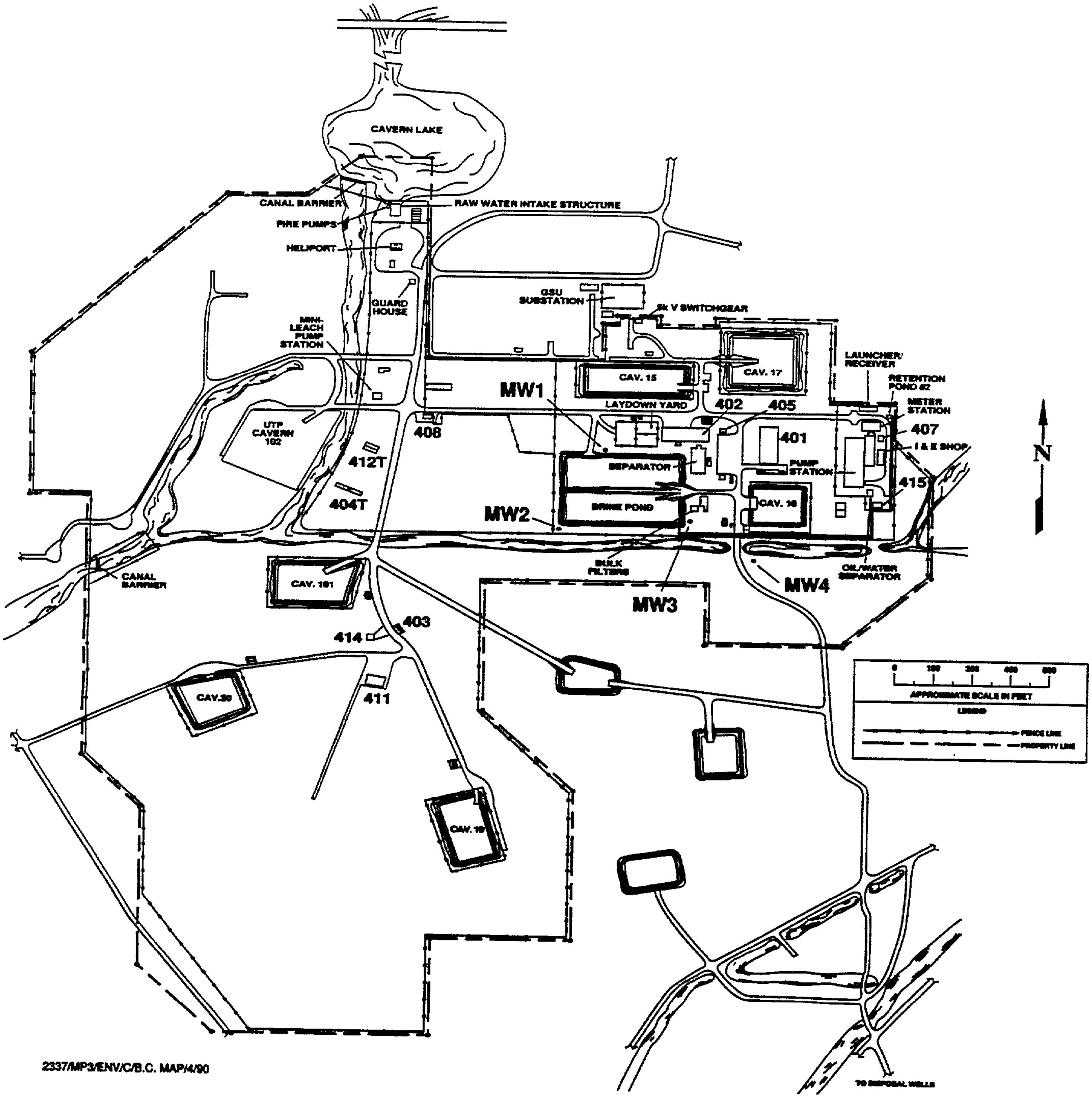
Sampling performed twice per indicated period.
** Sampling performed 5 days/week.

HPP: High Pressure Pump Pad
SWD: Salt Water Disposal (Injection Well)
SOT: Slop Oil Tank

Table 5-1. Physiochemical Parameters

NOTE: Water quality stations (lettered stations) are sampled for possible detection of any adverse environmental condition on and in the waters surrounding the SPR sites.

BAYOU CHOCTAW



2337/MP3/ENV/C/B.C. MAP/4/90

Figure 5-1(Sheet 1 of 2). Bayou Choctaw Environmental Monitoring Stations

Discharge Monitoring Stations

001 Discharge from sewage treatment plant (administration building)

002 Discharge from sewage treatment plant (control building) stormwater discharges

Stormwater and pump flush from pump pads

Stormwater runoff from well pads 15, 17-20, and 101

Water Quality Monitoring Stations

A Canal north of Cavern Lake at perimeter road bridge

B North-South Canal at bridge to caverns 10, 11, and 13

C East-West Canal at Intersection of road to brine disposal wells

D East-West Canal at cavern 10

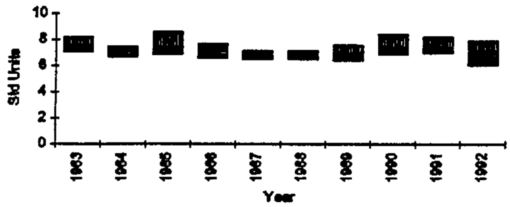
E Wetland Area near well pad 20

F Wetland Area near well pad 19

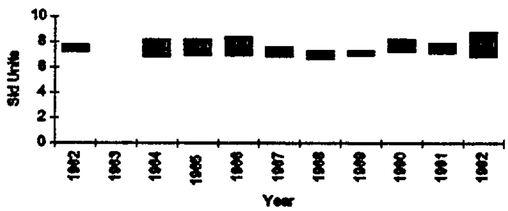
G Near Raw Water Intake

Figure 5-1 (Sheet 2 of 2). Bayou Choctaw Environmental Monitoring Stations

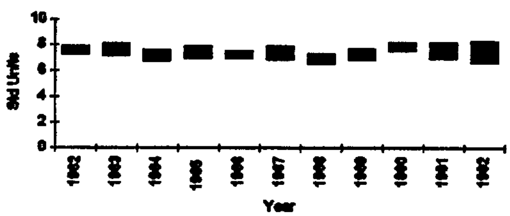
Bayou Choctaw
pH Sample Point A

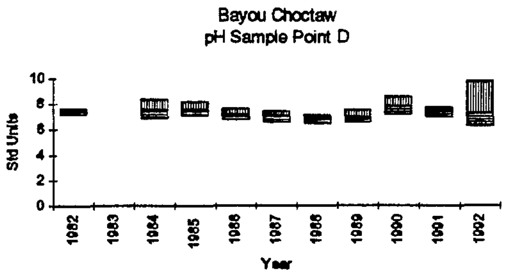


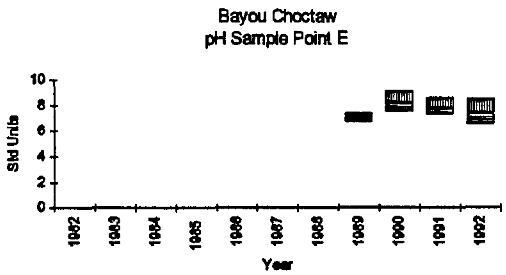
Bayou Choctaw
pH Sample Point B

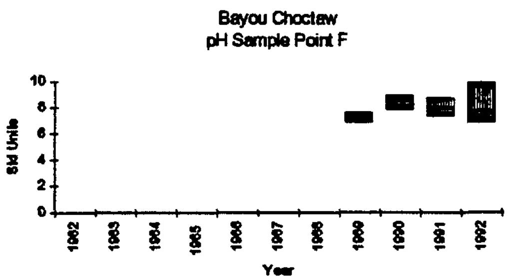


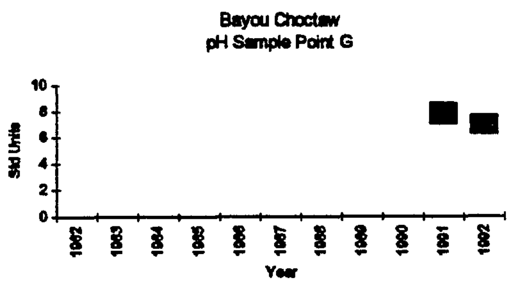
Bayou Choctaw
pH Sample Point C




Bayou Choctaw
pH Sample Point D
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
pH Sample Point E
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

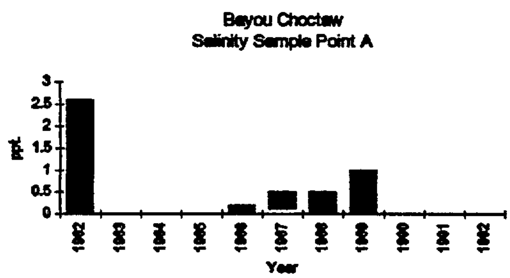

Bayou Choctaw
pH Sample Point F
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

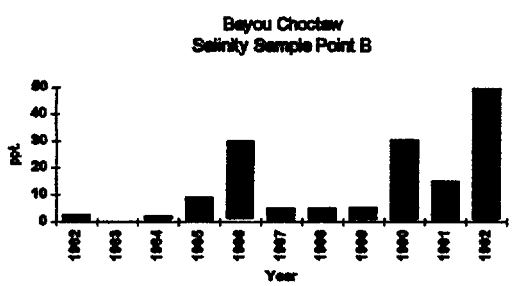

Bayou Choctaw
pH Sample Point G
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

NOTE: Scale between stations changes to show long term variation with greater amplitude.

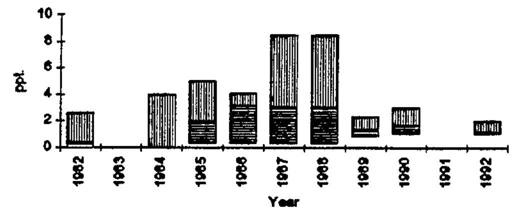
5.2.1.2 Salinity

Average annual salinities remained less than 1.0 ppt, at all monitor stations during 1992 except B and C which averaged 5.9 and 1.1 ppt respectively. A spike observed at station B occurred in August and could possibly have received offsite contamination from a neighboring facility. Additionally, the effects of Hurricane Andrew passing over the Gulf Coast may have imparted some minor shortterm alterations to the salinity measurements as a peak was noted during August at most of the stations.

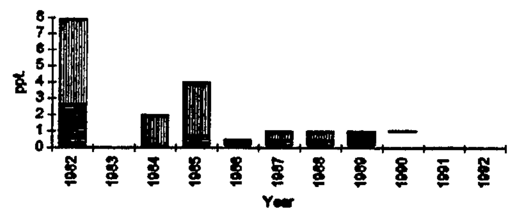




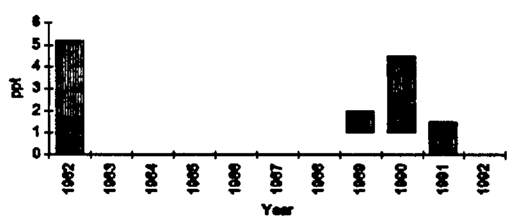
Bayou Choctaw
Salinity Sample Point C

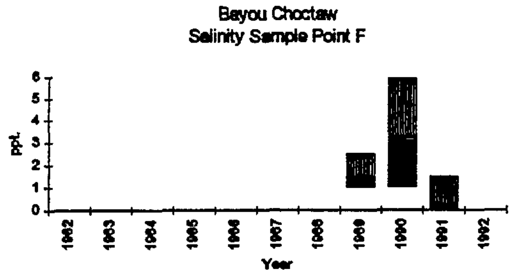


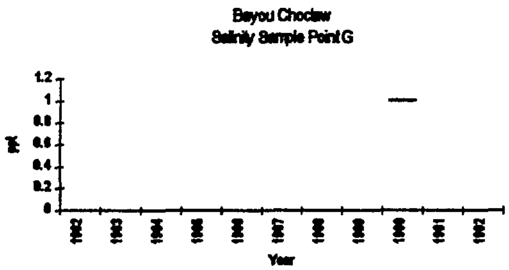
Bayou Choctaw
Salinity Sample Point D



Bayou Choctaw
Salinity Sample Point E





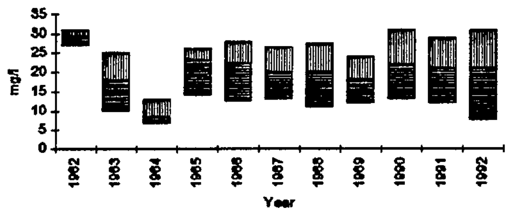


Salinity at sample point
G was below detection
limits in 1992

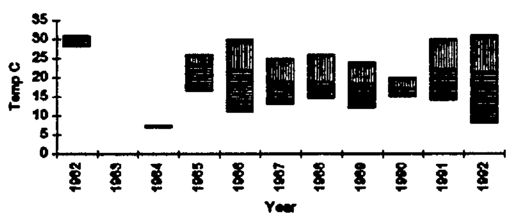
5.2.1.3 Temperature

More variations in temperature were observed at all monitoring stations than in 1991. Temperature fluctuations are attributed solely to meteorological conditions since Bayou Choctaw produces no thermal discharges.

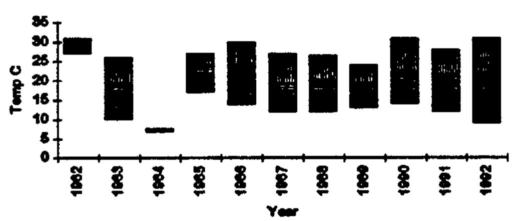
Bayou Choctaw
Temperature Sample Point

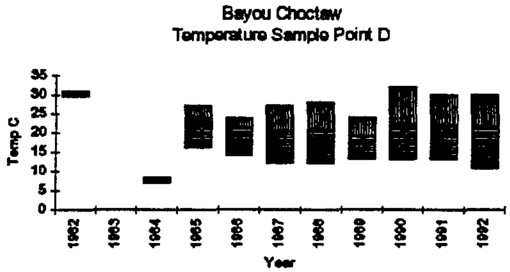


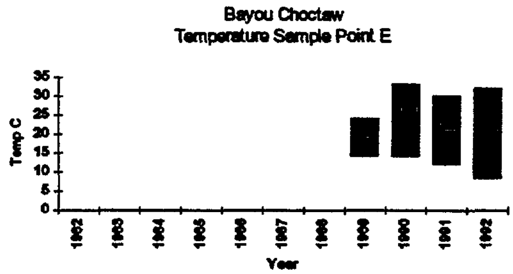
Bayou Choctaw
Temperature Sample Point B



Bayou Choctaw
Temperature Sample Point C




Bayou Choctaw
Temperature Sample Point D
Temp C
35
30
25
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Temperature Sample Point E
Temp C
35
30
25
20
15
10
5
0
1982
1983
1984
1985
1986
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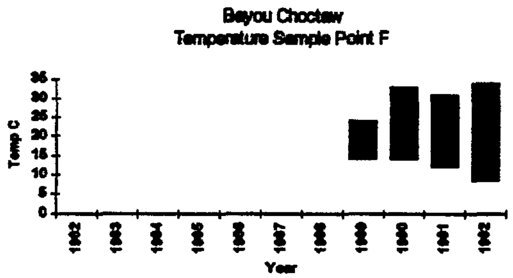
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Temperature Sample Point F
Temp C
35
30
25
20
15
10
5
0
1982
1983
1984
1985
1986
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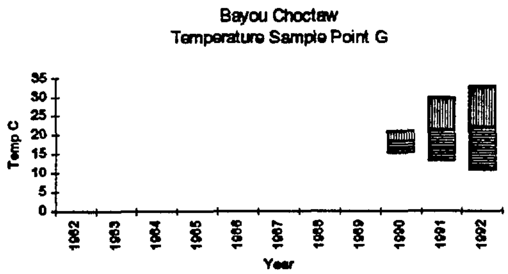
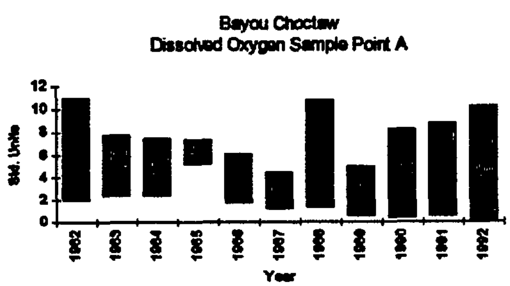
1988
1989
1990
1991
1992
Year



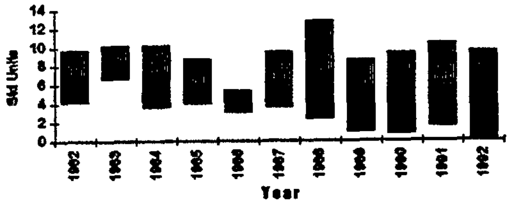
5.2.1.4 Dissolved Oxygen (DO)

The consistency in DO observations suggests that SPR runoff and discharges do not significantly reduce the DO of receiving waters. Low levels observed at various times of the year are attributed to low flow and minimal flushing typically observed at times in a wetland environment. The low point for all reporting stations was in September. The low values observed are attributed to the passage of Hurricane Andrew through the area in late August, and the resulting decaying biomass.

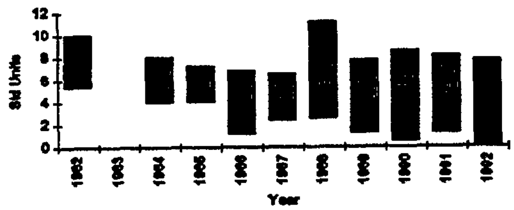


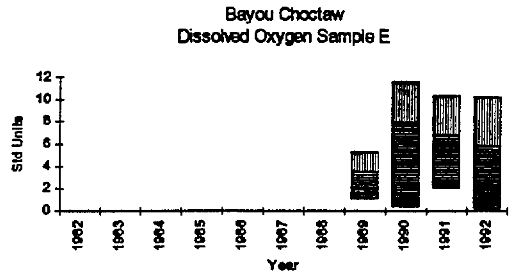
Bayou Choctaw
Dissolved Oxygen Sample Point B

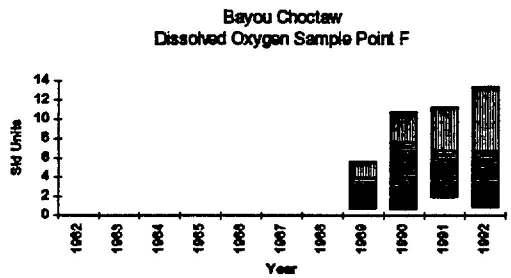
Bayou Choctaw
Dissolved Oxygen Sample Point C

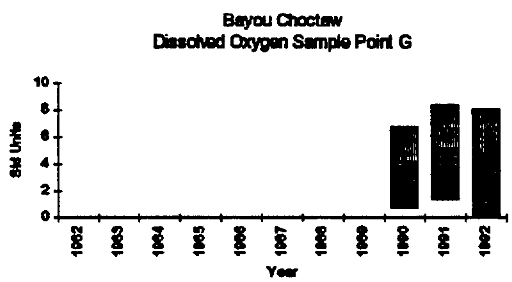


Bayou Choctaw
Dissolved Oxygen Sample Point D



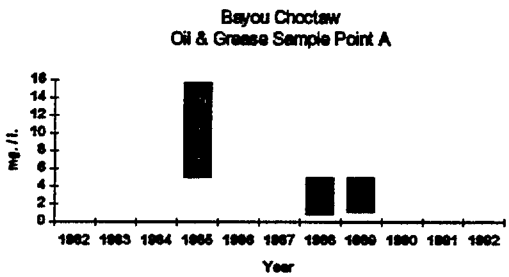

Bayou Choctaw
Dissolved Oxygen Sample E
12
10
8
6
4
2
0
Std Units
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

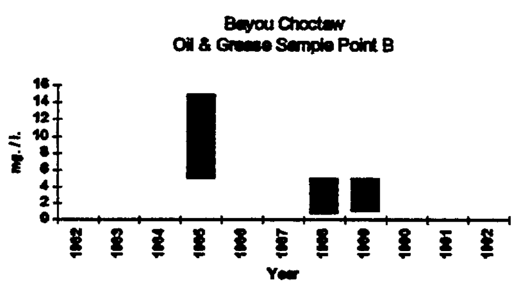

Bayou Choctaw
Dissolved Oxygen Sample Point F
14
12
10
8
6
4
2
0
Std Units
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

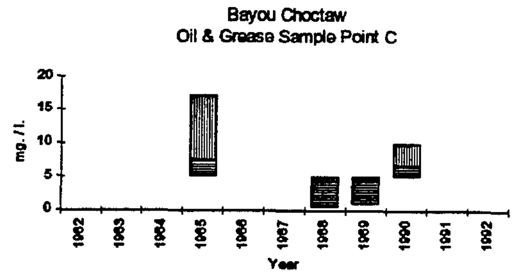

Bayou Choctaw
Dissolved Oxygen Sample Point G
10
8
6
4
2
0
Std Units
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

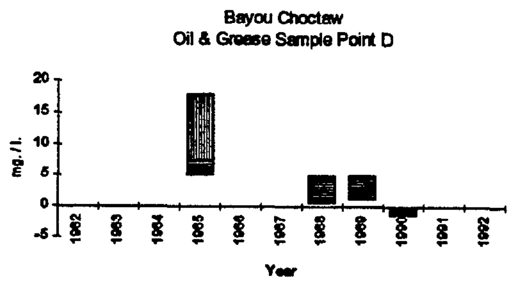
5.2.1.5 Oil and Grease

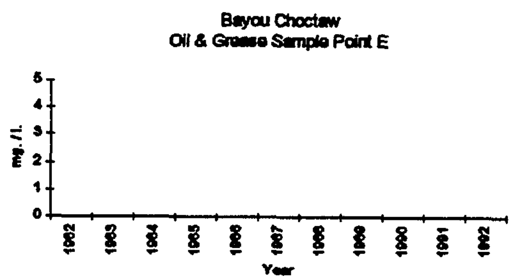
Oil and grease levels were below detectable levels (<5 mg/l) at all monitoring stations throughout 1992 for all stations. These data are consistent with data collected in 1991. Data prior to 1988 were obtained using "wet chemistry" methods which had a lower detection limit of 5.0 mg/l. Data for 1988 through 1990 were obtained using instrumentation with lower detection levels of 1.0 mg/l. The data favorably reflect continued good site housekeeping and effective site spill prevention, control, and response efforts. For sample points E and G, oil and grease levels were below detection limits of the instrument.

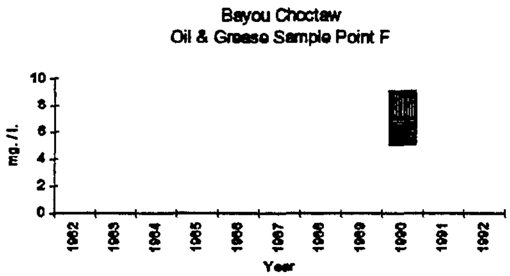


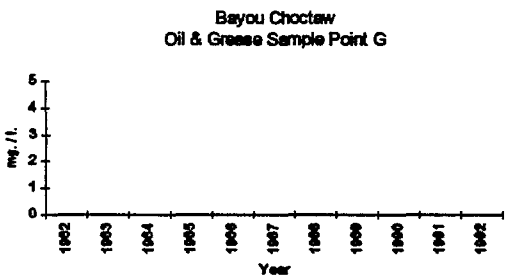



Bayou Choctaw
Oil & Grease Sample Point C
mg./l.
0
5
10
15
20
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Oil & Grease Sample Point D
mg./l.
-5
0
5
10
15
20
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Oil & Grease Sample Point E
mg./l.
0
1
2
3
4
5
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year





5.2.1.6 General Observations

Based on the above discussion, the following general observations are made regarding the quality of Bayou Choctaw surface waters.

a. The surrounding surface waters continue to have a relatively neutral pH.

b. The observed salinities were generally low. Those slightly elevated salinities observed were not attributed to SPR activity and could possibly reflect effects from Hurricane Andrew.

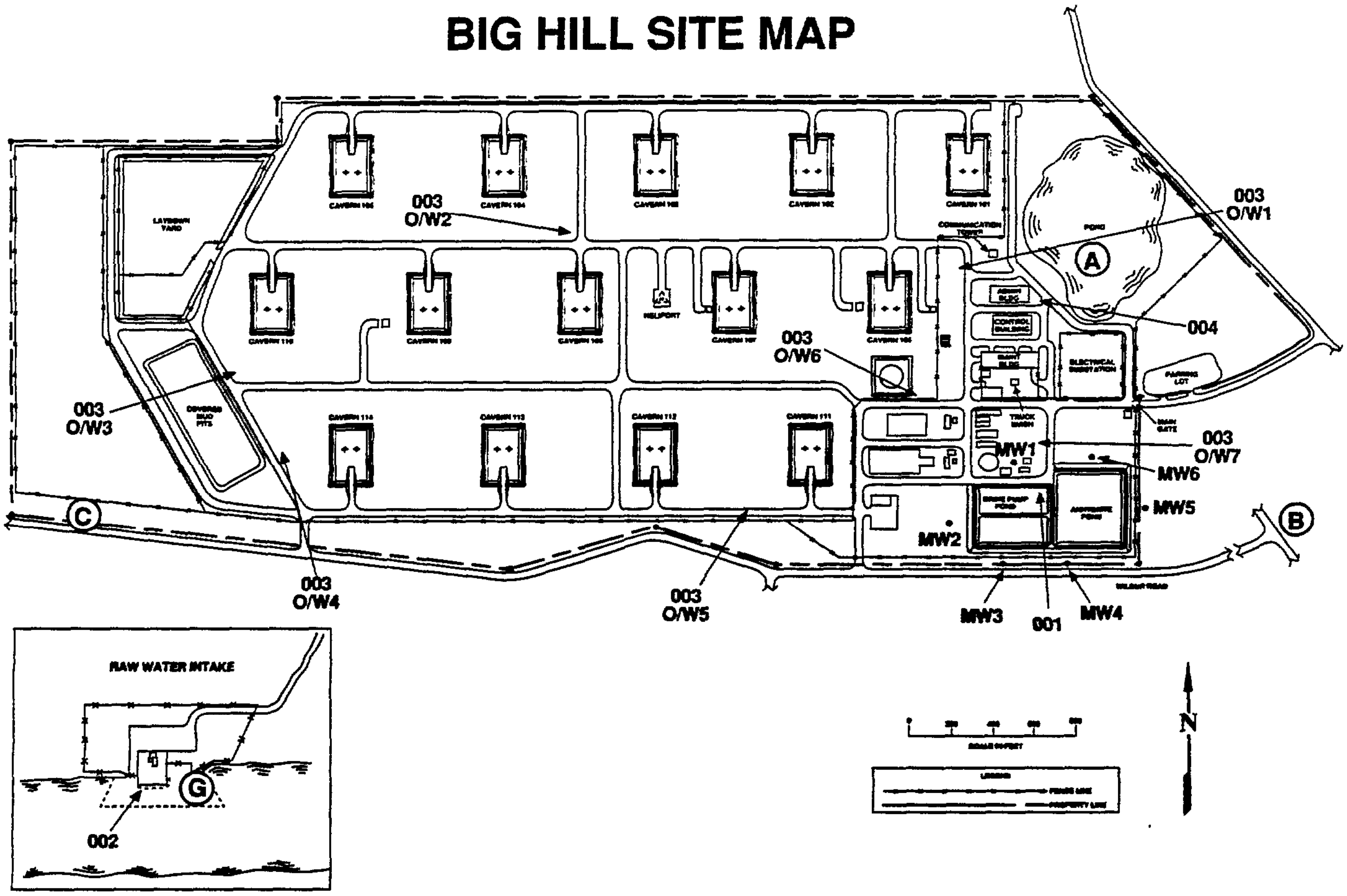
c. Temperature variations due to seasonal changes remained consistent with values observed in the past and with those expected, since there are no thermal processes used at any SPR site.

d. The lower DO levels observed are attributed to low flow and minimal flushing, typically observed in backwater swamp areas and the decaying biomass produced by Hurricane Andrew.

e. The consistently low oil and grease levels observed since 1982 indicate that site oil spills are effectively managed, minimizing any impact on the Bayou Choctaw environs.

5.2.2 Big Hill

Beginning July 1989, selected locations were established as monitoring stations (Figure 5-2) to assess site-associated surface water quality and to provide early detection of any surface water quality degradation that may result from SPR operations. Parameters such as pH, salinity, temperature, total organic carbon (TOC) or oil and grease, and DO, were monitored. Since Big Hill water quality monitoring program only began in 1989, there is insufficient data to formulate any longterm trends. However, observation of surrounding areas indicates that there has been no observed adverse impact from SPR operations.



2071/MP1/ENV/C/B.H. MAP/4/90

Figure 5-2 (Sheet 1 of 2). Big Hill Environmental Monitoring Stations

Discharge Monitoring Stations

001 Brine disposal to Gulf of Mexico

002 Hydroclone and blowdown at raw water intake structure

003 Stormwater discharges

O/W1 Stormwater from well pads 101, 102, 106, 107

O/W2 Stormwater from well pads 103, 104, 105

O/W3 Stormwater from well pads 108, 109, 110

O/W4 Stormwater from well pads 113, 114

O/W5 Stormwater from well pads 111, 112

O/W6 Stormwater from BHT-7 (crude oil surge tank) diked area

O/W7 Stormwater from pump and meter pads

004 Discharge from sewage treatment plant (TWC only)

Water Quality Monitoring Stations

A Ten Acre Pond (STP Pond) (A was combined with B due to access difficulty)

C Wilber Road Ditch - southwest of site

E Pier at Pipkin Pond (D was combined with E due to dense vegetation and low water level)

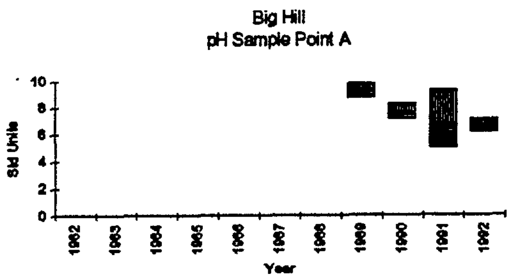
F Culvert crossover (Gator Hole) on RWIS road

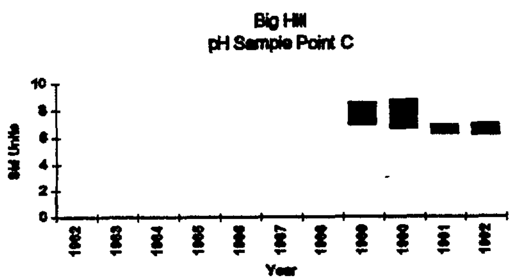
G RWIS at Intracoastal Waterway (ICN)

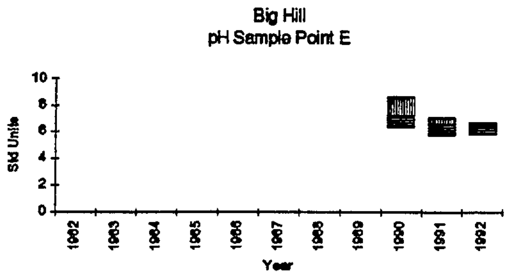
Figure 5-2 (Sheet 2 of 2). Big Hill Environmental Monitoring Stations

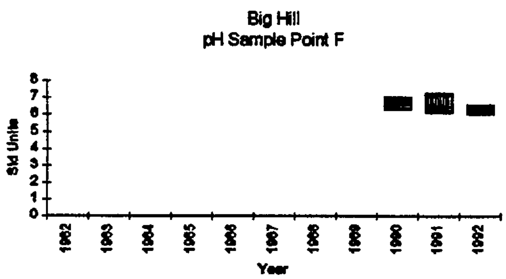
5.2.2.1 Hydrogen Ion Activity (pH)

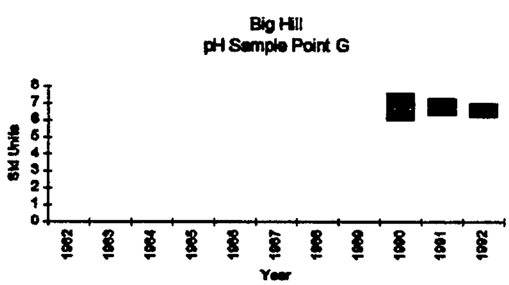
The 1992 data show the pH of the site and surrounding surface waters remained consisten between 5.8 and 7.1 standard units. The annual median values of pH for each of the monitored stations ranged from 6.3 to 6.6 standard units.





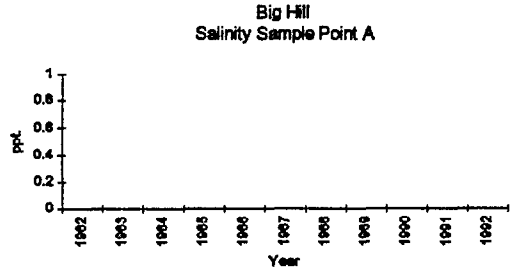


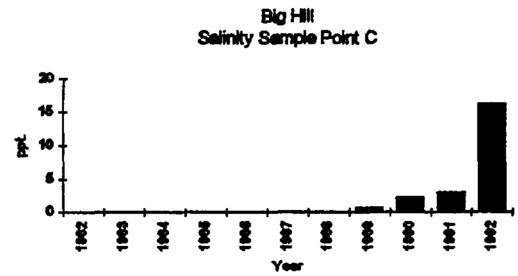


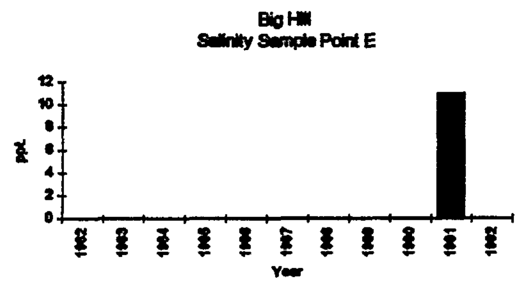


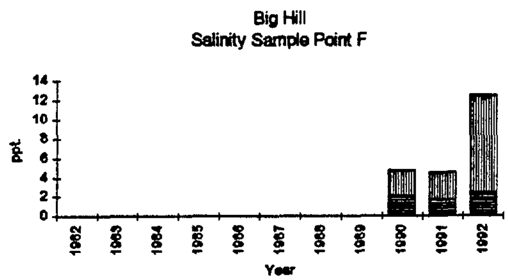
5.2.2.2 Salinity

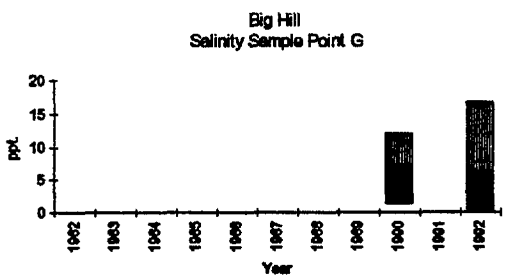
Salinities were generally, however the further south the sample station, the higher the salinity. This is expected based on marsh changes from a fresh to intermediate regime. Charts with missing bars indicate that values were less than detectable. Sample point E indicated nondetectable salinity during 1992 which was similar to the data observed in both 1989 and 1990.





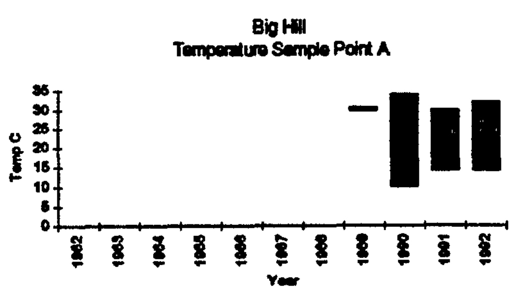




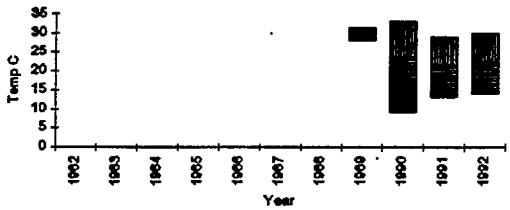


5.2.2.3 Temperature

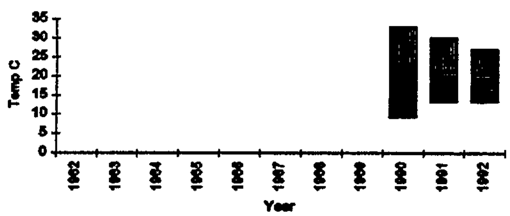
Temperature data for 1992 exhibited the characteristics expected from seasonal meteorological changes.



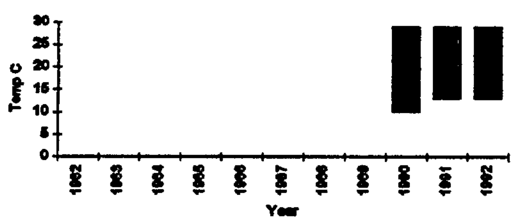
Big Hill
Temperature Sample Point C

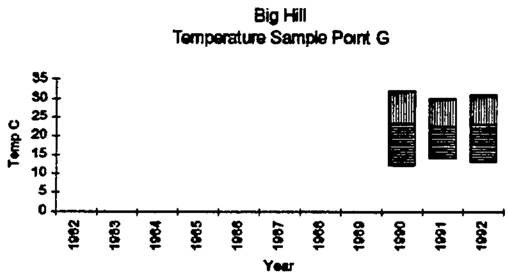


Big Hill
Temperature Sample Point E



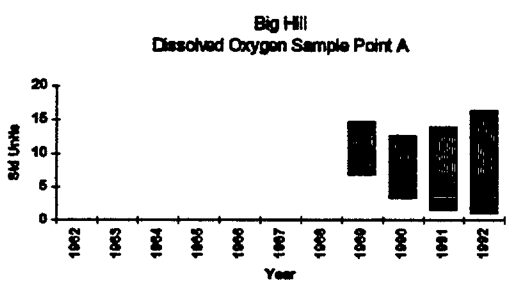
Big Hill
Temperature Sample Point F



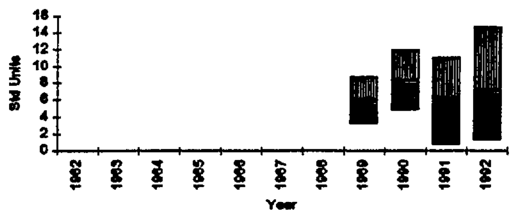


5.2.2.4 Dissolved Oxygen (DO)

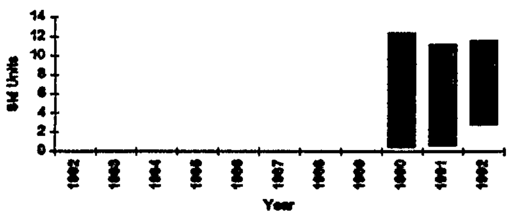
Dissolved oxygen fluctuated with the seasonal temperature changes, as expected. The widest range of DO fluctuation during 1992 was associated with station G (the RWIS). The wide range in DO is indicative of the variability associated with the ICW and the values observed reflect the normal range of surface waters of this type.



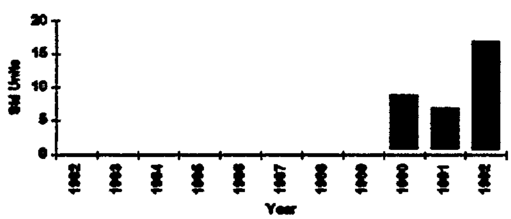
Big Hill
Dissolved Oxygen Sample Point C

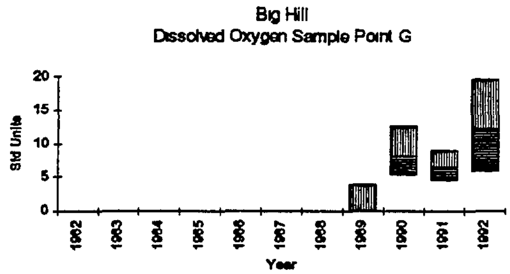


Big Hill
Dissolved Oxygen Sample Point E



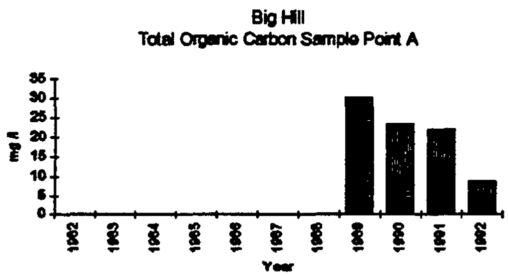
Big Hill
Dissolved Oxygen Sample Point F



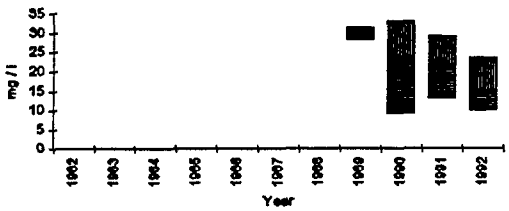


5.2.2.5 Total Organic Carbon (TOC)

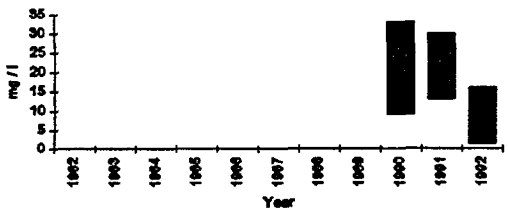
There are insufficient data to establish a trend for this parameter; however, the wide range of values seen in 1990 appear to have settled into a generally low and narrow range for the site.



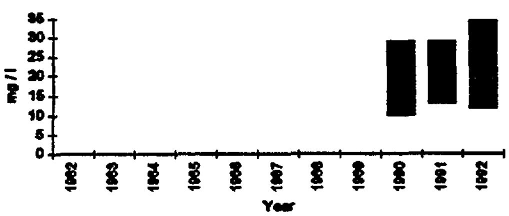
Big Hill
Total Organic Carbon Sample Point C

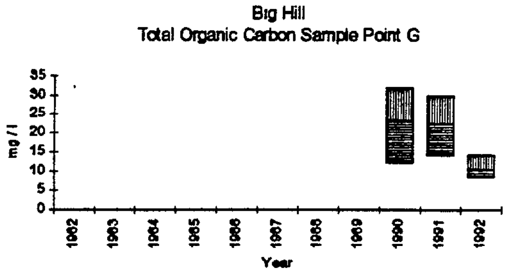


Big Hill
Total Organic Carbon Sample Point E



Big Hill
Total Organic Carbon Sample Point F





5.2.2.6 General Observations

The limited data do not allow accurate longterm trending or substantial conclusions to be drawn. No significant impacts have been observed on site, or adjacent to it, indicating that SPR operations are not affecting the environs.

5.2.3 Bryan Mound

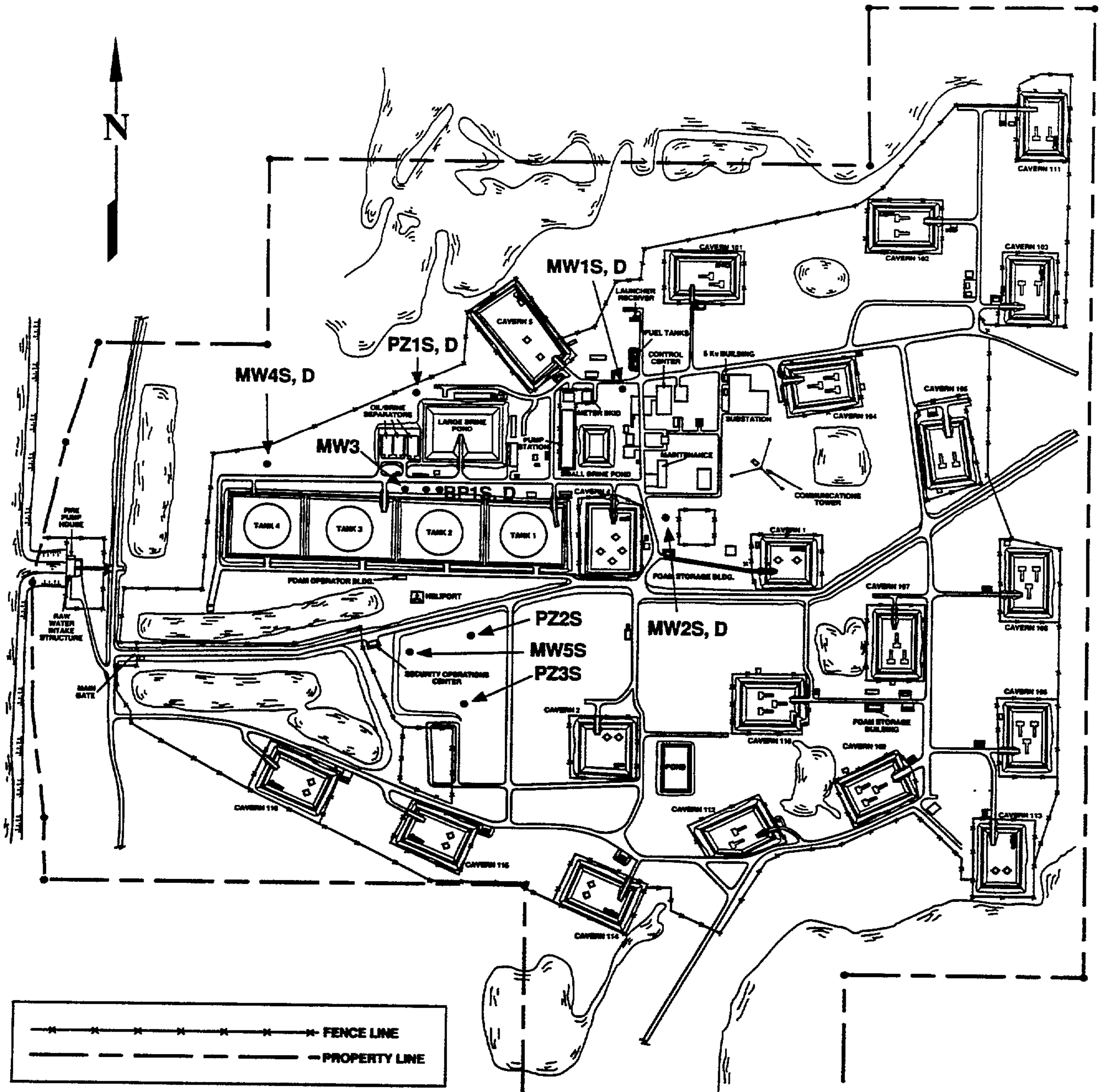
The surface waters surrounding the Bryan Mound site were monitored throughout 1992. Blue Lake was sampled once monthly at each station. Mud Lake was sampled once monthly except during January, February, and March when low tides restricted access to the lake.

Specific surface water monitoring stations are identified in Figure 5-3. Stations A through C and E through G are located along the Blue Lake shoreline to monitor effects of site runoff. Station D, located farther away from the site in Blue Lake, serves as a control. Stations H and I are located along the Mud Lake shoreline to monitor effects of site runoff.

Shoreline station J, located away from the shoreline in Mud Lake, serves as a control.

Specific parameters monitored in the Bryan Mound surface waters include pH, salinity, temperature, DO, and TOC. The parameters are discussed below and compared to 1982 through 1992 monitoring data.

BRYAN MOUND



2333/MP2/ENV/C/B.M. MAP/4-90

Figure 5-3 (Sheet 1 of 2). Bryan Mound Environmental Monitoring Stations

Discharge Monitoring Stations

001 Brine disposal

002 Discharge from the sewage treatment plant

Stormwater runoff from surge tank area (corresponds to TWC permit no. 02271 discharge 001)

Stormwater discharges

Stormwater runoff from well pads 1, 2, 4, 5, and 101-116

Stormwater runoff from the high-pressure pump pad

Water Quality Monitoring Stations

A Blue Lake

B Blue Lake

C Blue Lake

D Blue Lake - Control Point 1

E Blue Lake

F Blue Lake

G Blue Lake

H Mud Lake

I Mud Lake

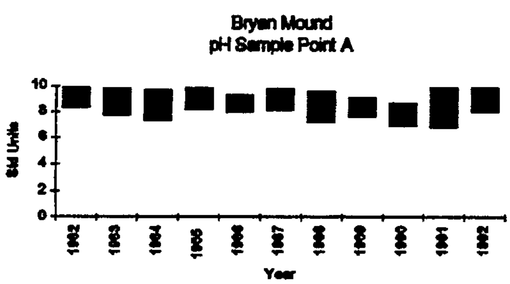
J Mud Lake - Control Point 2

Figure 5-3 (Sheet 2 of 2). Bryan Mound Environmental Monitoring Stations

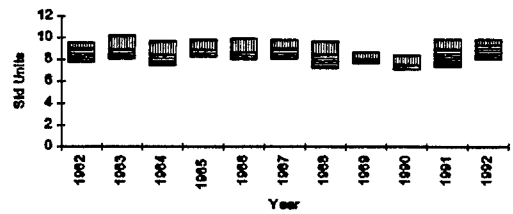
5.2.3.1 Hydrogen Ion Activity (pH)

The 1992 pH data is relatively consistent with data from previous years. The consistently basic conditions indicate natural waters devoid of carbon dioxide and generally hard in regard to mineral content. Marine and estuarine waters, such as those in Blue Lake and Mud Lake, typically have somewhat elevated pH levels and high mineral contents. The pH is believed to fluctuate directly with the rate of carbon dioxide uptake as related to low primary productivity (lower pH) during cool periods and high primary productivity (higher pH) during warm periods.

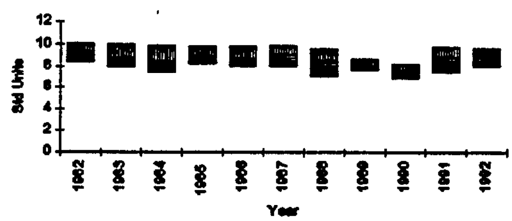
There were no known pH inducing impacts resulting in any pH changes to Mud Lake during 1992 or previous years as indicated by these comparisons. Thus, minor pH fluctuations in the Bryan Mound surface waters appear to be the result of seasonal weather and tidal variations rather than site activity.



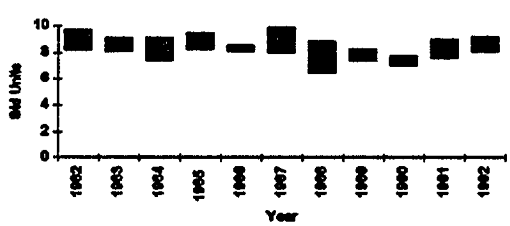
Bryan Mound
pH Sample Point B

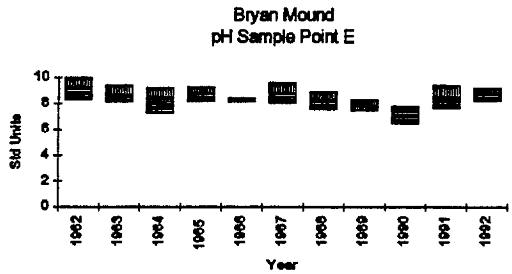


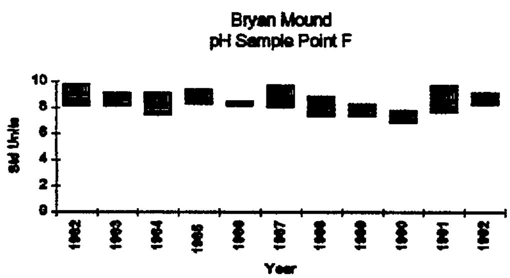
Bryan Mound
pH Sample Point C

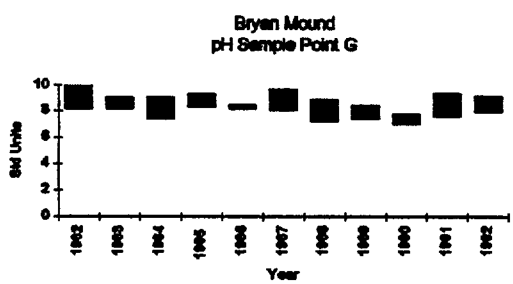


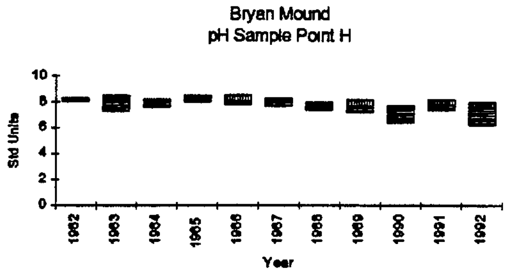
Bryan Mound
pH Sample Point D

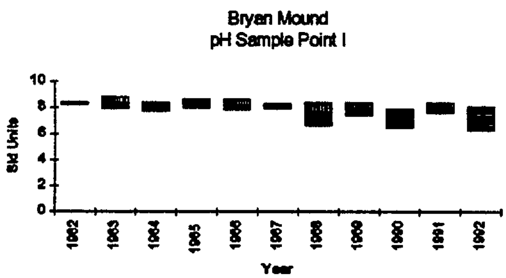


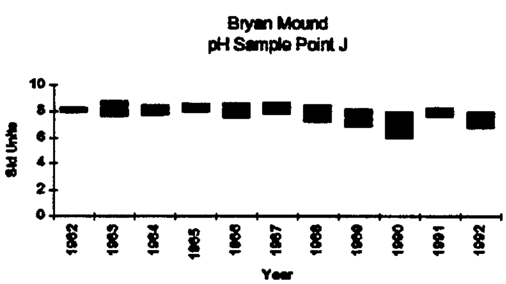

Bryan Mound
pH Sample Point E
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bryan Mound
pH Sample Point F
Std Units
Year


Bryan Mound
pH Sample Point G
Std Units
Year



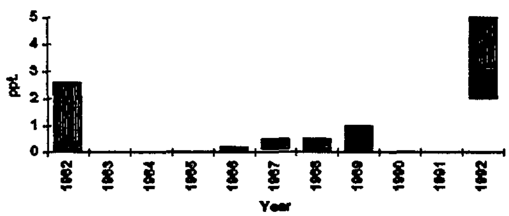




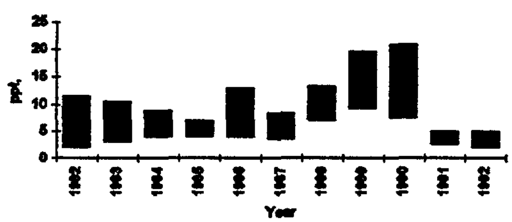
5.2.3.2 **Salinity**

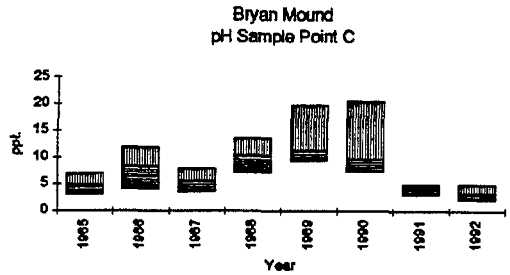
Salinity fluctuations in Blue Lake have been attributed to meteorologically induced conditions rather than site operations, since salinities observed at control sample points were consistent with those found along the site shoreline. The larger salinity variations in Mud Lake relative to Blue Lake are primarily attributed to the strong tidal and wind influence on the lake and its more direct link with the Gulf of Mexico. Mean salinities were generally below the midpoint since 1982 in Blue Lake. This phenomenon is attributed to heavy rainfall and flood conditions in the area. Salinities observed in Mud Lake increased to pre-1991 levels and were higher than that of Blue Lake.

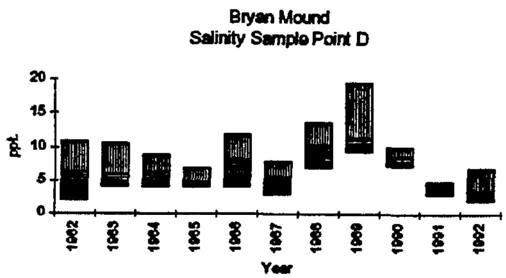
Bryan Mound
Salinity Sample Point A

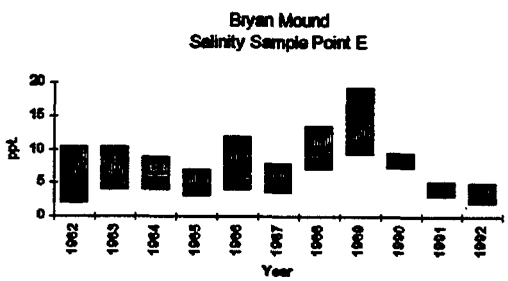


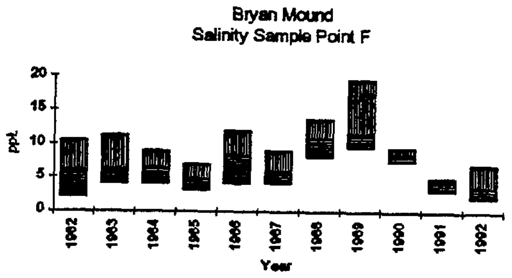
Bryan Mound
Salinity Sample Point B

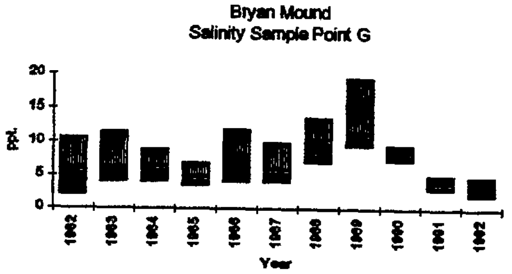


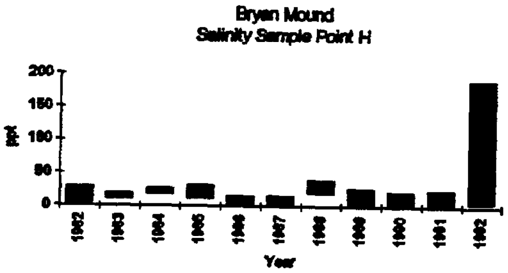

Bryan Mound
pH Sample Point C
ppt.
25
20
15
10
5
0
1985
1986
1987
1988
1989
1990
1991
1992
Year

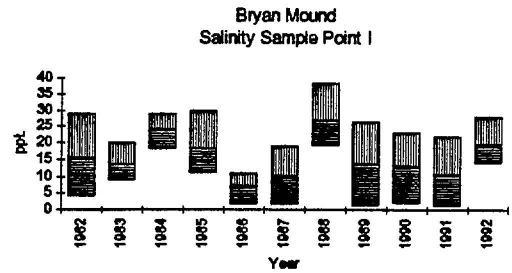

Bryan Mound
Salinity Sample Point D
ppt.
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

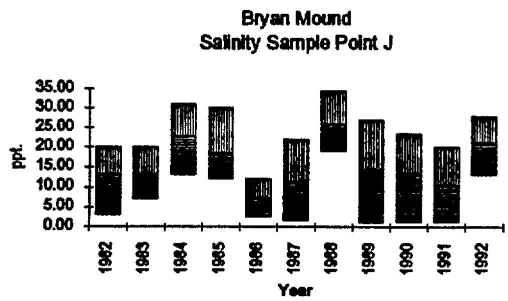

Bryan Mound
Salinity Sample Point E
ppt.
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bryan Mound
Salinity Sample Point F
ppt
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bryan Mound
Salinity Sample Point G
ppt
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

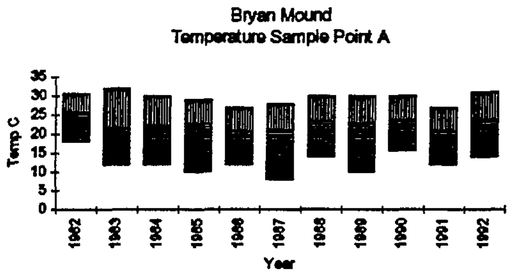

Bryan Mound
Salinity Sample Point H
ppt
200
150
100
50
0
Year





5.2.3.3 Temperature

Temperature data for 1992 was relatively consistent with data from previous years, which indicate fairly consistent temperatures with no influence from site operation.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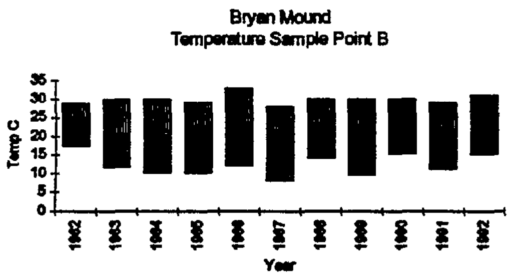
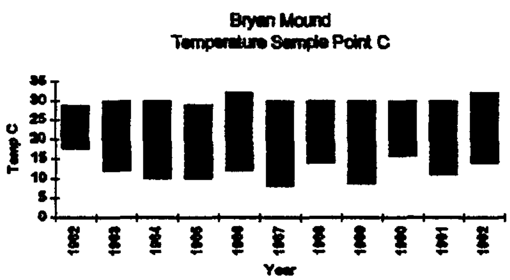
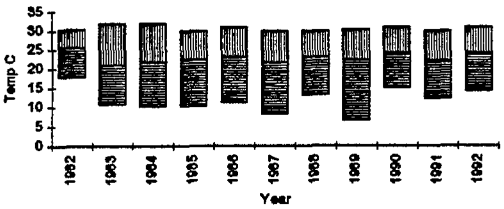
Temperature Sample Point A
Temp C
0
5
10
15
20
25
30
35
Year

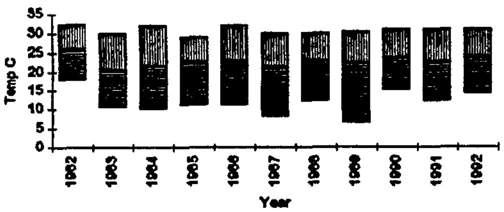

Bryan Mound
Temperature Sample Point B
Temp C
0
5
10
15
20
25
30
35
Year


Bryan Mound
Temperature Sample Point C
Temp C
Year

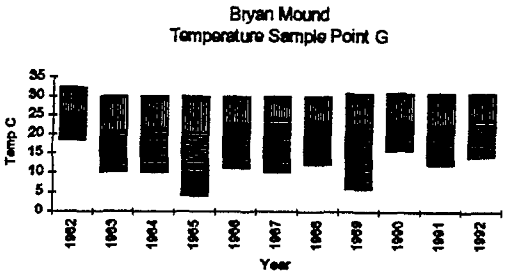
Bryan Mound
Temperature Sample Point D

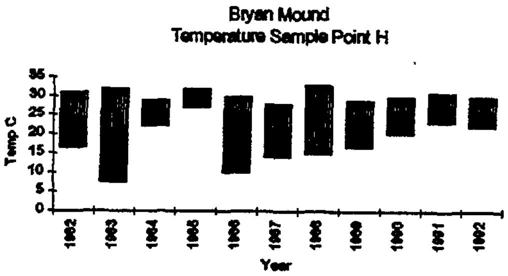


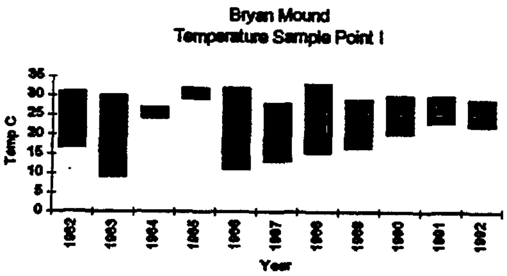
Bryan Mound
Temperature Sample Point E

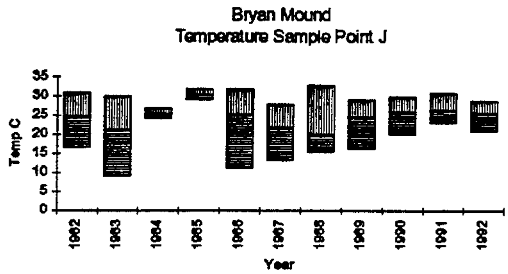


Bryan Mound
Temperature Sample Point F


Bryan Mound
Temperature Sample Point G
Temp C
Year

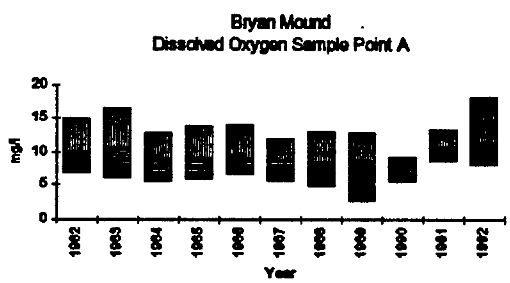

Bryan Mound
Temperature Sample Point H
Temp C
Year

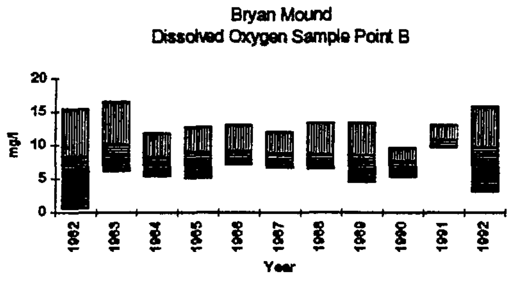

Bryan Mound
Temperature Sample Point I
Temp C
Year

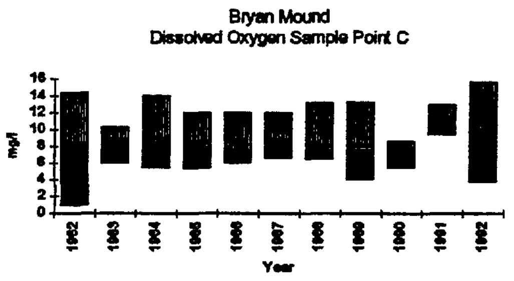


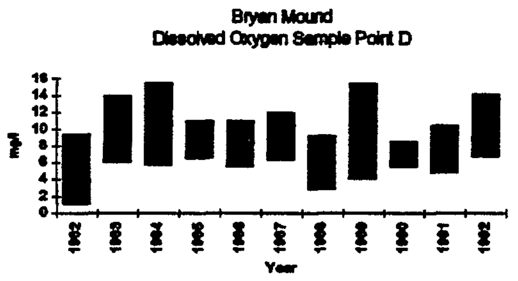
5.2.3.4 Dissolved Oxygen (DO)

The DO levels in 1992 were consistent with that observed since 1982. The DO ranges observed are considered beneficial to the aquatic organisms inhabiting these lakes. Fluctuations in DO levels were attributed to the inverse relationship between temperature and DO as well as seasonal fluctuations in primary organic productivity, and meteorological factors such as wind driven mixing.

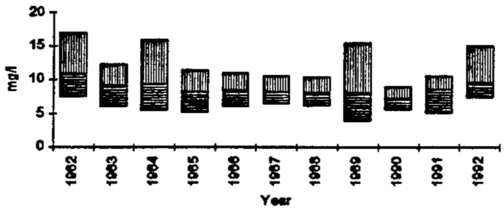



Bryan Mound
Dissolved Oxygen Sample Point B
mg/l
Year

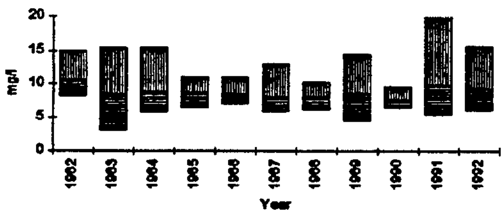

Bryan Mound
Dissolved Oxygen Sample Point C
mg/l
Year


Bryan Mound
Dissolved Oxygen Sample Point D
mg/l
Year

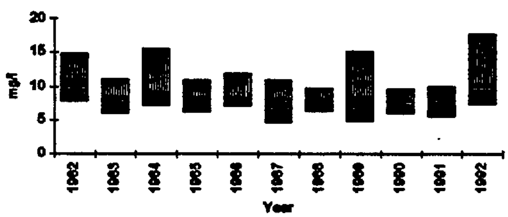
Bryan Mound
Dissolved Oxygen Sample Point E

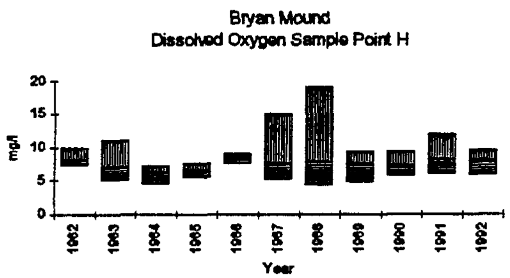


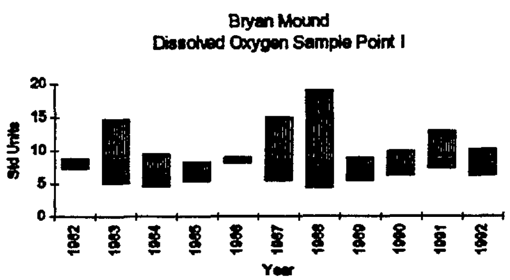
Bryan Mound
Dissolved Oxygen Sample Point F

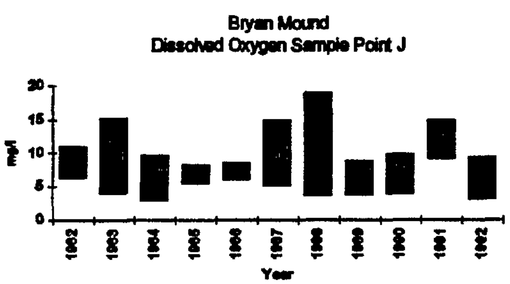


Bryan Mound
Dissolved Oxygen Sample Point G



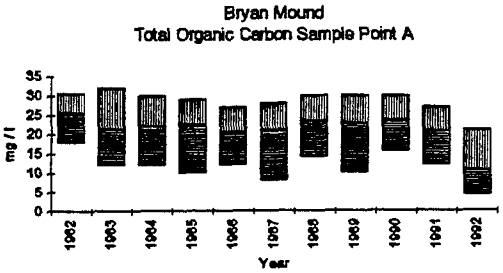


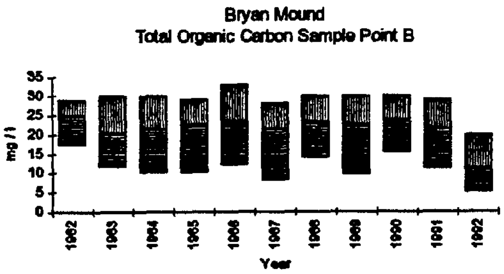


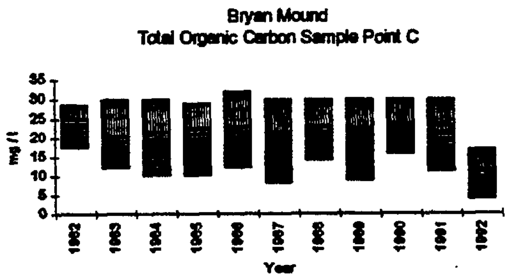


5.2.3.5 Total Organic Carbon (TOC)

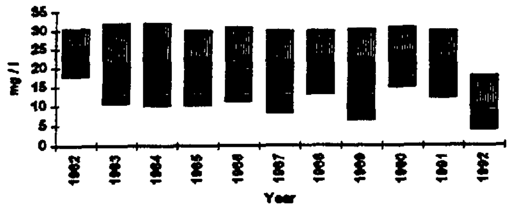
Average TOC data for 1992 increased overall from that observed in 1991 but still has remained consistent since 1982. The TOC levels observed in both lakes are indicative of healthy conditions and a stable oxygen demand.





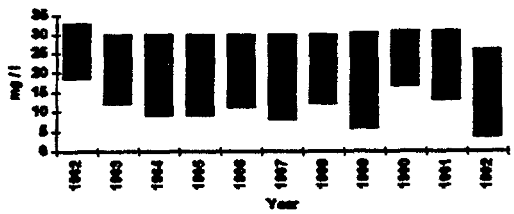


Bryan Mound
Total Organic Carbon Sample Point D



Bryan Mound
Total Organic Carbon Sample Point E

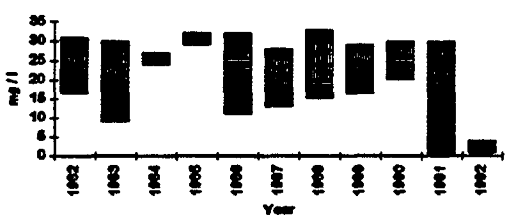
Bryan Mound
Total Organic Carbon Sample Point F

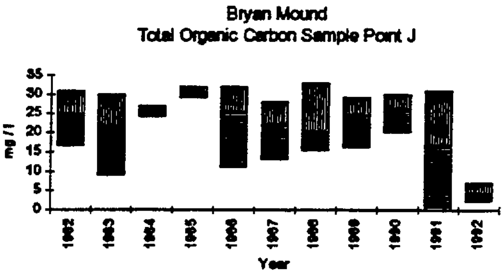


Bryan Mound
Total Organic Carbon Sample Point G

Bryan Mound
Total Organic Carbon Sample Point H

Bryan Mound
Total Organic Carbon Sample Point I





5.2.3.6 Additional Water Quality Monitoring

Visual surveys of adjacent water bodies were performed periodically to monitor those climatic events and environmental perturbations that may affect Bryan Mound either directly or by association. Survey findings for 1992 were negative.

5.2.3.7 General Observations

Based on the above discussions, the following general observations are made regarding the quality of Bryan Mound surface waters.

a. The observed pH was stable and predominantly neutral in Blue Lake and Mud Lake. This is consistent with the observed characteristic alkalinity and relative water hardness data from previous years.

b. Salinity levels in Mud Lake returned to that observed prior to 1991. Salinity levels of Blue Lake remained low and similar to that of 1991. Salinity fluctuations during and among years are attributed to meteorologically induced conditions and previous industrial activity rather than site operations.

c. Levels of DO remained moderate and fairly constant throughout the year. Temperature, DO, and TOC were consistent with that observed since 1982.

d. Mud Lake experiences more pronounced changes in water quality than Blue Lake. The more direct link of Mud Lake with the Gulf of Mexico and the frequent wind and tidal induced flushing are responsible for dramatic seasonal changes in water quality.

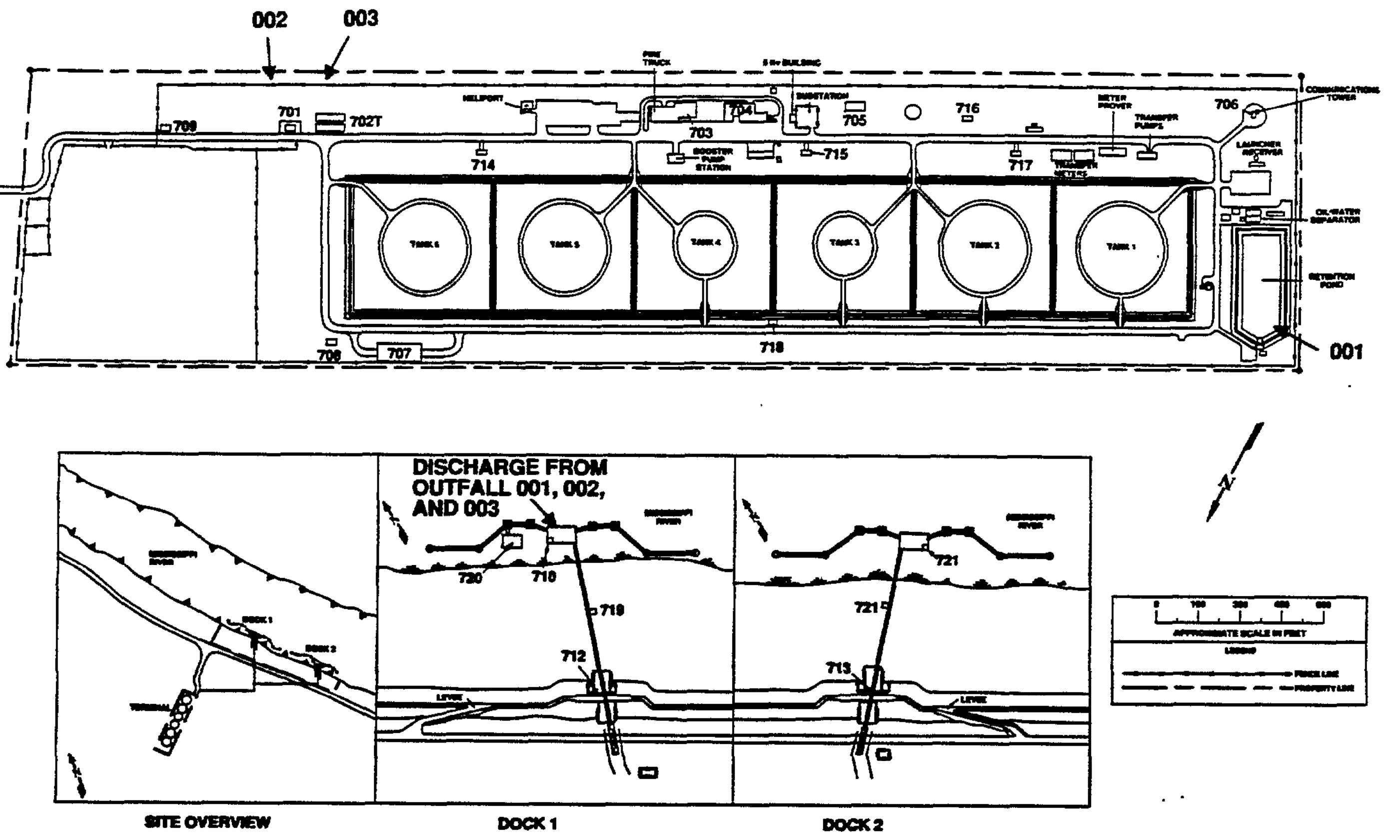
5.2.4 St. James Terminal

St. James Terminal is located in a low-lying agricultural area beyond the west levee of the Mississippi River. All precipitation is effectively drained from the terminal and surrounding sugar cane fields by a series of ditches.

The two St. James docks are located on the west bank of the Mississippi River. They are curbed with all runoff pumped to the stormwater treatment system and retention pond. The site retention pond, which also collects stormwater runoff from the six crude oil storage tank containment areas, is discharged intermittently through outfall 001 (Figure 5-4) into the Mississippi River. Two wastewater treatment plants, which serve the site control and maintenance buildings, discharge as state outfalls 002 and 003 through outfall 001 into the Mississippi River.

At St. James, the Mississippi River has a large flow volume and rapid currents providing a strong assimilative capacity. The intermittent nature of discharges from site outfalls, the characteristic hydrographic features of the Mississippi River, and a state-conducted water quality monitoring program limit the value of a site-directed water quality monitoring program in the Mississippi River. There are no other surface waters located near the site.

ST. JAMES SITE MAP



2334/MP2/ENV/C/ST. JAMES MAP/4-90

Figure 5-4 (Sheet 1 of 2). St. James Terminal Environmental Monitoring Stations

Discharge Monitoring Stations

001 Discharge from retention pond

002 Discharge from package sewage treatment plant

003 Discharge from package sewage treatment plant

There are no water quality monitoring stations at St. James

Figure 5-4 (Sheet 2 of 2). St. James Terminal Environmental Monitoring Stations

5.2.5 Sulphur Mines

Samples collected once monthly at each monitoring station were used to monitor surface water quality. Specific monitoring stations are identified in Figure 5-5. Station C has not been monitored since 1990 due to access problems associated with construction activities by an adjacent landowner. Specific parameters monitored in the Sulphur Mines surface waters were pH, salinity, TSS, temperature, oil and grease, and DO. These data are summarized and compared to data collected since 1982.

The Sulphur Mines site was decommissioned, and all crude oil transferred to West Hackberry and Big Hill in late 1991 and early 1992.

SULPHUR MINES SITE MAP

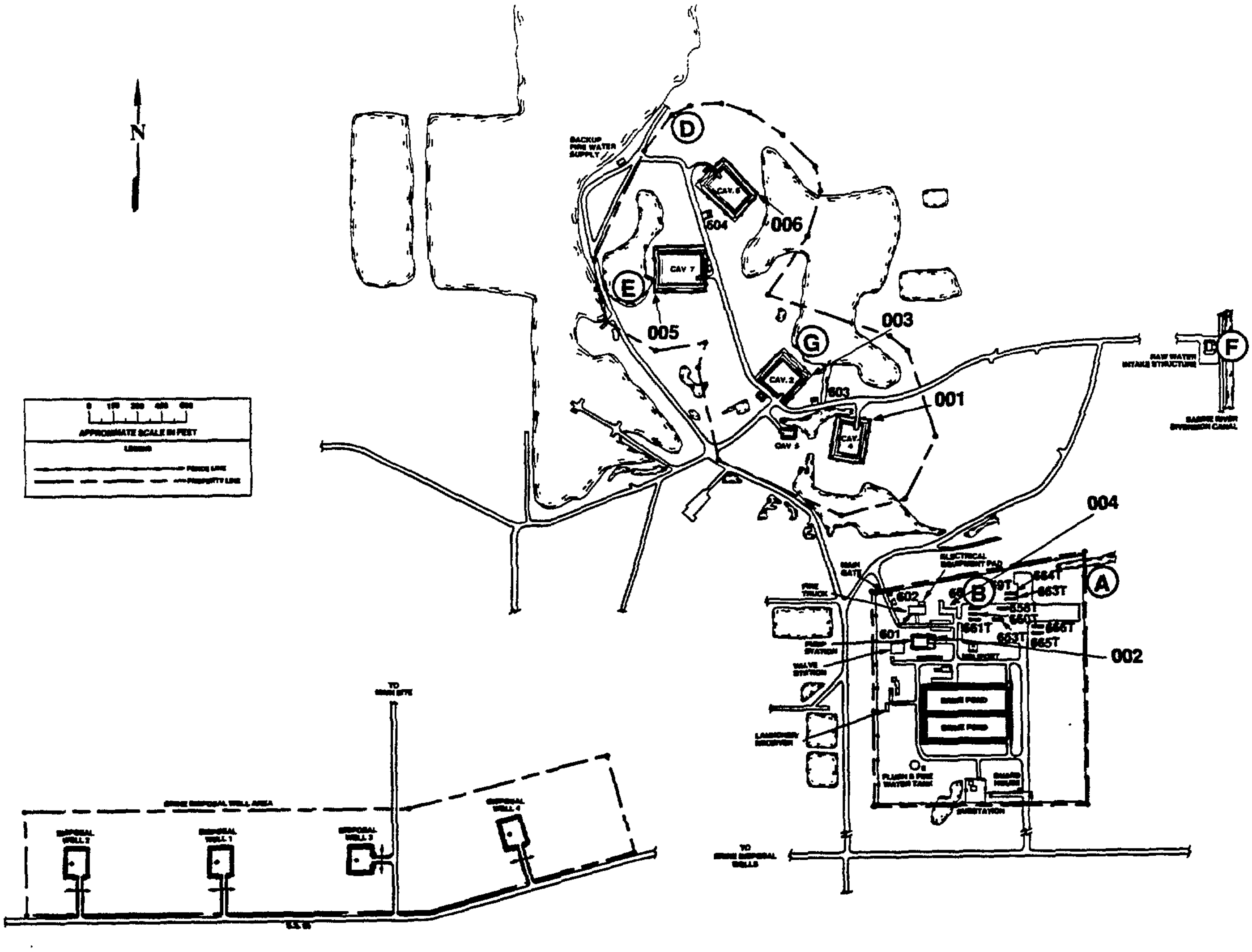


Figure 5-5 (Sheet 1 of 2). Sulphur Mines Environmental Monitoring Stations

Discharge Monitoring Stations*

001 Discharge from sewage treatment plant

002 Stormwater discharge from high pressure pump pad

Stormwater discharge from well pads 2, 4, 6, and 7

Water Quality Monitoring Stations

A Drainage ditch at northeast corner of primary site

B Creek north of primary site

C Subsidence area (pump) replaced with G

D Impoundment north of Cavern 6

E Impoundment west of Cavern 7

F Intake structure

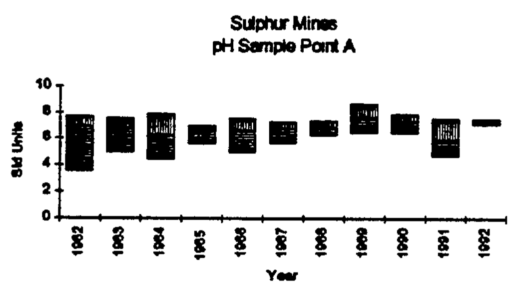
G Subsidence area

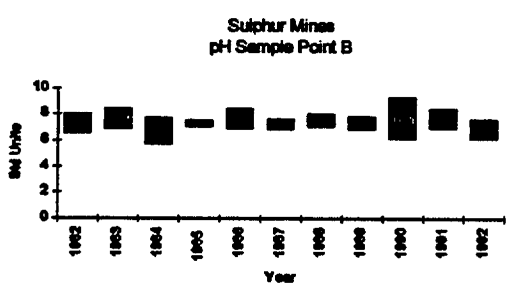
* The permit renewal submitted in 1990 and again in 1992 regrouped discharges to simplify the reporting process

Figure 5-5 (Sheet 2 of 2). Sulphur Mines Environmental Monitoring Stations

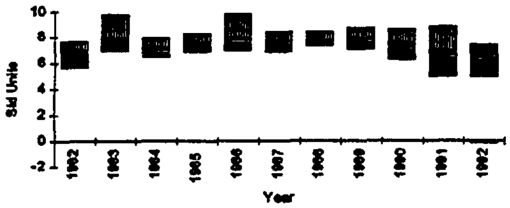
5.2.5.1 Hydrogen Ion Activity (pH)

1992 pH data was consistent with corresponding data from previous years. The range of annual (1992) median values is from a low of 7.1 S.U. to a high of 7.8 S.U. for all reporting stations. The lowest routine observation was at station D (4.9 S.U.); and the highest observation was at station G (8.4 S.U.).

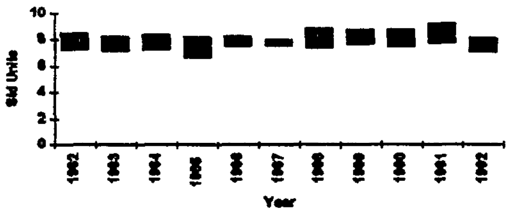




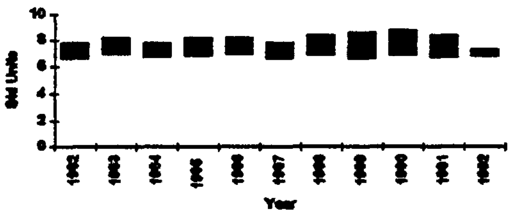
Sulphur Mines
pH Sample Point D

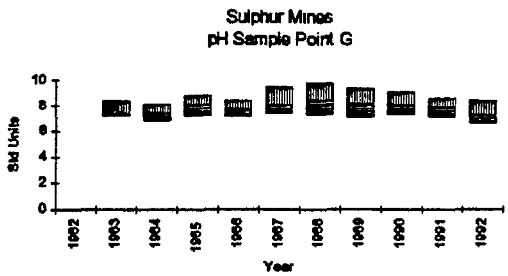


Sulphur Mines
pH Sample Point E



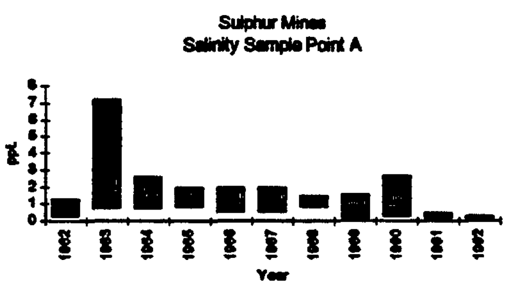
Sulphur Mines
pH Sample Point F

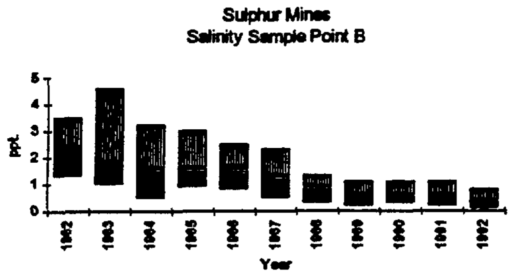


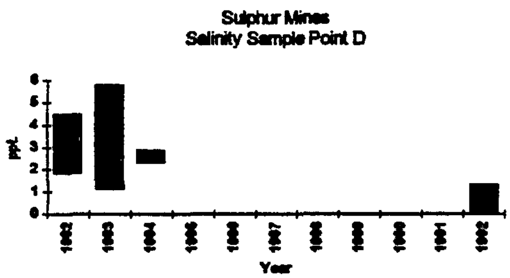


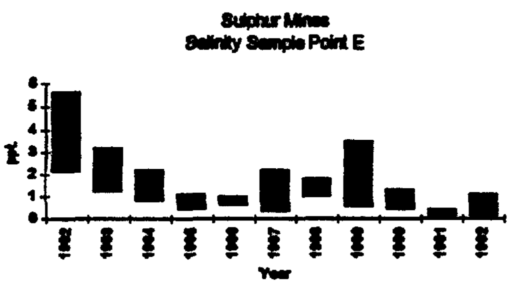
5.2.5.2 Salinity (SAL)

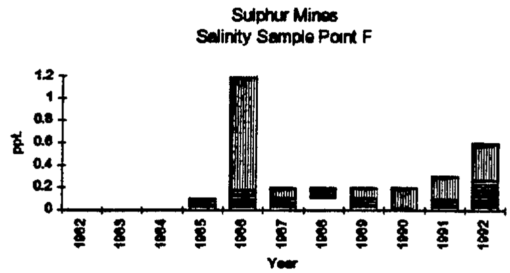
1992 average annual salinity values ranged from 0.2 to 0.8 ppt (sample points A and G respectively). During the year, the lowest values observed were 0.0 ppt at stations D and F; and the highest value was 1.6 ppt observed at station G. In general the salinity measurements remained very similar to the previous years and indicates no discernible longterm impacts from brine.

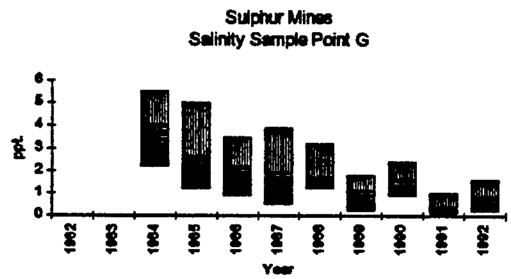



Sulphur Mines
Salinity Sample Point B
ppt.
0
1
2
3
4
5
Year


Sulphur Mines
Salinity Sample Point D
ppt.
0
1
2
3
4
5
6
Year


Sulphur Mines
Salinity Sample Point E
ppt.
0
1
2
3
4
5
6
Year





5.2.5.3 Total Suspended Solids (TSS)

TSS levels have been relatively consistent over the past years, 1982-1990. Since the site is located in an essentially wetland/marshy area, TSS fluctuations are a natural occurrence and do not reflect site operations or influences. To limit marginally related analyses and to standardize where possible across the SPR, the TSS data was not generated.

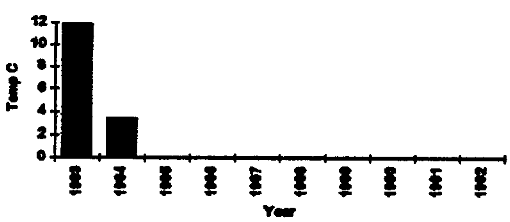
5.2.5.4 Temperature

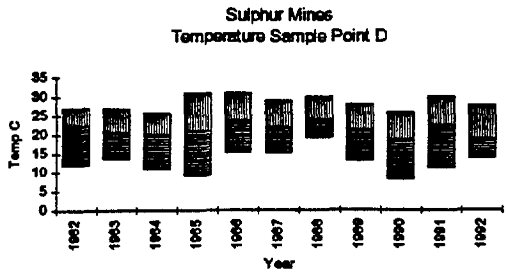
The sample temperatures of the Sulphur Mines surface waters were conducive to supporting aquatic life throughout 1992. The 1992 temperature data was comparable to temperature data from previous years.

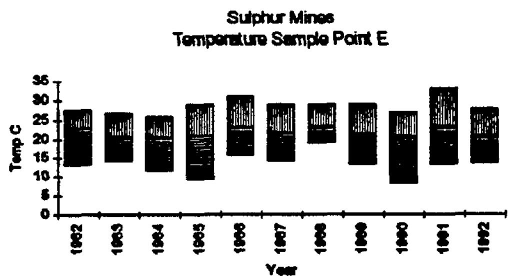
Sulphur Mines
Temperature Sample Point A

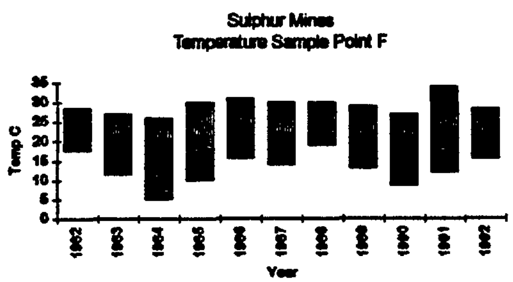
Sulphur Mines
Temperature Sample Point B

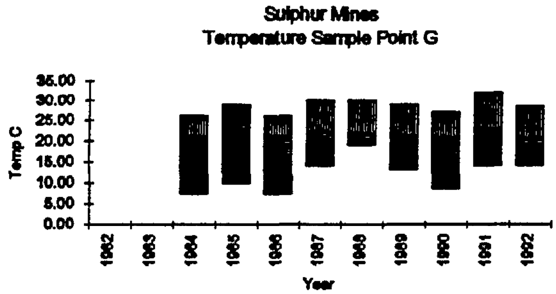
Sulphur Mines
Temperature Sample Point C




Sulphur Mines
Temperature Sample Point D
Temp C
Year
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992

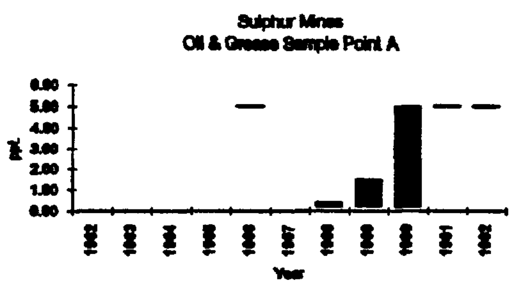

Sulphur Mines
Temperature Sample Point E
Temp C
Year
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992


Sulphur Mines
Temperature Sample Point F
Temp C
Year
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992

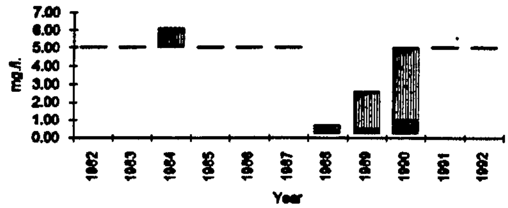


5.2.5.5 Oil and Grease

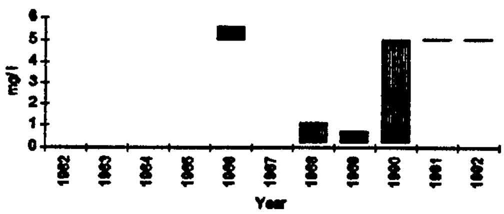
Oil and Grease levels were less than 5 mg/l at all monitoring stations throughout 1992. These data reflect favorably on the site spill prevention, control, and overall good housekeeping during 1992. These results are consistent with that collected during previous years. In 1988 through 1990 a more discrete analytical method was used enabling the SPR to have lower detection limits instead of the normal <5 mg/l; however, equipment configuration problems during 1992 caused analyses to be run using gravimetric procedure.



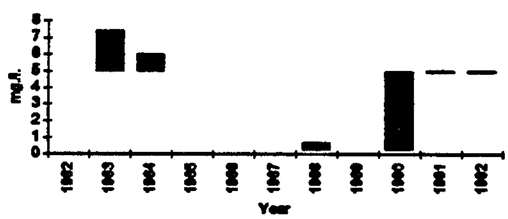
Sulphur Mines
Oil & Grease Sample Point B

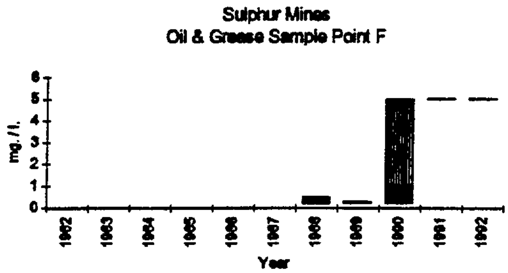


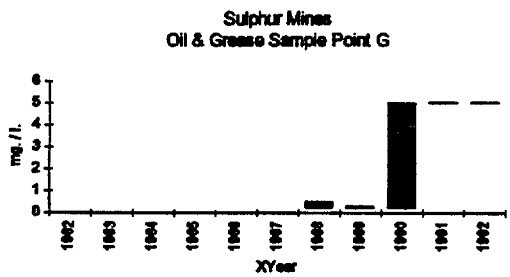
Sulphur Mines
Oil & Grease Sample D



Sulphur Mines
Oil & Grease Sample Point E

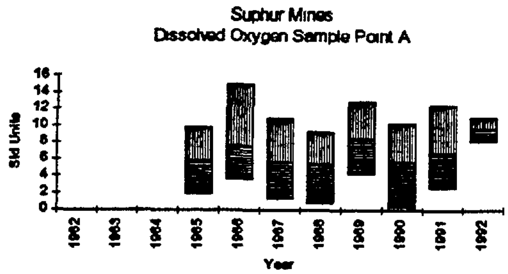


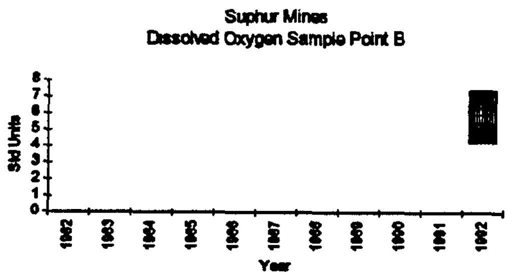




5.2.5.6 Dissolved Oxygen (DO)

Dissolved oxygen monitoring is performed historically only at station A. This station is located in a relatively stagnant drainage ditch that receives effluent from the site package sewage treatment plant. The sewage plant operated in compliance throughout 1992. Additionally, DO was measured at all sampling stations in 1992. The average annual values ranged from 5.4 mg/l to 9.6 mg/l (stations B and A respectively). The lowest measurement was 4.2 mg/l at station B; the highest 11.0 mg/l at station A, during 1992.


Suphur Mines
Dissolved Oxygen Sample Point A
Std Units
Year


Suphur Mines
Dissolved Oxygen Sample Point B
Std Units
Year

5.2.5.7 General Observations

Based on the above discussion, the following general observations are made regarding the quality of Sulphur Mines surface waters.

a. Overall, pH continued to be relatively neutral.

b. Changes in water temperature observed during years since 1982 are attributed to seasonal meteorological variation, since the SPR has no thermal discharges.

c. The DO levels observed since 1985 have been relatively consistent, with only a sight deviation in 1986, and are attributed to natural factors as well as low BOD_5 levels in effluent from the site sewage treatment plant.

d. Stations B and G have leveled off after years of a steady decline in salinity suggesting a general reduction of salinity when compared to previous levels and the years of industrial activity in the area.

5.2.6 Weeks Island

The Weeks Island site is located on the Weeks Island salt dome approximately 30 m (100 ft) above sea level. The surrounding topography is of rather sharp relief with several small ponds. None of the SPR outfalls discharge directly into these ponds. Other surface waters at this site are intermittent in nature, draining rapidly and thoroughly after any precipitation. The site outfalls (Figure 5-6) discharge small volumes into surface runoff at a substantial distance from receiving waters. The lack of potentially impacted surface waters precludes the need for surface water quality monitoring at the Weeks Island site. Outfalls 004 and 01B are combined with 01A into a single surface drain, similar to the St. James arrangement.

WEEKS ISLAND SITE MAP

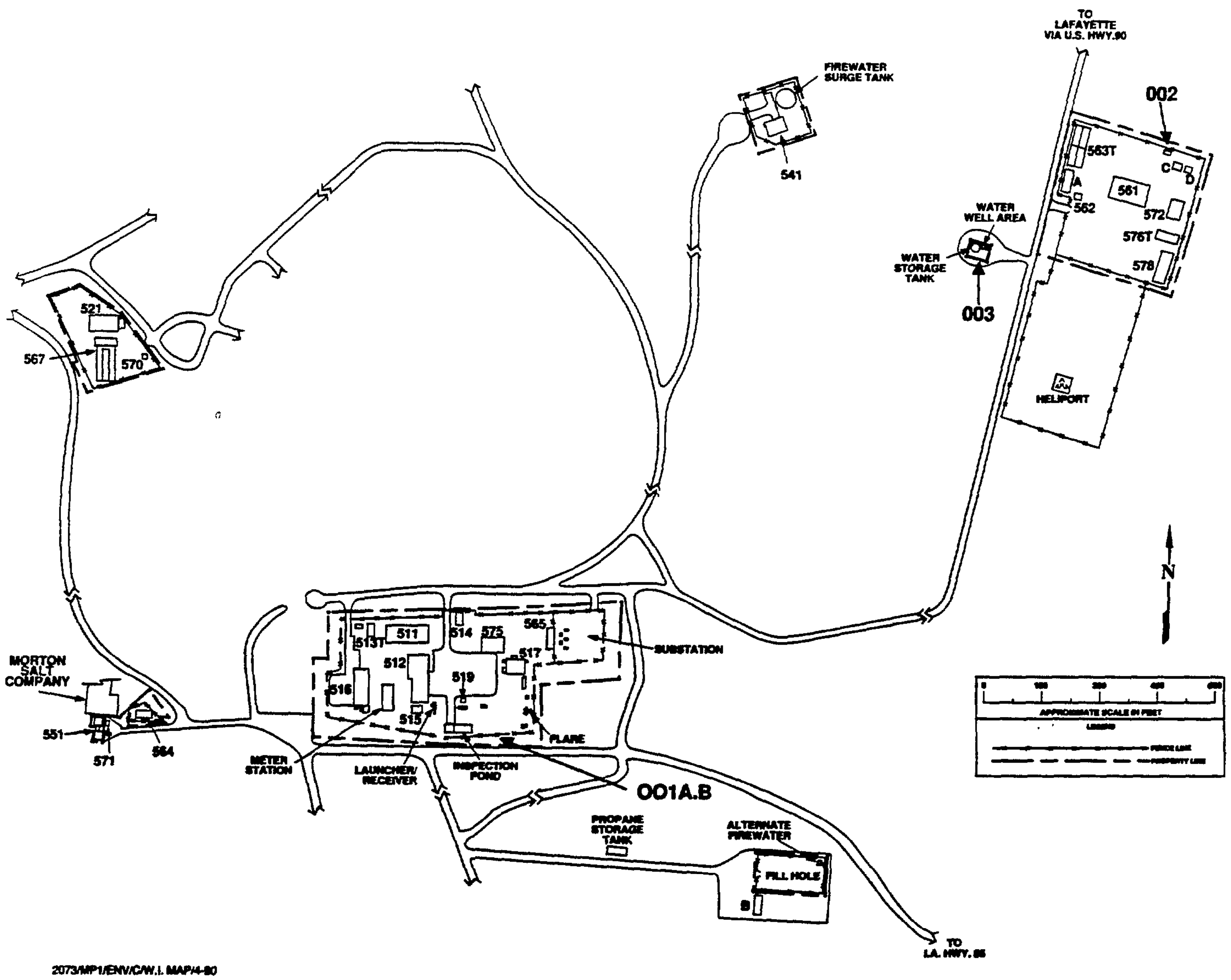


Figure 5-6 (Sheet 1 of 2). Weeks Island Environmental Monitoring Stations

Discharge Monitoring Stations

01A Stormwater runoff

01B Discharge from sewage treatment plant

002 Discharge from sewage treatment plant

003 Discharge from potable water iron removal system

004 Discharge condensate from mine air dryer

There are no water quality monitoring stations at Weeks Island

Figure 5-6 (Sheet 2 of 2). Weeks Island Environmental Monitoring Stations

5.2.7 West Hackberry

West Hackberry surface water quality was monitored by sampling once monthly at each station throughout 1992. Specific monitoring stations are identified in Figure 5-7. Specific parameters monitored in the West Hackberry surface waters include pH, salinity, temperature, TOC, and oil and grease. TOC was monitored only at station E corresponding to the NPDES permit requirement regarding stormwater discharges. Each parameter is discussed in the following sections.

5.2.7.1 Hydrogen Ion Activity (pH)

1992 data is consistent with data from previous years. Natural waters low in, or devoid of, carbon dioxide are medium hard to hard, with regard to mineral content, and characteristically have a slightly high pH. Some compounds, such as hydrogen cyanide and hydrogen sulfide, increase in toxicity with the degree of dissociation, resulting in increasing aquatic toxicity with reduced pH. A mildly high pH is beneficial to aquatic life and consistent with an environmentally sound ecosystem.

WEST HACKBERRY SITE MAP

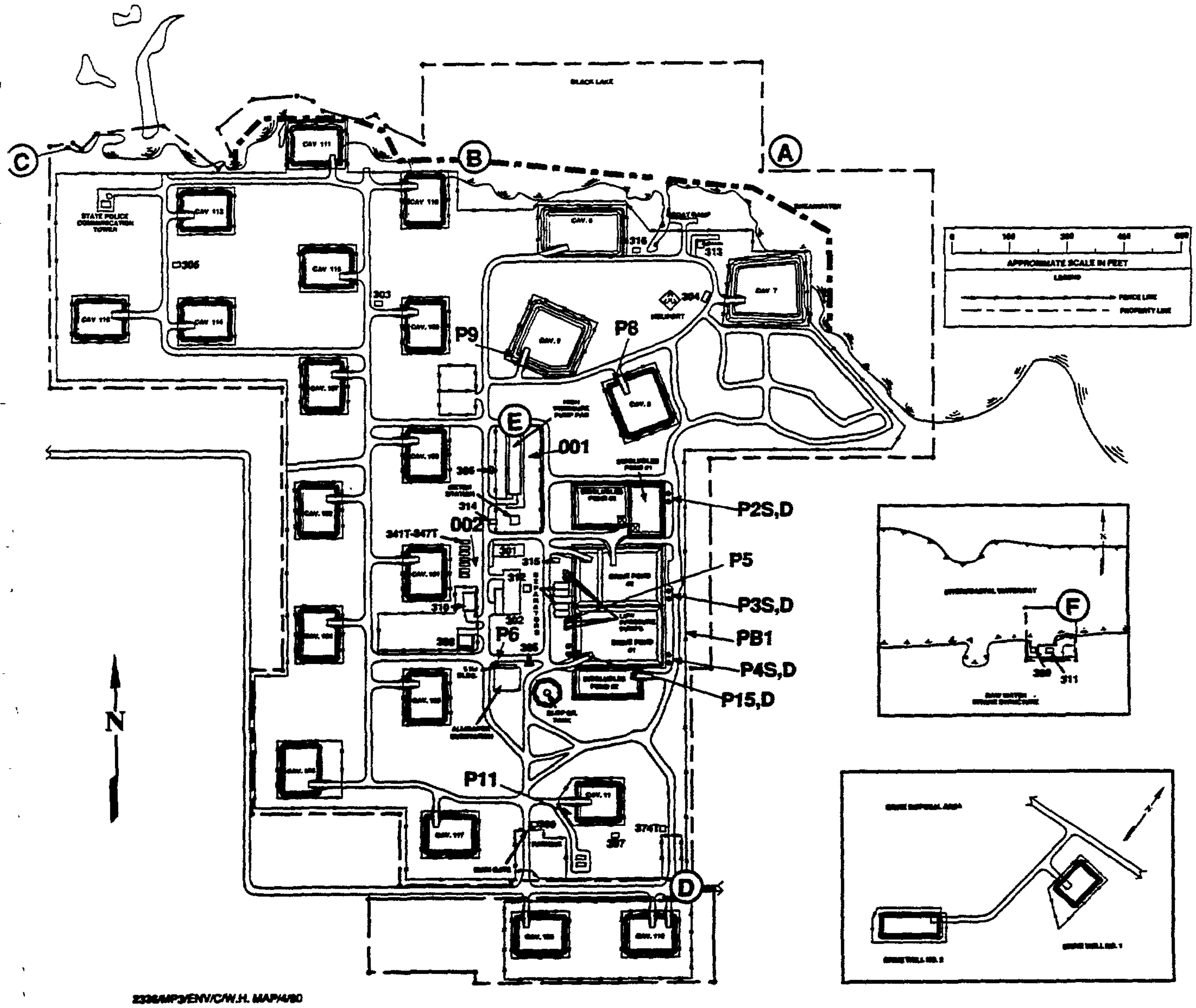


Figure 5-7 (Sheet 1 of 2). West Hackberry Environmental Monitoring Stations

Discharge Monitoring Stations

001 Brine disposal

002 Discharge from sewage treatment plant

003 (State) Stormwater and pump flush from high-pressure pump pad Stormwater runoff from well pads 6-9, 11, and 101-117

004 Stormwater from the Texoma/Lake Charles meter station

Water Quality Monitoring Stations

A Black Lake

B Black Lake

C Black Lake

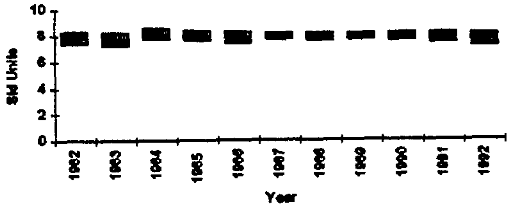
D Southeast drainage ditch

E High-pressure pump pad

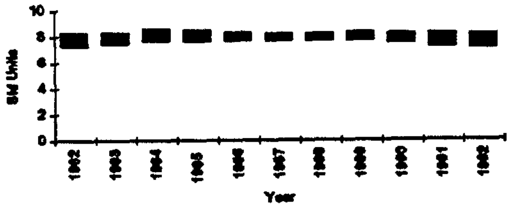
F Raw water intake structure

Figure 5-7 (Sheet 2 of 2). West Hackberry Environmental Monitoring Stations

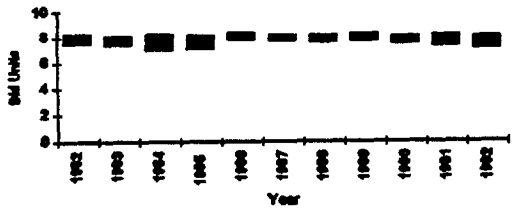
West Hackberry
pH Sample Point A

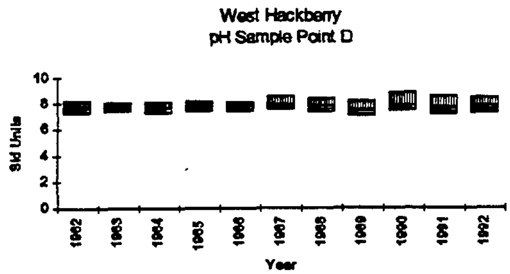


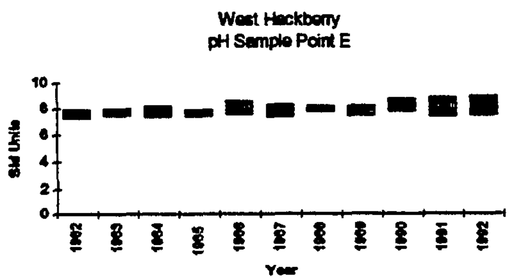
West Hackberry
pH Sample Point B

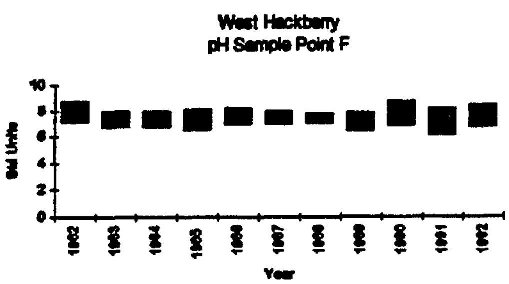


West Hackberry
pH Sample Point C



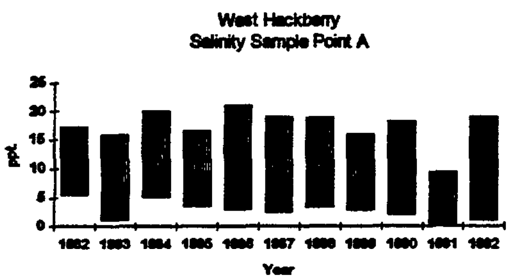

West Hackberry
pH Sample Point D
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

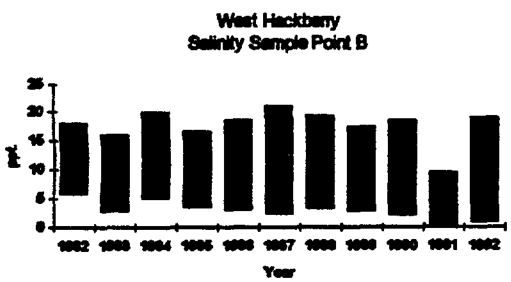

West Hackberry
pH Sample Point E
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

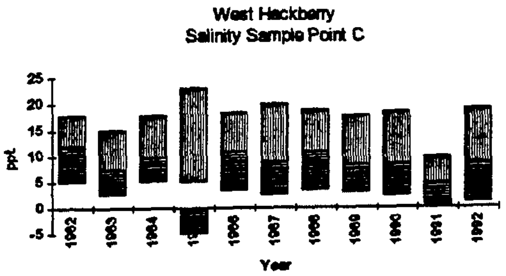

West Hackberry
pH Sample Point F
Std Units
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

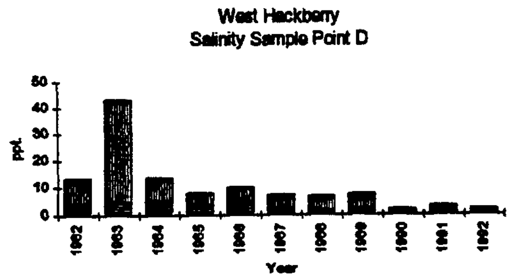
5.2.7.2 Salinity (SAL)

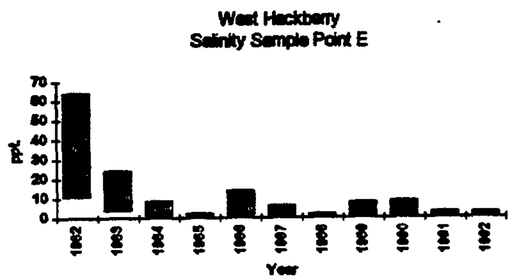
In 1992 Black Lake exhibited a salinity increase from that observed in 1991 that is possibly attributed to fewer tropical storms than during the previous year, with all other data being consistent with previous years. Wind, tide, and rainfall contributed to the salinity variation in Black Lake. The broad salinity range observed in Black Lake is more conducive to supporting euryhaline organisms or those with sufficient mobility to avoid salinity stresses with such seasonal changes. Salinity at stations D and E averaged near 1.0 ppt, suggesting that the brine spills did not get offsite. Salinity at station F (Intracoastal Waterway) exhibited less variation than in 1991, indicative of more stable meteorlogical conditions in 1992.

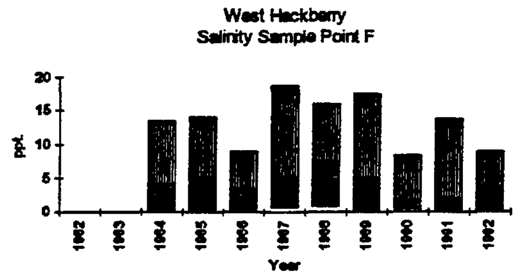





West Hackberry
Salinity Sample Point C
25
20
15
10
5
0
-5
ppt
1982
1983
1984
1986
1987
1988
1989
1990
1991
1992
Year

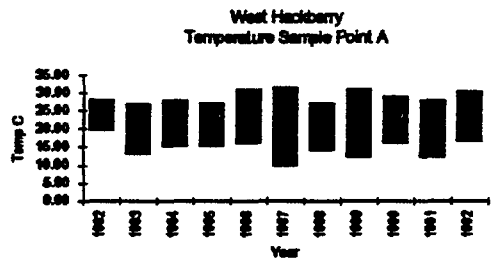

West Hackberry
Salinity Sample Point D
50
40
30
20
10
0
ppt
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

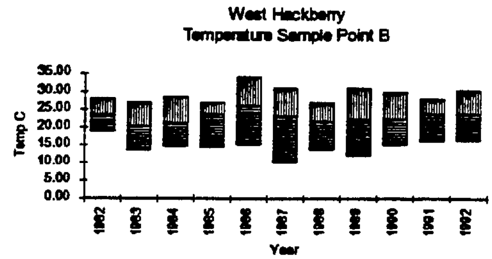

West Hackberry
Salinity Sample Point E
70
60
50
40
30
20
10
0
ppt
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

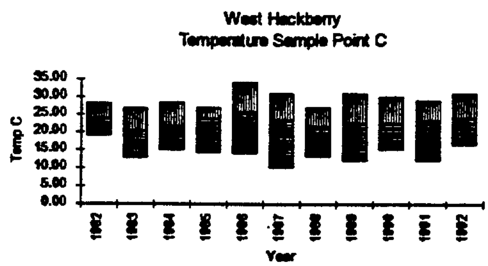


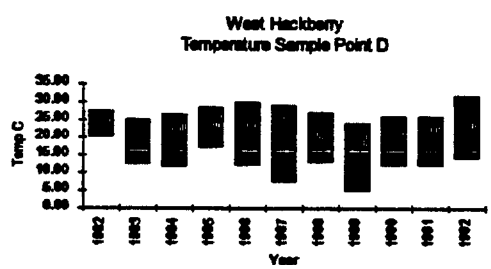
5.2.7.3 Temperature

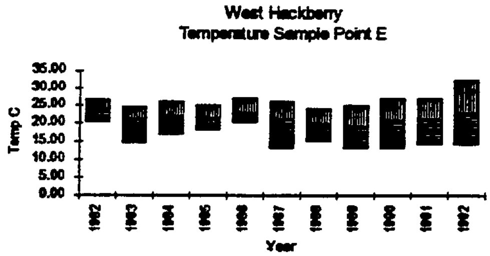
1991 data was consistent with observations at other sites indicative of regional climatic effects. No off-normal measurements were observed.

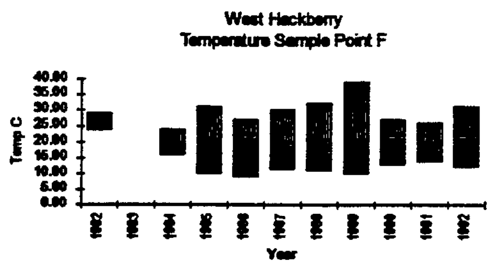



West Hackberry
Temperature Sample Point B
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temp C
Year


West Hackberry
Temperature Sample Point C
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temp C
Year

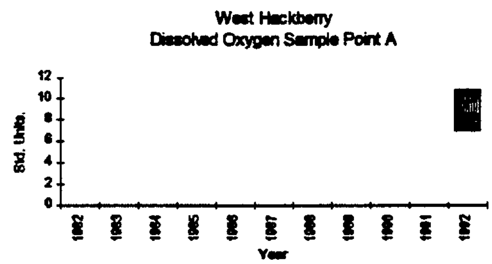

West Hackberry
Temperature Sample Point D
Temp C
Year


West Hackberry
Temperature Sample Point E
Temp C
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Year


West Hackberry
Temperature Sample Point F
Temp C
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Year

5.2.7.4 Dissolved Oxygen

Quantification of dissolved oxygen was begun in 1992. Ranges observed in Black Lake and the Intracoastal Waterway are beneficial to aquatic organisms and exhibited less fluctuation than observed in ditches on site. DO levels in site ditches (stations D and E) dropped to annual low levels during summer as a result of high water temperature.



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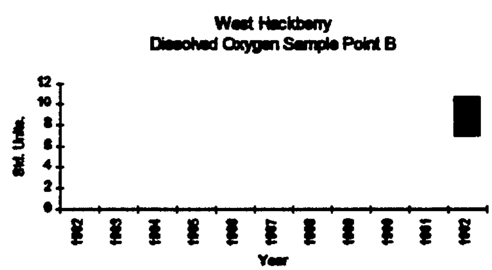
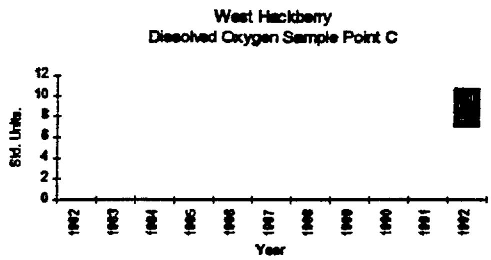
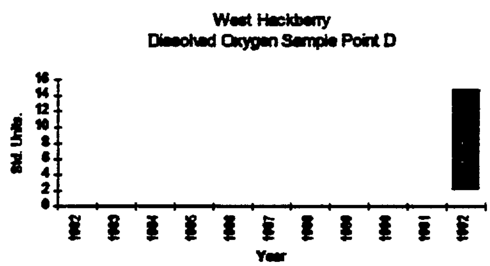



West Hackberry
Dissolved Oxygen Sample Point C
Std. Units
Year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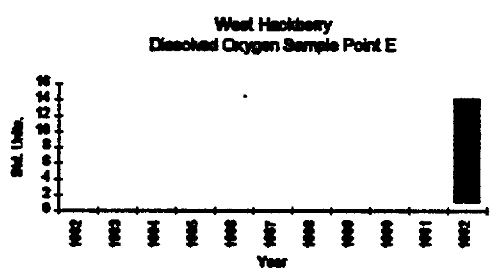
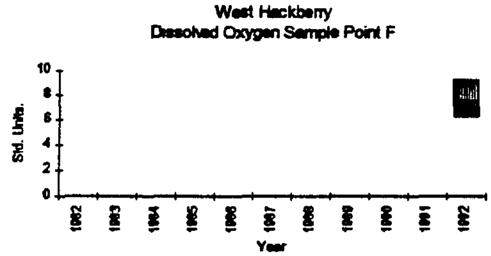
Dissolved Oxygen Sample Point D
Std. Units
Year

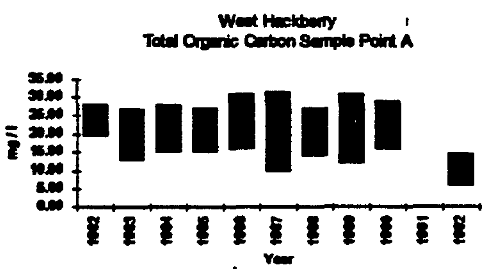

West Hackberry
Dissolved Oxygen Sample Point E
Std. Units
Year



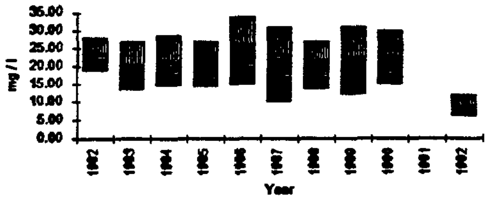
5.2.7.5 Total Organic Carbon

TOC is an NPDES permit required parameter for discharges from the high-pressure pump pad and adjacent stormwater discharges. The low levels indicate that effluent from the pad did not contribute to TOC loading in the lake.

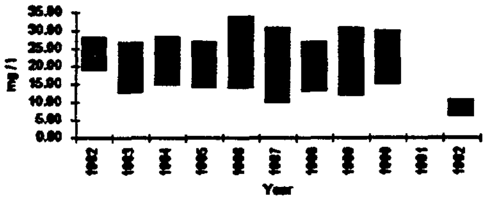
TOC testing was begun on all other sampling stations in 1992. Overall, TOC was greater at other stations than at Station E (High Pressure Pump Pad ditch). The Hackberry community water supply is the water source that feeds the ditch at Station E. It is not as rich in biomass as natural waters at other site ditches, Black Lake, and the Intracoastal Waterway.



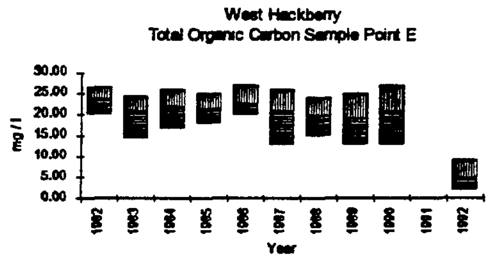
West Hackberry
Total Organic Carbon Sample Point B

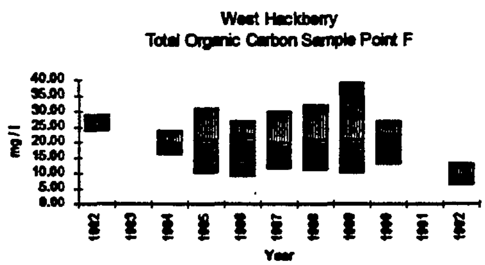


West Hackberry
Total Organic Carbon Sample Point C



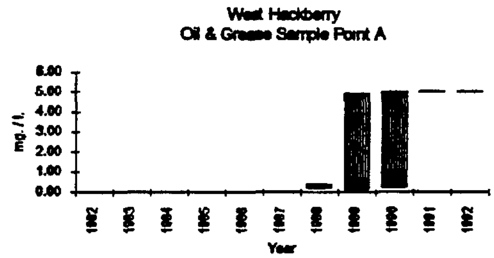
West Hackberry
Total Organic Carbon Sample Point D

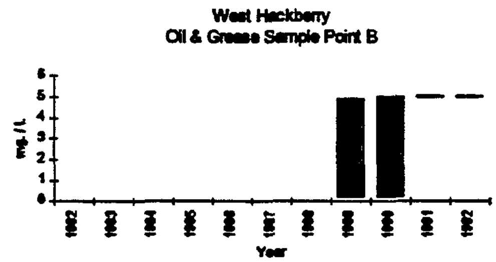


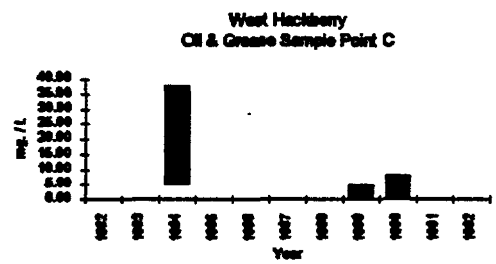


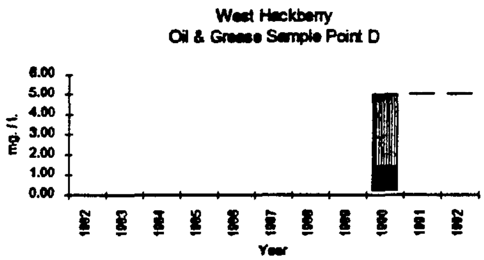
5.2.7.6 Oil and Grease

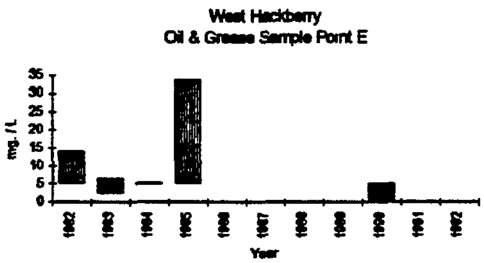
Oil and grease levels were at or below the previously detectable levels (5 mg/1) at all stations throughout 1992. These data are generally consistent with oil and grease data collected since 1982. Data from 1988 through 1990 were analyzed using an infrared method which gives detection limits below 5 mg/1.

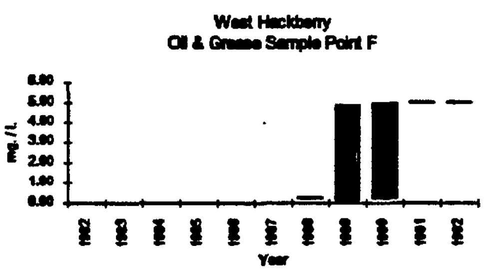

West Hackberry
Oil & Grease Sample Point A
mg. / l.
Year


West Hackberry
Oil & Grease Sample Point B
mg. / l.
Year


West Hackberry
Oil & Grease Sample Point C
mg. / l.
Year







5.2.7.7 **General Observations**

The following observations are made, based on the above discussion, concerning operational impacts on the West Hackberry aquatic environs.

a. pH and temperature remained fairly stable and consistent with previous years.

b. Runoff from the high pressure pump pad was of lower salinity than the Black Lake receiving waters. This demonstrates continuing good control of brine leaks and spills observed since 1982.

c. Oil and grease levels were <5 mg/l in Black Lake throughout 1992.

d. Dissolved oxygen levels in receiving waters were consistently high and did not appear affected by site operations. Dissolved oxygen in site ditches exhibited a summer decrease in relation to an increase in primary productivity and water temperature.

e. TOC at Station E which receives water from the high pressure pump pad remained well below permit limits and lower than that of natural receiving water

5.3 WATER DISCHARGE PERMIT MONITORING

The water discharge permit monitoring program fulfills the requirements of the EPA NPDES, and corresponding state programs, TPDES and LWDPS. All SPR point source discharges are conducted in compliance with these Federal and state programs.

SPR personnel regularly conducted point source discharges from all sites during 1992. These discharges are grouped as:

a. brine discharge to the Gulf of Mexico,
b. stormwater runoff from tank, well, and pump pads
c. rinsate from vehicles at specific locations draining to permitted outfalls.
d. effluent from package sewage treatment plants.

Parameters monitored varied by site and discharge. Table 5-1 identifies frequency of specific parameters measured at each SPR site. The variations in data are discussed by site.

5.3.1 Bayou Choctaw

Most monitoring is related to water discharges regulated under the EPA (NPDES) permit and a corresponding permit issued by the Louisiana Department of Environmental Quality (LDEQ) Office of Water Resources. Discharges are from two package sewage treatment plants (STP), and stormwater runoff from well pads, pump pads (containment areas), and the site vehicle rinsing station. The outfalls are shown in Figure 5-1.

Parameters for the Bayou Choctaw outfalls are described below.

Bayou Choctaw

Location/Discharge	Parameter	Compliance Range
sewage treatment plants	flow	(report only)
	BOD_5	≤45 mg/l
	TSS	≤45 mg/l
	pH	6.0 - 9.0
stormwater and vehicle rinsing	flow	(report only)
	oil and grease	≤15 mg/l
	pH	6.0 - 9.0

A total of 802 measurements were performed on permitted outfalls and reporting stations to monitor NPDES and state permit compliance during 1992. There were no noncompliances in 1992. The site therefore earned a perfect (100%) compliance level for 1992. A LWDPS permit renewal was submitted to LDEQ for the Bayou Choctaw facility in 1992.

5.3.2 Big Hill

Water discharges at Big Hill are regulated and enforced through the EPA NPDES permit program and the similar TWC discharge permit program (TPDES). An NPDES renewal application was submitted in 1988 as required every five years. No significant changes were requested in the application. The discharges at the facility involve brine to the Gulf of Mexico, hydroclone blowdown into the Intracoastal Waterway, effluent from the sewage treatment plant, and stormwater from well pads, pump pads, and a vehicle rinsing station. Figure 5-2 shows the existing outfalls. There were no discharges during 1992 from the hydroclone blowdown system. Parameters for all the discharges are described below. A total of 1307 measurements were performed to monitor NPDES and state discharge permit compliance during 1992. There were 7 noncompliances during 1992 (Table 5-2) resulting in a 99.5% site compliance performance level.

Parameters for the Big Hill outfalls are described below.

Big Hill

Location/Discharge	Parameter	Compliance Range
brine to Gulf	flow	0.27 million m^3/day
	velocity	$\geq$ 6.1 m/sec)
	oil and grease	$\leq$ 15 mg/l
	TDS	(report only)
	TSS	< 40 mg/l (TWC only)
	pH	6.0-9.0
	DO	detectable (when using O_2 scavenger)
stormwater and car wash	oil and grease	$\leq$ 15 mg/l
	TOC	$\leq$75mg/l (EPA only)
	pH	6.0-9.0
sewage treatment plant (TWC only)	flow	< 37.8 m^3/day
	BOD_5	$\leq$ 65 mg/l
	TSS	$\leq$ 65 mg/l
	chlorine	1.0 - 4.0 mg/l
	pH	6.0-9.0
hydroclone blowdown (not used)	flow	report
	TSS	report
	pH	6.0-9.0

Table 5-2. 1992 Noncompliances/Bypasses at Big Hill

Outfall Location	Permit Parameter	Value/ Limit	Cause
003	Bypass	------	A leaking valve on Cavern 108 resulted in an overflow and bypass of stormwater.
003	no sample	------	During the bypass (above) a sample was not obtained of the unauthorized discharge.
004	no sample	------	A broken pipeline resulted in sulted in an unauthorized discharge of raw sewage. The discharge was not sampled.
003 (Carwash)	High TOC	90.1/ 75	Soiled brine pond boom was washed with a weak chlorine containing cleanser at the car wash producing the high TOC.
001	no sample	------	A discharge to the gulf was sampled for O&G; samples for other required analyses were not obtained.
001	DO	0.0/ detectable	Excessive oxygen scavenging resulted in oxygen depletion in a flow of brine to the gulf.
001	no sample	-------	No sample was obtained for O&G on a brine flow to the Gulf.

5.3.3 Bryan Mound

Water discharges at Bryan Mound are regulated and enforced through the EPA NPDES permit program and the similar TWC discharge permit program for state waters (TPDES). An NPDES renewal application was submitted during 1988 as required every five years. No significant changes were requested in the application. The three permitted discharges are brine to the Gulf of Mexico; stormwater from the tank farm, well pads, and pump pads; and package sewage treatment plant effluent.

Parameters for the Bryan Mound outfalls are described below.

Bryan Mound

Location/Discharge	Parameter	Compliance Range
brine to Gulf (EPA only)	flow	0.17 million m^3/day
	velocity	$\geq$ 6.1 m/sec
	oil and grease	$\leq$15 mg/l
	TDS	(report only)
	TSS	(report only)
	pH	6.0 - 9.0
stormwater	flow	(report only)
	oil and grease	$\leq$15 mg/l
	TOC	$\leq$75 mg/l (EPA only)
	pH	6.0 - 9.0
	COD	$\leq$200 mg/l (TWC only)
sewage treatment only)	flow	$\leq$22.7 m^3/day (TWC
plant	BOD_5	$\leq$45 mg/l and $\leq$0.68 kg/day
kg/day	TSS	$\leq$45 mg/l and $\leq$0.68
	chlorine	1.0 - 4.0 mg/l
	pH	6.0 - 9.0

In response to a brine spill in late June (1991); the site was placed into an administratively "shut-down" mode. As a result, the site essentially operated in a minimal impact fashion for most of 1991. After completing required root cause analyses and after implementation of some procedural changes the site was returned to an operational (stand-by) mode in 1992.

A total of 3073 measurements were made on permitted outfalls for the purpose of monitoring NPDES and state discharge permit compliance during 1992.

There were twenty noncompliances during 1992 (Table 5-3) resulting in a 99.3% site compliance performance level.

plants. All three outfalls discharge through a common pipe to the Mississippi River.

A total of 128 measurements were performed on permitted outfalls to monitor NPDES and state discharge permit compliance. There was one noncompliance in 1992 (Table 5-4) giving the site a 99.2% compliance level.

Parameters for the St. James outfalls are described below.

St. James

Location/Discharge	Parameter	Compliance Range
retention pond	flow	(report only)
	oil and grease	≤15 mg/l
	pH	6.0 - 9.0
	TOC	≤50 mg/l
sewage treatment plants	flow	(report only)
	BOD_5	≤45 mg/l
	TSS	≤45 mg/l
pH	6.0 - 9.0	

Table 5-4. 1992 Noncompliances/Bypasses at St. James Terminal

Outfall Location	Permit Parameter	Value/ Limit	Cause
001	no sample	------	A storm water TOC sample was held beyond the recommended holding time of 28 days.

5.3.5 Sulphur Mines

The water discharge points at Sulphur Mines are regulated through the EPA NPDES program. The 1990 permit renewal regrouped the discharges. Five of the discharges are stormwater runoff from the well and pump pads. The sixth (outfall 001) is the effluent from the sewage treatment plant and the seventh (outfall 002) is from the water treatment system back flush. An LWDPS renewal was submitted to LDEQ during 1992 for the Sulphur Mines facility. See Figure 5-6 for outfall locations.

Parameters for the Sulphur Mines outfalls are described below.

Sulphur Mines

Location/Discharge	Parameter	Compliance Range
stormwater	flow	(report only)
	oil and grease	≤15 mg/l
	pH	6.0 - 9.0
sewage treatment plant	flow	≤5.6 m^3/day
	BOD_5	<45 mg/l
	TSS	≤45 mg/l
	pH	6.0 - 9.0
water treatment system back flush	flow	(report only)
	pH	6.0 - 9.0
	salinity	(report only)

A total of 338 measurements were provided on permitted outfalls to monitor NPDES compliance during 1992. The water system back flush was not used in 1992. There were no noncompliances during 1992 resulting in a perfect performance compliance level. The site is presently being decommisssioned from the SPR.

5.3.6 Weeks Island

The water discharges at Weeks Island are regulated and enforced in accordance with the EPA NPDES permit program and the state water discharge program (LWDPS). There are separate outfalls (01B and 002) for each package sewage treatment plant. Outfall 01A handles all of the stormwater runoff collected in an onsite retention pond (Figure 5-6). There was no discharge from the iron removal unit (outfall 003) in 1992. The water condensing unit for the mine air (outfall 004) operated continuously in 1992.

A LWDPS permit renewal was submitted to LDEQ for the Weeks Island facility during 1992.

Parameters for the Weeks Island outfalls are described below.

Weeks Island

Location/Discharge	Parameter	Compliance Range
stormwater	flow	(report only)
	oil and grease	≤15 mg/l
	pH	6.0 - 9.0
sewage treatment plant	flow	(report only)
	BOD_5	≤45 mg/l
	TSS	≤45 mg/l
	fecal coliforms	≤400 colonies/100 ml
	pH	6.0 - 9.0
iron removal unit	flow	(report)
	TSS	≤45 mg/l
mine air dryer condensate water	flow	(report)
	pH	6.0 - 9.0
	TOC	(report)

A total of 215 measurements were performed on permitted outfalls to monitor NPDES compliance during 1992. There was one noncompliance in 1992 (Table 5-5). The site experienced a compliance performance level of 99.5%.

Table 5-5. 1992 Noncompliances/Bypasses at Weeks Island

Outfall Location	Permit Parameter	Value/ Limit	Cause
004	pH	2.8/ 6.0	The mine air dryer was washed with a cleanser containing phosporic acid; the rinsate pH lowered the pH in the sump and was discharged.

5.3.7 West Hackberry

The water discharges at the West Hackberry site are regulated and enforced in accordance with the EPA NPDES permit program and LDEQs state water discharge program (LWDPS). The three categories of discharges (Figure 5-7) at West Hackberry are brine disposal to the Gulf of Mexico; sewage treatment plant effluent; and, stormwater runoff from well pads, pump pads, and vehicle rinsing. The various parameters for these discharges are listed below with their maximum limits.

Parameters for the West Hackberry outfalls are described below.

West Hackberry

Location/Discharge	Parameter	Compliance Range
brine to Gulf	flow	$\leq$0.17 million m^3/day
	velocity	>7.6 m/sec (25 ft/sec)
	oil and grease	$\leq$15 mg/l
	TSS	(report only)
	TDS	(report only)
	pH	6.0 - 9.0
	DO	detectable (when using O_2 scavenger)
sewage treatment plant	flow	(report only)
	BOD_5	$\leq$15 mg/l
	TSS	$\leq$45 mg/l
	fecal coliform	(report only)
	pH	6.0 - 9.0
stormwater	flow	(report only)
	oil and grease	$\leq$15 mg/l
	TOC	$\leq$75 mg/l
	pH	6.0 - 9.0

A total of 2932 measurements were performed on permitted outfalls to monitor NPDES compliance during 1992. Permit noncompliances were identified on two occasions (Table 5-6). These two noncompliances, on a per analysis basis, resulted in a site compliance performance level of 99.9%.

Table 5-6. 1992 Noncompliances/Bypasses at West Hackberry

Outfall Location	Permit Parameter	Value/ Limit	Cause
002	BOD_5	11.0/ 10.0	A single sample during the month was below the Daily Max. but above the Daily Avg. limit for BOD_5 at the STP.
002	BOD_5	13.9/ 10.0	A chronic upset in the STP produced the high Daily Avg. value for BOD_5 at the STP. These two NCs are of similar nature.

5.4 ENVIRONMENTAL PERMITS

The active environmental permits, required by regulatory agencies to construct, operate and maintain the SPR, are discussed by site.

5.4.1 Bayou Choctaw

Table 5-7 lists the active permits at Bayou Choctaw. Individual work permits are received from the Louisiana Underground Injection Control Division of LDNR for each well workover performed. State inspectors regularly visit the site to observe SPR operations. A renewal application for the LWDPS Discharge permit was submitted in October and accepted for review on 10/1/92. A concurrence with Nationwide Permit coverage was received from the COE on electrical upgrade work performed at two brine disposal well pads. A Notice Of Intent for General Permit coverage for stormwater associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92.

5.4.2 Big Hill

Table 5-8 lists the active permits at Big Hill. The Big Hill site has an amendment to its TWC permit for appropriating additional state waters for the leaching, site utility, and fire protection systems. The permit requires a yearly report of water quantities used. In 1992, the site appropriated 1.09 million m^3 (881.65 acre-feet) of water from the Intracoastal Waterway exclusive of water for fire protection. This represents only 0.75% of the total allowable withdrawal for a year.

5.4.3 Bryan Mound

Table 5-9 lists the active permits for the Bryan Mound site. The Bryan Mound site has a second TWC permit for the appropriation of state waters for the leaching program, site utility, and fire protection systems. The permit requires a yearly report of the quantity of water used. In 1992, the site used a total of 0.06 million m^3 (45.81 acre/feet) of water from the Brazos River Diversion Channel. A total of 147.02 million m^3 (119,188 acre-feet) of water has been appropriated to date for site activities which represents 32.5% of the total volume permitted.

Notice Of Intent for General Permit coverage for storm water associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92.

5.4.4 St. James

Table 5-10 lists the active permits at St. James Terminal. A Notice Of Intent for General Permit coverage for storm water associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92.

5.4.5 Sulphur Mines

Table 5-11 lists the active permits at Sulphur Mines. All state underground injection control certifications are current. State inspectors regularly visit the site to observe underground injection operations. A Notice Of Intent for General Permit coverage for storm water associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92. An LWDPS renewal application was submitted to LDEQ and was accepted for review on 11/5/92.

5.4.6 Weeks Island

The active permits for Weeks Island are listed in Table 5-12. A Notice Of Intent for General Permit coverage for storm water associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92. A

LWDPS renewal application was submitted to LDEQ and accepted for review on 7/24/92.

5.4.7 West Hackberry

Active permits for West Hackberry are listed in Table 5-13. A Notice Of Intent for General Permit coverage for storm water associated with industrial activity was made in September; a notice of permit coverage was received from EPA on 12/31/92. A concurrence for Nationwide Permit coverage was received from the COE for wetlands work at the West Hackberry 42-inch crude line valve station #2.

Table 5-7. Active Permits at Bayou Choctaw

PERMIT NUMBER	ISSUING* AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0053040	EPA	NPDES	3/13/83	3/12/88	(1)
LAR00A280	EPA	NPDES*	12/31/92	12/31/97	(2)
WP0179	LDEQ	Water (Disch.)	7/22/83	7/21/88	(3)
1280-00015-000	LDEQ	Air	10/01/87	Open	
None	LDNR	Injection	1/11/83	Open	(4)
SDS-1	LDNR	Injection	9/09/77	Open	(5)
LMNOD-SP (Bayou Plaquemine)17	COE	Maint.	9/26/77	9/26/87	(6) (7)
LMNOD-SP (Bull Bay)3	COE	Constr. Maint.	1/30/79 1/30/79	1/29/82 9/26/87	(8) (9)
LMNOD-SP (Iberville Parish Wetlands)7	COE	Constr. & Maintain	9/26/77	-	(10)
LMNOD-SP (Iberville Parish Wetlands)10	COE	Constr. & Maintain	6/12/78	-	(11)
LMNOD-SP (Iberville Parish Wetlands)17	COE	Constr. & Maintain	11/6/78	-	(12)
LMNOD-SP (Iberville Parish Wetlands)31	COE	Constr. & Maintain	5/27/80	-	(13)
LMNOD-SP (Iberville Parish Wetlands)102	COE	Constr. & Maintain	9/26/77	-	(14)

(1) Renewal submitted (11/9/87 and letter to DOE of January 31, 1991 addresses status).

(2) NPDES* General Permit for Storm Water Associated with Industrial Activity; Notice of Intent made 9/30/92.

(3) Renewal submitted 11/9/87; No response from LDEQ. Application resubmitted. Follow-up LWDPS submission 10/92; accepted for review 10/1/92.

(4) Letter of financial responsibility to plug and abandon injection wells.

(5) Permit approved use of salt dome cavities for storage of liquid hydrocarbons.

(6) Maintain 36-inch crude oil pipeline.

(7) Maintenance clause of permit is being renewed.

(8) Maintain Bull Bay 24" brine disposal pipeline.

(9) Recorded with applicable Registrar of Deeds.

(10) Construct and maintain well pads (brine disposal wells).

(11) Enlarge existing well pads and construct access roads (brine disposal Wells 1, 2, & 3.)

(12) Construct and maintain access road to brine disposal well area.

(13) Construct and maintain well pad, levees, access road & appurtances to cavern 102 and additional bank stabilization, warehouse pad and culvert per additions of 1983.

(14) Construct and maintain ring levee, drill site and appurtenances, Well 101.

COE - U.S. Army Corps of Engineers

EPA - Environmental Protection Agency

F&WS - U.S. Fish and Wildlife Service

LDEQ - Louisiana Department of Environmental Quality

LDNR - Louisiana Department of Natural Resources

LDOTD - Louisiana Department of Transportation and Development

RCT - Railroad Commission of Texas

TACB - Texas Air Control Board

TDH&PT - Texas Department of Highways and Public Transportation

TWC - Texas Water Commission

Table 5-8. Active Permits at Big Hill

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
TX0092827	EPA	NPDES	01/18/89	01/17/94	(1)
TXR00B608	EPA	NPDES*	12/31/92	12/31/97	(2)
SWGCO-RP 16536 (01,02,03)	COE	Constr. & Maint.	01/11/84 01/11/84	1/11/94	(3)
P-7	F&WS	Constr. Operate	07/31/86 07/31/86	07/31/88 06/30/36	(4)
9256	TACB	Air	05/17/83	5/16/98	(5)
02937-02939	RCT	Operate	11/28/83	Open	(6)
P000226A-P000226B	RCT	Operate/Maintain	09/19/84	Open	(7)
0048295-0048320	RCT	Operate	05/09/83 06/23/83	Open Open	(8)
02638	TWC	Water (Disch.)	03/27/89	03/26/94	(9)
4045A	TWC	Water (Use)	11/14/83	Open	(10)

(1) Renewal submitted 10-23-88. - accepted as administratively complete.

(2) Permits to construct and maintain RWIS, raw water 48" pipeline, brine disposal 48" pipeline, crude oil 36" pipeline

(3) Completion of raw water, brine disposal, and crude oil pipeline extended. Amended to install offshore pipeline by trenching.

(4) Completion of pipeline construction extended. (48" Brine Pipeline)

(5) While under construction.

(6) Valid until ownership changes, system changes, or other physical changes are made in the system.

(7) Permits to operate and maintain anhydrite and brine/oil pits.

(8) Permits to create, operate, and maintain an underground hydrocarbon storage facility consisting of 14 caverns.

(9) Corresponds to TX0092827. (EPA-NPDES)

(10) Permit expires after consumption of 239,080 acre-feet of water or end of project.

Table 5-9. Active Permits at Bryan Mound

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
TX0074012	EPA	NPDES	02/02/89	02/01/94	(1)
TXR00B609	EPA	NPDES*	12/31/92	12/31/97	(2)
SWGCO-RP-12347(01)	COE	Dredging	02/29/84	12/31/94	(3)
3-67-782 (Docket#)	RCT	Injection	08/21/78	Open	(4)
3-70-377 (Docket#)	RCT	Injection	12/18/78	Open	(4)
P001447	RCT	Operate	10/30/84	Open	(5)
P001448	RCT	Operate	10/30/84	Closed	(6)
3681A	TWC	Water	07/20/81	Open	(7)
02271	TWC	Water	02/05/90	02/04/95	(8)
6176B	TACB	Air	02/23/87	02/22/02	
82-8475	TDH&PT	Constr.	01/01/83	Open	(9)
SWGCO-RP 11666	COE	Constr. & Maint.	10/15/77	-	(10)
SWGCO-RP 12112	COE	Constr. & Maint.	07/25/77	-	(11)
SWGCO-RP 12062	COE	Constr. & Maint.	10/10/78	-	(12)
SWGCO-RP 14114 (01)	COE	Constr. & Maint.	05/18/85	-	(13)
SWGCO-RP 16177	COE	Constr. & Maint.	09/07/82	-	(14)

(1) Renewal submitted 9/7/88. Accepted as administratively complete.

(2) NPDES* General Storm Water permit; Notice of Intent sent 9/30/92.

(3) Maintenance dredging of raw water intake extended. (SWGCO-RP 12347 authorized constr. of RWIS)

(4) Approval of oil storage and salt disposal program.

(5) Authority to operate brine pond.

(6) Small brine pond closed August, 1989.

(7) Permit expires after consumption of 367,088 acre-feet of water or project ends.

(8) Corresponds with TX0074012 (EPA-NPDES). (Renewal submitted 1/30/89,

RCT presently reviewing)

(9) Corresponds with SWGCO-RP-16177.

(10) for 30-inch crude oil pipeline to 3 miles SW from Freeport

(11) for 30-inch crude oil pipeline to 2 miles S from Freeport

(12) for 36-inch brine disposal pipeline & diffuser (revision 01 in process)

(13) general permit for pipeline crossings by directional drilling in navigable waters

(14) place an 8-inch water line (PVC, potable)

Table 5-10. Active Permits at St. James Terminal

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0054674	EPA	NPDES	07/11/90	07/10/95	(1)
LAR00A276	EPA	NPDES*	12/31/92	12/31/97	(2)
LMNOD-SP (Mississippi River) 998	COE	Maint.	03/20/78	03/20/88	(3)
WP 0929	LDEQ	Water (Disch.)	05/04/90	05/03/95	(4)
983	LDEQ	Air	07/25/78	Open	(5)

(1) Permit renewal submitted May 25, 1990. Accepted as administratively complete

(2) NPDES* General Storm Water permit; Notice of Intent made 9/30/92.

(3) Permit and all amendments recorded with Registrar of Deeds in St.James Parish.

(4) LDEQ Water Permit renewal submitted.

(5) Requires annual operating report. (EIQ and permit being revised.)

Table 5-11. Active Permits at Sulphur Mines

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0055786	EPA	NPDES	04/12/90	04/11/95	(1)
LAR00A277	EPA	NPDES*	12/31/92	12/31/97	(2)
NONE	LDEQ	Water (Disch.)	12/07/84	Open	(3)
1042	LDEQ	Air	09/26/78	Open	(4)
None	LDOTD	Water (Use)	01/01/90	12/31/90	(5)
None	LDNR	Brine Injection	01/11/83	Open	(6)
SDS-6	LDNR	Brine Injection	07/20/78	Open	(7)
LMNOD-SP (LTCS)20	COE	Maint.	07/24/78	Open	(8)

(1) Third round renewal submitted April 12, 1990. Accepted as administratively complete.

(2) NPDES* General Storm Water permit; Notice of Intent made 9/30/92.

(3) Application submitted to LDEQ. State never responded. EPA NPDES renewal notification sent to LDEQ 8/13/85. No response from state. LWDPS renewal sent 10/92; accepted for review 11/5/92.

(4) Requires annual operating report.

(5) Water purchase agreement (renewed annually).

(6) Letter of financial responsibility to close, plug, and abandon any and all injection wells.

(7) Approval for use of salt dome cavities for storage of liquid hydrocarbons.

(8) Renewal submitted 8/13/85 for erosion control work on the Intracoastal Waterway. Recorded permit and amendments with applicable Parish Registrars of Deeds.

Table 5-12. Active Permits at Weeks Island

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0056243	EPA	NPDES	10/14/87	10/13/92	(1)
LAR00A278	EPA	NPDES*	12/31/92	12/31/97	(2)
LMNOD-SP (Atchafalaya Floodway) 251	COE	Constr. Maint.	07/12/78	07/11/88	(3)
1105	LDEQ	Air	01/30/79	Open	(4)
SDS-8	LDNR	Injection	02/16/79	Open	(5)
WP1051	LDEQ	Water (Disch.)	01/17/87	1/16/92	(6)

(1) Renewal submitted 9/25/87. Accepted as administratively complete. (renewal anticipated for CY 1993)

(2) NPDES* General Storm Water permit; Notice of Intent made 9/30/92.

(3) Recorded permit and amendments with applicable Parish Registrar of Deeds. Maintenance clause being renewed.

(4) Requires annual operating report.

(5) Approval for use of salt dome cavities for storage of liquid hydrocarbons.

(6) Permit interpereted to expire 1/16/93 via LAC; LDWPS renewal submitted for June 1992; accepted for review on 7/24/92.

Table 5-13. Active Permits at West Hackberry

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0053031	EPA	NPDES	08/22/89	08/21/94	(1)
LAR00A279	EPA	NPDES*	12/31/92	12/31/97	(2)
LMNOD-SP (LTCS)26	COE	Dredging	02/08/79	02/08/99	(3)
LMNOD-SP (Black Lk)31	COE	Dredging	10/26/82	05/15/97	(4)
LMNOD-SP (Black Lk)43	COE	Constr. Maint.	07/26/84 07/26/94	07/25/87 Open	(5)
LMNOD-SP (Gulf of Mexico)2574	COE	Constr. Maint.	08/11/80 08/11/80	08/11/90 Open	(6)
LMNOD-SE (LTCS)40	COE	Constr. Maint.	05/25/88 05/25/88	06/30/91 Open	(7)
LMNOD-SP (Cameron Parish Wetlands)162	COE	Maint.	03/09/78	03/09/88	(8)
None	LDNR	Injection	08/07/79	Open	(9)
971198-9	LDNR	Injection	10/06/83	Open	(10)
WP1892	LDEQ	Water (Disch.)	12/08/88	12/09/93	(11)
1048	LDEQ	Air	10/26/78	Open	(12)
SWGCO-RP-12342	COE	Constr. & Maint.	3/28/78	-	(13)
LMNOD-SP (Cameron Parish Wetlands) 152		Constr. & Maint.	3/16/78	-	(14)
LMNOD-SP (Cameron Parish Wetlands)276		Constr. & Maint.	2/11/80	-	(15)

(1) Renewal submitted 4/6/89. Dates based on previous permit. Accepted as administratively complete

(2) NPDES* General Storm Water permit; Notice of Intent made 9/30/92.

(3) Maintenance dredging for raw water intake.

(4) Maintenance dredging for fire water canal.

(5) Maintenance of erosion control dike completed in 1986.

(6) Amended to install parallel pipeline (05/29/86).

(7) Permit to construct and maintain 36" crude oil pipeline from site to Texoma/LC Meter Station.

(8) Permit to maintain 42" crude oil pipeline.

(9) Approval to create 16 additional salt dome cavities.

(10) Approval to construct and operate wells 117A and B.

(11) Includes Texoma/Lake Charles Meter Station-Outfall 004.

(12) Requires semi-annual status-of-construction report.

(13) For 42" crude oil pipeline crossings of waters & waterways

(14) For brine disposal wells, well pads, and brine disposal pipelines, (12", 20", & 24")

(15) For well pads, levees, and access roads (Wells 110, 111, 112, 113, 114, & 115)

5.5 SARA TITLE III REPORTING REQUIREMENTS

To fulfill requirements set forth in the Emergency Planning and Community Right-To-Know Act of 1986, the SPR submitted SARA Title III Tier Two forms for 1992, for each site. Five sites increased the number of reportable chemicals onsite compared with 1991 reports due to receipt of materials for use from Sulphur Mines during decommissioning. Tables 5-14 through 5-22 list chemical name, maximum daily value (lbs) for regulatory specified ranges, and location of hazardous chemicals on the SPR above Threshold Planning Quantity (TPQ). No extremely hazardous substances were found on the SPR above the TPQ or the release Reportable Quantity (RQ). No hazardous or extremely hazardous substance release occurred on the SPR in 1992.

Table 5-14.

QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT BAYOU CHOCTAW

Chemical Name/Category	Max Daily Amount (lbs)	Location
AFFF, (butylcarbitol)	10,000 - 99,999	Foam deluge bldg & storage bldg
Ammonium bisulfite	10,000 - 99,999	Adj to brine pond
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control room in ops bldg
Crude oil, petroleum flammable and combustible liq	100,000,000 - 499,999,999	Offsite pipeline in Iberville Parish, LA
Crude oil, petroleum combustible liq	1 billion > 1 billion	Six underground and storage caverns in salt dome & site piping
Diesel fuel	1,000 - 9,999	Fuel station, flood pump & generators near SW exit, water pumps near NW entrance
Ethylene glycol	100 - 999	Laydown yd and satellite areas
Gasoline	10,000 - 99,999	Fuel station near SW exit, emergency generator at disposal wells
Oil, flammable and combustible	1,000 - 9,999	Flammable stg bldg and maintenance bldg
Paint, flammable or combustible	1,000 - 9,999	Flammable storage bldg & maintenance bldg
Visco 1152 biocide	1,000 - 9,999	Pig trap at NE corner of site

Table 5-15.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT BIG HILL

Chemical Name/Category	Max Daily Amount (lbs)	Location
1,1,1 Trichloroethane	1,000 - 9,999	Tool room
AFFF, (butylcarbitol)	10,000 - 99,999	Drum storage in laydown yd, fire systems at/near pump pads
Ammonium bisulfite	10,000 - 99,999	Near brine pond
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control bldg (control room), RWIS
Compound tree or weed killing liq, poison B	100-999	Tool room
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipelines in Jefferson County, TX
Crude oil, petroleum, flammable and combustible liq	1 billion > 1 billion	Tanks, piping, & underground storage caverns across the salt dome
Diesel fuel	10,000 - 99,999	Fuel station & RWIS
Gasoline	10,000 - 99,999	Fuel station
Oil, flammable and combustible	1,000 - 9,999	Warehouse, lab & RWIS
Paint, flammable or combustible	1,000 - 9,999	Laydown yd, RWIS, lab & warehouse

Table 5-16.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT BRYAN MOUND

Chemical Name/Category	Max Daily Amount (lbs)	Location
1,1,1-Trichloroethane	1,000 - 9,999	Laydown yd, flammable storage bldg, warehouse tool room
AFFF (butylcarbitol)	100,000 - 999,999	Fire systems around site, foam bldg, laydown & excess yd
Ammonium bisulfite	10,000 - 99,999	Brine disposal area
Antifreeze	100 - 999	Chemical storage and tool room
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control room motor control center
Compound, cleaning liq, flammable	100 - 999	Flammable storage bldg
Crude oil, petroleum, flammable and combustible liq	50,000,000 - 99,999,999	Offsite pipelines in Brazoria County, TX
Crude oil, petroleum, flammable and combustible liq	1 billion > 1 billion	Tanks, piping, & underground storage caverns across the salt dome
Diesel fuel	10,000 - 99,999	Fuel station & RWIS
Gasoline	10,000 - 99,999	Fuel station
Hazardous waste liquid or solid, N.O.S.	100 - 999	Laydown yd & satellite storage
Insecticide, liq	100 - 999	Laydown yd, flammable storage bldg & tool room

Table 5-16 (continued).
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT BRYAN MOUND

Chemical Name/Category	Max Daily Amount (lbs)	Location
Oil, flammable and combustible	1,000 - 9,999	Laydown yd, flammable storage bldg, & warehouse
Paints, flammable or combustible	1,000 - 9,999	Flammable storage bldg
Thinners, flammable	1,000 - 9,999	Chemical storage bldg, paint and combustible storage shed, tool room
Visco 1152, biocide	10,000 - 99,999	Phillips, ARCO, Jones Creek, & BM pig launcher receiver

Table 5-17.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT NEW ORLEANS

Chemical Name/Category	Max Daily Amount (lbs)	Location
Ink, flammable or combustible	100 - 999	Warehouse, Elmwood Complex bldg, & Graphic in 850 bldg
Paint, flammable or combustible	100 - 999	Warehouse, Elmwood Complex bldg, & Graphic in 850 bldg
Thinner, flammable or combustible	100 - 999	Warehouse, Elmwood Complex bldg, & Graphics in 850 bldg

Table 5-18.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT ST. JAMES TERMINAL

Chemical Name/Category	Max Daily Amount (lbs)	Location
AFFF (butylcarbitol)	10,000 - 99,999	Fire truck bay, fire systems on main site & dock
Bromotrifluoromethane (Halon 1301)	100 - 999	Control room in ops
Compound, tree/weed killing liq, poison B	1,000 - 9,999	Laydown area
Compressed gas (except helium, neon, argon, krypton, xenon)	100 - 999	Lab, meter station, inside & outside of ops bldg
Crude oil, petroleum flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipelines in St. James Parish, LA
Crude oil, petroleum flammable and combustible liq	100,000,000 - 499,999,999	Six large tanks, onsite piping & sumps
Diesel fuel	1,000 - 9,999	Fuel station in laydown area, dock fire pumps, site emergency generators, & fire pump near fuel station
Gasoline	1,000 - 9,999	Fuel station in maint. bldg area
Oil, flammable and combustible	1,000 - 9,999	Flammable storage bldg in lab, flammable storage cabinet on side of ops bldg
Paint, flammable or combustible	1,000 - 9,999	Flammable storage bldg & paint shed near laydown area
Propane or liquified petroleum gas supplied as pressurized	1,000 - 9,999	Lab, fire pumps, flammable shed near laydown area
Thinner, flammable and combustible	100 - 999	Flammable storage bldg
Visco 1152, biocide	1,000 - 9,999	West end of main site

Table 5-19
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT SULPHUR MINES

Chemical Name/Category	Max Daily Amount (lbs)	Location
AFFF (butylcarbitol)	10,000 - 99,999	Drum storage in laydown yard
Bromotrifluoromethane (Halon 1301)	100 - 999	Main site area control room
Crude oil, petroleum flammable and combustible liq	1,000,000 - 9,999,999	Offsite pipelines in Calcasieu Parish, LA
Crude oil, petroleum flammable and combustible liq	100,000 - 999,999	Underground storage caverns in salt dome & site piping
Diesel fuel	1,000 - 9,999	Main site flammable storage area & fuel station, secondary site firewater pumps, RWIS
Gasoline	1,000 - 9,999	Main site fuel station
Oil, flammable and	1,000 - 9,999	Main site drum storage area combustible & paint shed
Paint, flammable or combustible	1,000 - 9,999	Main site paint shed
Propane or liquified gas supplied as pressurized	1,000 - 9,999	Main site petroleum motor control center, secondary site subsidence area
Visco 1152 biocide	1,000 - 9,999	Main site meter skid

Table 5-20.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT WEEKS ISLAND

Chemical Name/Category	Max Daily Amount (lbs)	Location
AFFF (butylcarbitol)	10,000 - 99,999	Fire equipment at maint & foam storage bldg
Antifreeze compound, liquid	1,000 - 9,999	Laydown area

Table 5-20 (continued).
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT WEEKS ISLAND

Chemical Name/Category	Max Daily Amount (lbs)	Location
Bromotrifluoromethane (Halon 1301)	10,000 - 99,999	Control room in ops bldg & mine service shaft
Cement	10,000 - 99,999	Laydown yd, service shaft & underground in mine
Compressed gases, (except helium, neon, argon, krypton, xenon)	1,000 - 9,999	flammable storage bldg
Crude oil, petroleum flammable and combustible liquid	1,000,000 - 9,999,999	Offsite piping in Iberia Parish, LA
Crude oil, petroleum flammable and combustibleliquid	1 billion > 1 billion	Underground storage cavern in salt dome & site piping
Diesel fuel	1,000 - 9,999	Fuel station in laydown area, fire storage area, production shaft area, & main site near emergency generator
Deithylene glycol	10,000 - 99,999	Underground in mine
Gasoline	10,000 - 99,999	Fuel station in laydown area
Glycerine	1,000 - 9,999	Underground in mine
Hazardous waste, liquid or solid,N.O.S.	1,000 - 9,999	Laydown yd & satellite areas
Insecticide, liquid, N.O.S.	100 - 999	Laydown yd, flammable storage bldg
Oil, flammable and combustible	1,000 - 9,999	Laydown yd, flammable storage bldg, & main maintenance bldg
Paint, flammable and combustible	10,000 - 99,999	Laydown yd paint shed & flammable storage bldg
Phosphoric acid	1,000 - 9,999	Laydown yd drum rack & shed

Table 5-20 (continued).
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT WEEKS ISLAND

Chemical Name/Category	Max Daily Amount (lbs)	Location
Propane or liq petroleum	10,000 - 99,999	Fill site rd, main site
Silica, crystalline quartz	10,000 - 99,999	Construction site
Visco 1152 biocide	100 - 999	Laydown area

Table 5-21.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT WEST HACKBERRY

Chemical Name/Category	Max Daily Amount (lbs)	Location
1,1,1-Trichloroethane	1,000 - 9,999	Warehouse & flammable storage bldg
AFFF (butylcarbitol)	10,000 - 99,999	Foam storage bldg & site fire systems
Ammonium bisulfite, solution	1,000 - 9,999	West of brine pond
Ammonium chloride	10,000 - 99,999	Disposal wells
Antifreeze compound, liquid	1,000 - 9,999	Property yd
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control room & lab
Cement	100-999	Warehouse D
Coal tar, naphtha flammable liq	100 - 999	Flammable storage bldg
Compound, rust preventing or rust removing	100 - 999	Site warehouse & and flammable storage bldg
Compound, tree or weed killing liq.	1,000 - 9,999	Pipeline bldg
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Offsite pipeline in Cameron Parish, LA

Table 5-21 (continued).
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS AT WEST HACKBERRY

Chemical Name/Category	Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liq	1 billion > 1 billion	Underground storage caverns in salt dome & site piping
Diesel fuel	10,000 - 99,999	Site fuel station & workover rig yd
Gasoline	10,000 - 99,999	Site fuel station & pipeline bldg
Hydrochloric acid, mixture	100,000 - 999,999	Disposal wells
Nitrogen	1,000 - 9,999	Well pads
Oil, flammable and combustible	10,000 - 99,999	Warehouse, property yd & flammable storage bldg
Paint, flammable or combustible	10,000 - 99,999	Flammable storage & warehouse bldg
Propane or liquefied petroleum gas supplied as pressurized	10,000 - 99,999	Maint bldg, motor control at Lake Charles meter station, & fire training area
Thinner, flammable & combustible	100 - 999	Flammable storage bldg
Visco 1152 biocide	10,000 - 99,999	Manifold area & maint. yd

Table 5-22.
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS IN OFFSITE PIPELINES

Chemical Name/Category	Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipelines in St. Martin Parish, LA
Crude oil, petroleum, flammable and combustible liq	50,000,000 - 99,999,999	Offsite pipeline in Assumption Parish, LA
Crude oil, petroleum, flammable and combustible liq	1,000,000 - 9,999,999	Offsite pipeline in Ascension Parish, LA

Table 5-22 (continued).
QUANTITIES/LOCATIONS OF HAZARDOUS SUBSTANCES/CHEMICALS IN OFFSITE PIPELINES

Chemical Name/Category	Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipeline in St. Mary Parish, LA
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipeline in Galveston County, TX
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipeline in Orange County, TX
Crude oil, petroleum, flammable and combustible liq	1,000,000 - 9,999,999	Offsite pipeline in Jefferson County, TX

adj - adjacent
AFFF - Aqueous Film Forming Foam
avg - average
bldg - building
lbs - pounds
maint - maintenance
max - maximum
NE - northeast
NW - northwest
ops - operations
SW - southwest
lab - laboratory
RWIS - raw water intake structure
yd - yard

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6. HYDROLOGY AND GROUND WATER MONITORING

Ground water monitoring is performed at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. Salinities are monitored although ground water monitoring is not required by any Federal or state regulations or permits at Bayou Choctaw, and Bryan Mound, but is required at Big Hill and West Hackberry in accordance with a monitoring plan agreed upon by DOE and the Louisiana Department of Natural Resources (LDNR). West Hackberry ground water monitoring and recovery activities were reported quarterly to the LDNR in 1992.

In a two-phase study, all sites except decommissioned Sulphur Mines were surveyed in December for possible brine and hydrocarbon ground water contamination. Field data from Phase I will be reviewed in 1993 for Phase II activities, verification of contamination.

Background information is not available on the construction and installation of some of the existing monitoring wells at Bryan Mound and West Hackberry, which limits the ability to interpret data. The ground water characteristics of each site are discussed within each site section.

6.1 BAYOU CHOCTAW

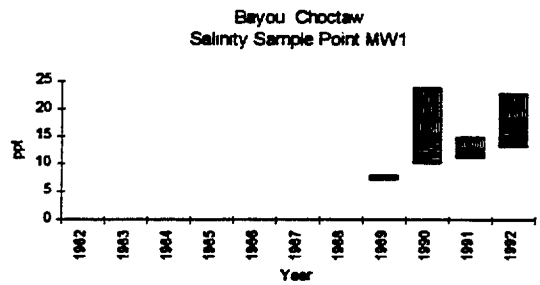
The Plaquemine Aquifer is the main source of fresh water for the site and several surrounding municipalities. It is located approximately 18 m (60 ft) below the surface and extends to a depth of 150 to 182 m (500-600 ft). The upper 18 m (60 ft) of sediments in the aquifer consist of predominantly Atchafalaya clay. The interface of freshwater and saline water occurs at a depth of 122 to 150 m (400-500 ft) below the surface. Ground water in the Plaquemine Aquifer communicates with the Mississippi River, flowing away from it during the high river stage and towards the river in the low stage.

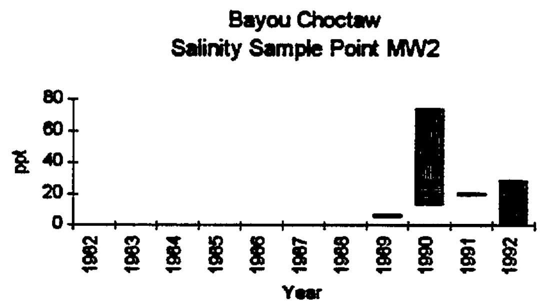
Three monitoring wells (MW1, 2, and 3) were installed at the Bayou Choctaw facility in 1989, and a fourth (MW4) in 1990. These wells were drilled to monitor the brine pond and not the

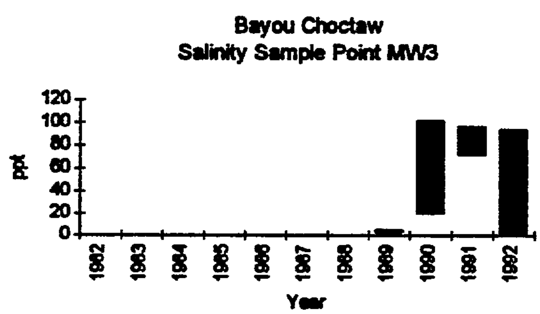
These wells were drilled to monitor the brine pond and not the Plaquemine Aquifer (Figure 6-1). Salinities increased substantially at MW1, 2, and 3 in 1990, decreased slightly at MW1 and 2 in 1991, and continued to increase at MW3 in 1991. Salinity at MW4 did not change appreciably in 1991.

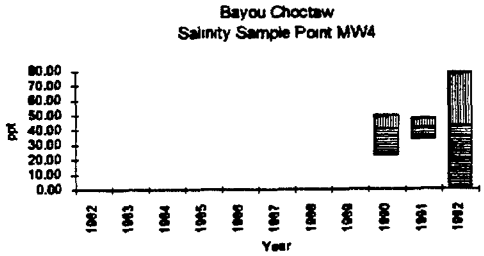
In 1992 average salinity increased to slightly above 1990 levels in MW1 and MW4. Average salinity remained similar to 1991 levels at MW2 and MW3. During the year, monthly salinities varied seasonally in all wells, reaching lows in late spring and highs in fall and winter. This variation is indicative of surface water recharge influences.

In 1992 brine spilled from the pond low pressure pump pad may have affected the elevated salinity at well MW3 just south of the pad. Salinity at this well remains substantially greater than that of wells MW1 and MW2, which are similar to each other. Similar to seasonal changes in salinity due to rainfall, surface brine spills may be also detected in these shallow wells. There were no other buried pipe leaks or brine spills around the brine pond in 1992 that could have created the elevated ground water salinities observed in all wells, assuming ground water flow across the site continued in an east-west direction. Past industrial activity may have caused present conditions. Future ground water data, including that of the all-sites survey, and on-going inspections of the brine pond and piping will assist in determining if leakage does exist.


Bayou Choctaw
Salinity Sample Point MW1
ppt
25
20
15
10
5
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Salinity Sample Point MW2
ppt
80
60
40
20
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Salinity Sample Point MW3
ppt
120
100
80
60
40
20
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bayou Choctaw
Salinity Sample Point MW4
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
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1991
1992
Year

BAYOU CHOCTAW

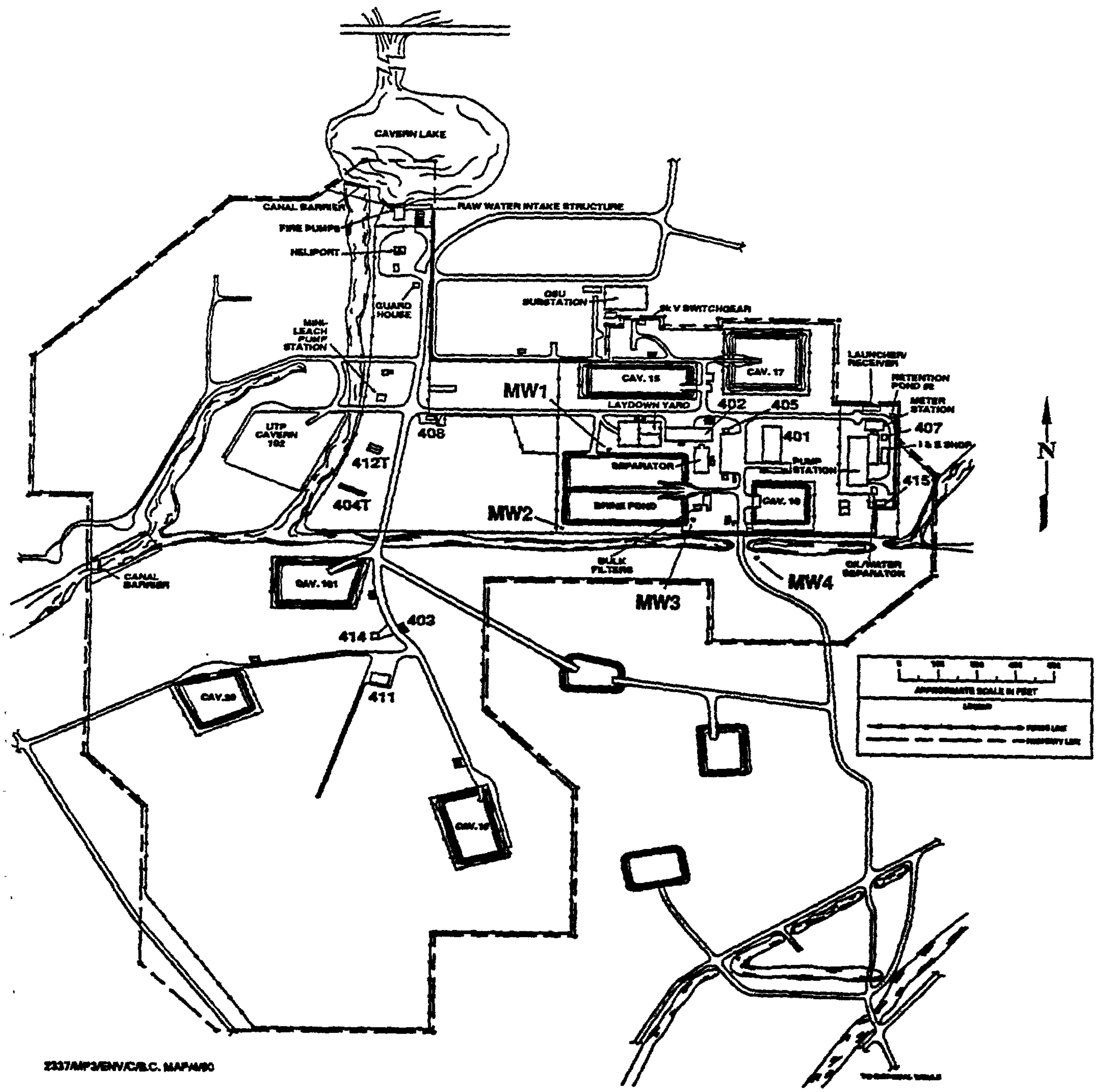


Figure 6-1. Bayou Choctaw Ground Water Monitoring Wells

6.2 BIG HILL

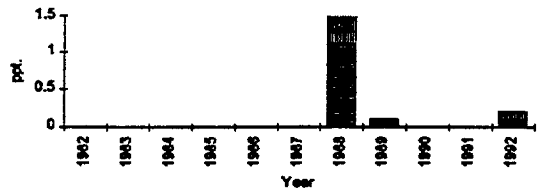
The three major subsurface hydrological formations in the Big Hill area are the Chicot and Evangeline aquifers and the Burkville aquitard. The major source of fresh water is the Chicot Aquifer which is compressed over the Big Hill salt dome. Fresh water in the upper Chicot Aquifer at Big Hill is limited from near the surface to a depth of -30 m (-98 ft) mean sea level.

The town of Winnie uses fresh water from the upper Chicot Aquifer. Beaumont and Port Arthur draw fresh water from the lower Chicot Aquifer.

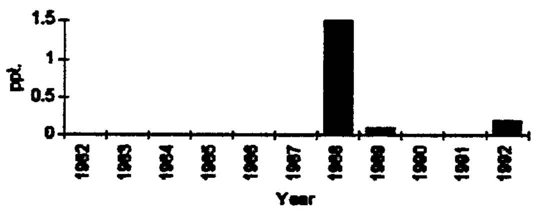
Sampling of six monitoring wells (wells MW1 to MW6) around the brine disposal pond system (Figure 6-2) began in 1987. The pond system is composed of a Hypalon lined pond with an underdrain contained within a slurry wall. Salinity data collected from the six wells for the past five years indicate a consistency among them. Salinity of ground water from five wells remained 0 throughout 1991 and less than 1.0 ppt in all wells in 1992. Overall, all wells except MW3 exhibited a slight salinity increase from 1991, a maximum 0.9 ppt salinity was observed at Well MW5. Well MW5 is downgradient of the brine pond and should intercept brine leakage past the slurry wall, but data are presently insufficient and observed changes salinity changes are too low to indicate contamination. Monitoring of these wells will continue so that trends can be developed.

Monthly sampling of 16 2-inch brine pipeline monitoring wells (wells MW2-1 to MW2-16) began in 1991. Unlike those around the brine pond, these smaller wells were installed adjacent to buried brine pipelines on site to detect brine leaks (Figure 6-2). The wells are roughly 15 feet deep and do not intercept an aquifer. As a result, one has remained dry and the remainder yielded very little water. Salinities at 15 of the wells ranged from 0 to 2.5 ppt, with most monthly readings remaining below 1.5 ppt. Only ground water from well MW2-15, east of Cavern 111, yielded salinities of 9.0 to 25.5 ppt. Elevated salinities in the clay are attributed to a past pipeline failure adjacent to that location.

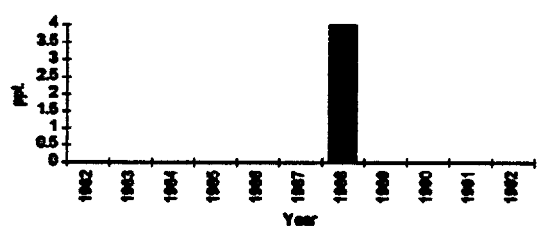
Big Hill
Salinity Sample Point MW1

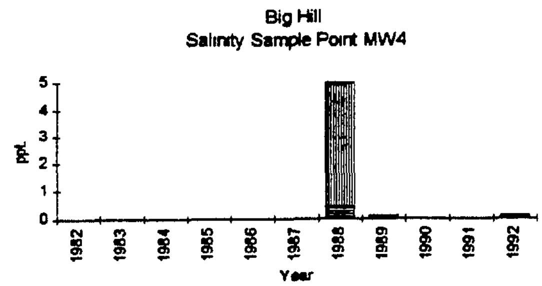


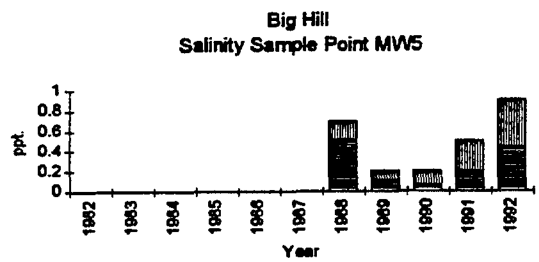
Big Hill
Salinity Sample Point MW2

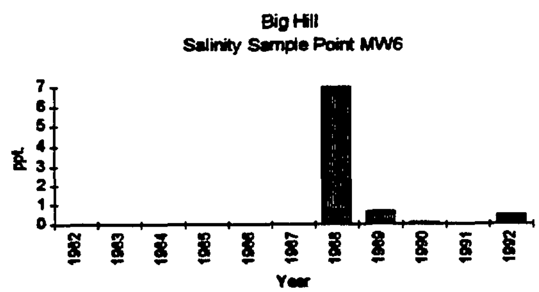


Big Hill
Salinity Sample Point MW3




Big Hill
Salinity Sample Point MW4
ppt.
5
4
3
2
1
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Big Hill
Salinity Sample Point MW5
ppt.
1
0.8
0.6
0.4
0.2
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Big Hill
Salinity Sample Point MW6
ppt.
7
6
5
4
3
2
1
0
1982
1983
1984
1985
1986
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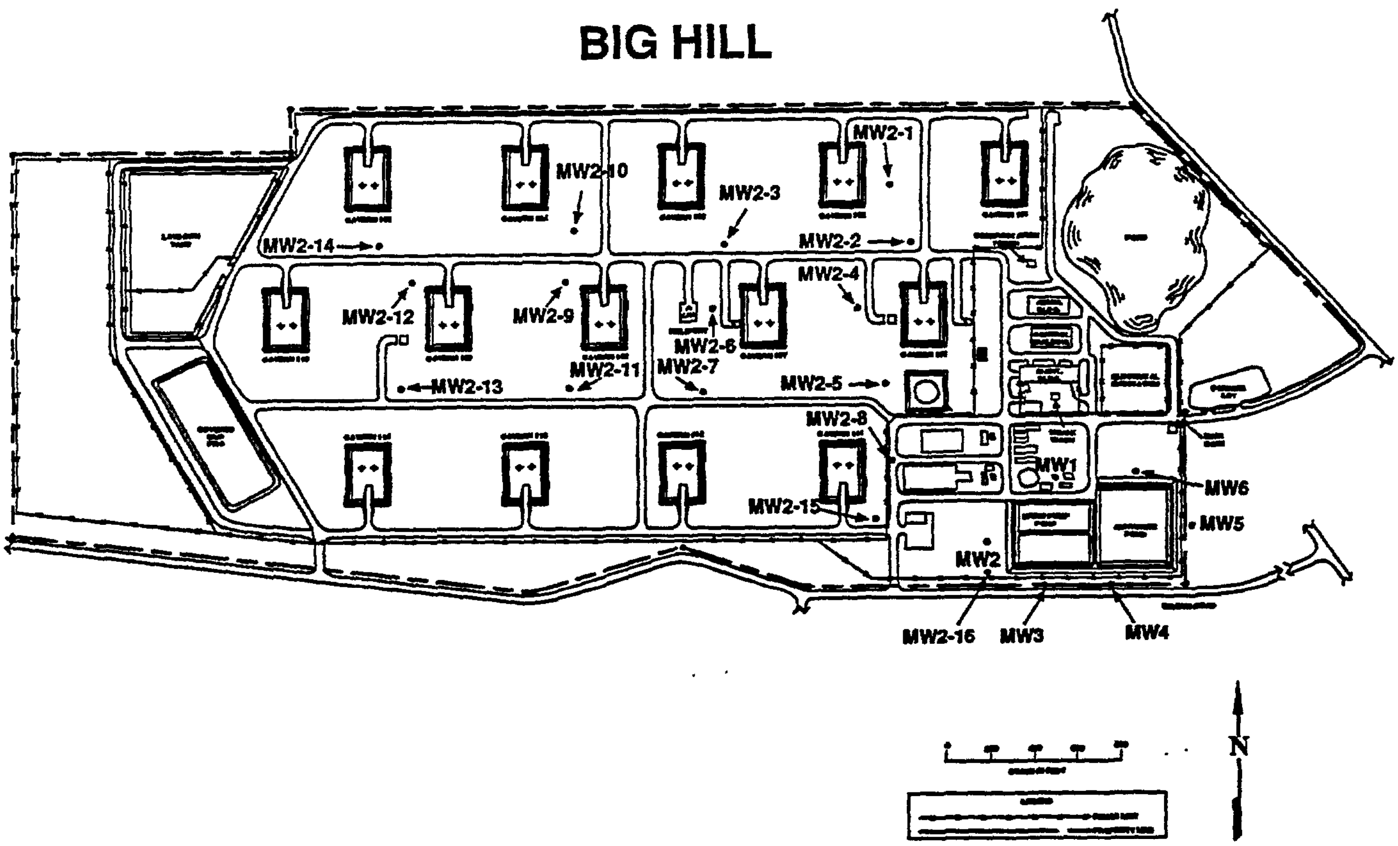
1989
1990
1991
1992
Year



3348/FG/ENV/J/B.H. MAP/6-91

Figure 6-2. Big Hill Ground Water and Brine Pond Monitoring Wells

6.3 BRYAN MOUND

The Chicot and Evangeline Aquifers are fresh to slightly saline in the Bryan Mound area. Fresh water for Brazoria County is obtained from the upper portions of the Chicot Aquifer. Fresh water does not exist over the salt dome. Mean monitoring well salinities ranged from 4.8 to 140.3 ppt.

Fifteen monitoring wells were drilled at Bryan Mound (Figure 6-3). Wells PZ1S, PZ2S, and PZ3S were installed in 1981. Sampling of wells PZ2S and PZ3S began in 1981, followed by that of PZ1S in 1983. Installation and sampling of two additional monitoring wells, BP1S and BP2S began in December of 1988. Three monitoring wells (MW1S, MW2S, and MW3S) were installed in August of 1989 and seven more (MW1D, MW2D, MW4D, PZ1D, BP1D, MW4S, and MW5S) were installed in 1990. Wells BP2S and PZ2S are presently out of service due to casing damage.

Salinities of shallow monitor wells PZ1S, MW1S, and BP1S have been high since installation. The origin of this high salinity is not yet known; however, it may be due to a large brine pond constructed with a 36 mil flexible Hypalon (chlorosulfonated polyethylene) membrane in 1978.

BRYAN MOUND

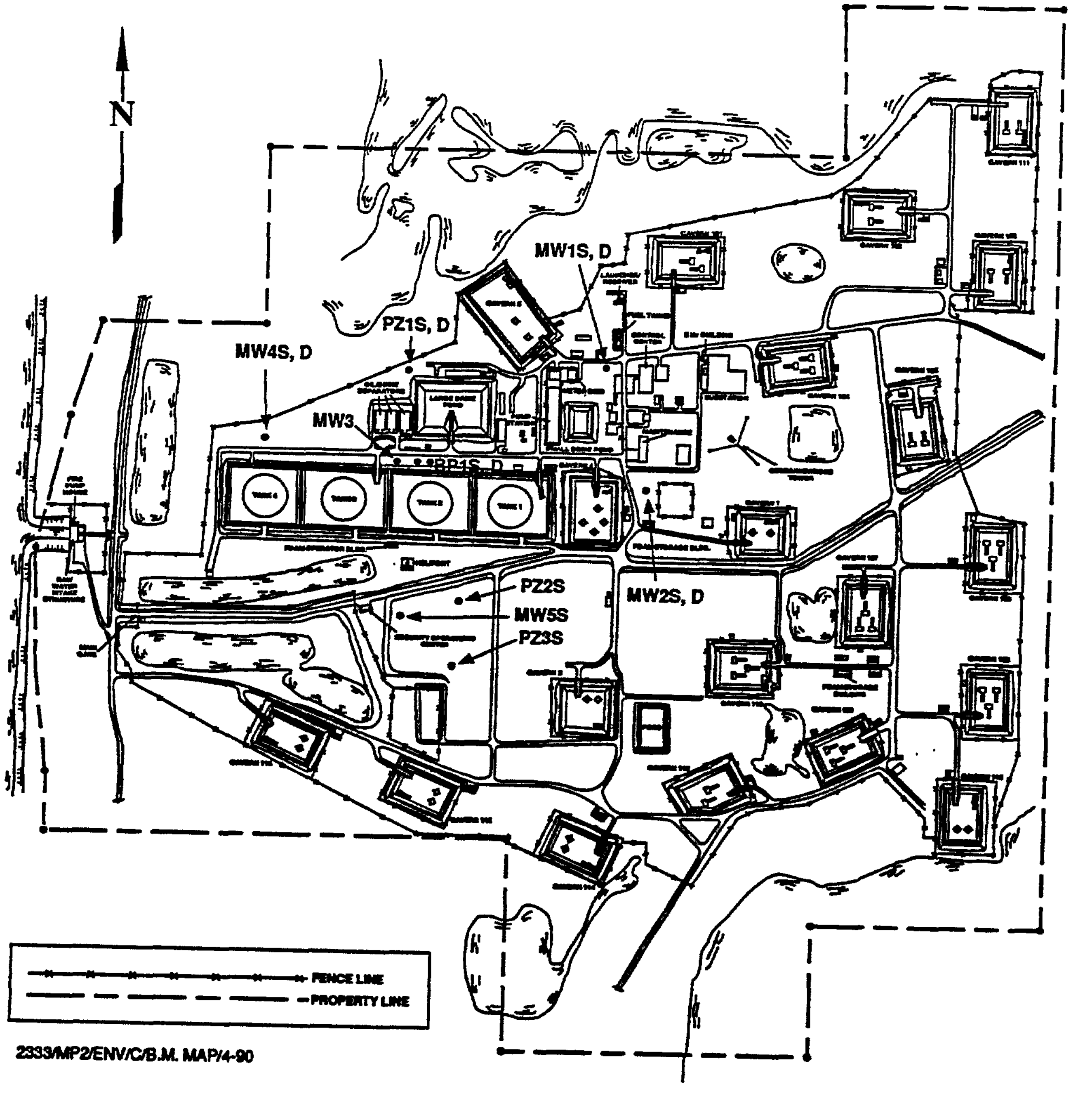


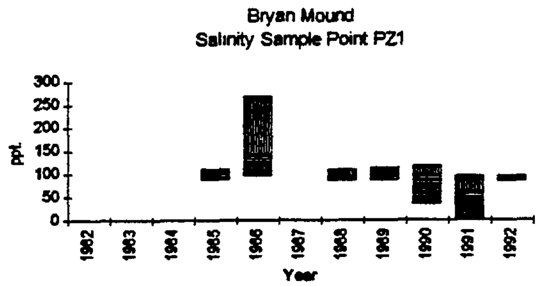
Figure 6-3. Bryan Mound Ground Water Monitoring Wells

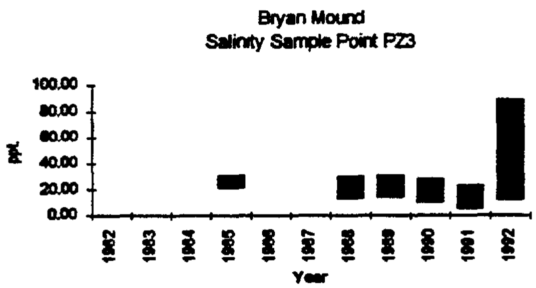
Despite the liner, the pond was known to have leaked and was renovated with Hypalon and concrete in 1982. High salinity could be attributed to continued leakage from the pond or from buried piping adjacent to the pond. Salinity of deep complements to wells PZ1S and BP1S (PZ1D and BP1D) are low and considered ambient for the site. They indicate no contamination of the deep zone around the present pond and no communication with the shallow zone.

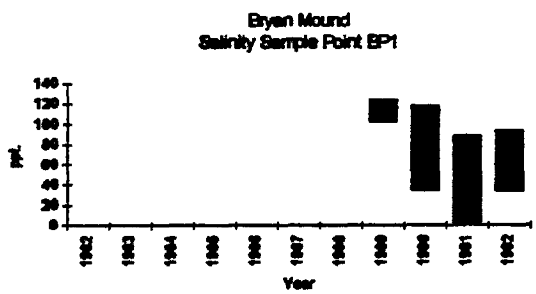
In contrast, salinity of the deep well complement to MW1S (MW1D) is greater than that of any shallow well and much greater than any other deep well. This well may be in a brine plume that extends northward from the pond. The high salinity of the deep well may also indicate upgradient communication of the two zones in that area. Future sampling of piezometric elevations and additional ground water chemical analyses may provide greater understanding of ground water movement.

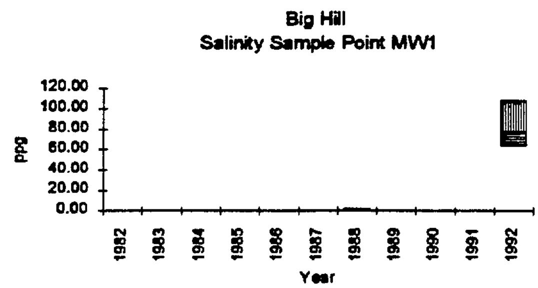
Shallow monitor well MW3S near the southwest corner of the brine pond, MW2S near the maintenance shop/laydown area, and PZ3S south of the tank farm, exhibit lower salinity which indicates they fall south and west of the brine plume.

In 1992, an increase in salinity was observed at the shallow wells around and north of the brine pond (wells BP1S, PZ1S, and MW1S) and shallow wells southwest of the pond (wells MW5S and PZ3S). The increase may indicate a brine plume in the pond area and an old anhydrite disposal area. Salinity in shallow well MW2S east of the pond and near the maintenance shop/laydown area did not change. The shallow aquifer in this area is believed to be out of the contamination zone. Salinities in deep wells northeast and southeast of the pond (MW1D and MW2D) also increased while that of low salinity deep wells around the brine pond (BP1D and PZ1D) decreased. This trend reinforces the idea that communication between the two zones may exist northeast of the pond, and the deep aquifer around the brine pond has not been affected by surface activity. Increased salinity in the deep zone at the maintenance shop/laydown area is not yet understood but may be from another brine source.








Big Hill
Salinity Sample Point MW1
120.00
100.00
80.00
60.00
40.00
20.00
0.00
ppg
1982
1983
1984
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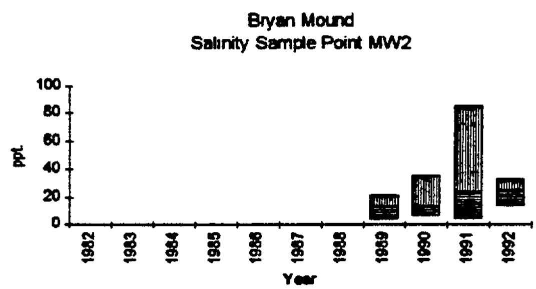
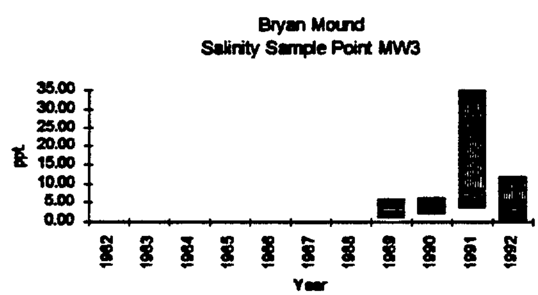
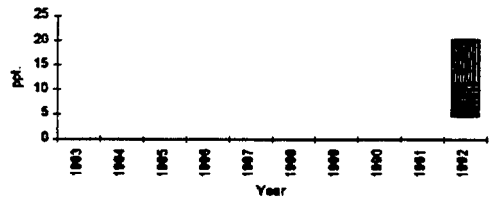
1989
1990
1991
1992
Year

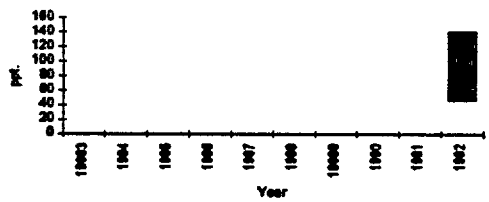

Bryan Mound
Salinity Sample Point MW2
100
80
60
40
20
0
ppt
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


Bryan Mound
Salinity Sample Point MW3
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
ppt
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year

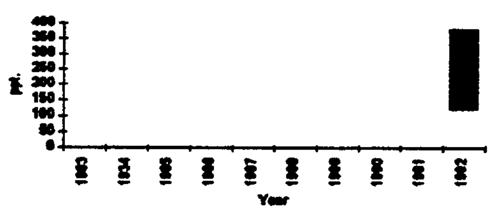
Bryan Mound
Salinity Sample Point MW4

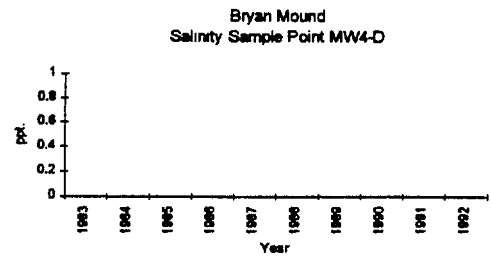


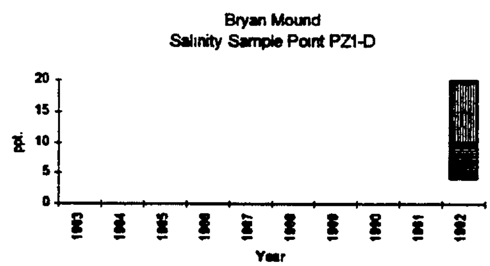
Bryan Mound
Salinity Sample Point MW5

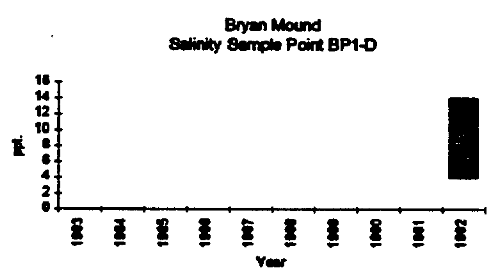


Bryan Mound
Salinity Sample Point MW2-D




Bryan Mound
Salinity Sample Point MW4-D
ppt.
Year


Bryan Mound
Salinity Sample Point PZ1-D
ppt.
Year


Bryan Mound
Salinity Sample Point BP1-D
ppt.
Year

6.4 ST. JAMES

The Chicot Aquifer is the principal redional aquifer at St. James. The upper strata of the Chicot Aquifer is in direct hydrologic contact with the Mississippi River. Most of the ground water contained in this aquifer is slightly brackish. In the St. James area only the uppermost units contain fresh water.

No ground water monitoring wells have been installed at the St. James site due to the absence of brine and chronic crude oil spillage. There is no evidence of leakage; however, data from the ground water contamination survey will be examined, and areas of potential contamination will be verified in 1993.

6.5 SULPHUR MINES

The main aquifers in the vicinity of Sulphur Mines are the Chicot, Evangeline, and Jasper. The Chicot Aquifer provides a fresh water source for public and industrial use to the towns of Hackberry, Lake Charles, and Sulphur. The Evangeline and Jasper aquifers are saline. The Evangeline Aquifer is used for salt water disposal in the Lake Charles area. No ground water monitoring wells were installed for brine or hydrocarbon contamination on the Sulphur Mines site, and due to decommissioning no ground water brine and hydrocarbon contamination survey was performed in 1992.

6.6 WEEKS ISLAND

The Chicot formation is the principal aquifer in the Weeks Island area. The aquifer surface is approximately at sea level near Weeks Island and slopes slightly northwest towards a cone of depression attributed to heavy withdrawals in the Lake Charles area. The fresh water sand layers provide water for the local area.

There are no ground water monitoring wells at Weeks Island. There has been no evidence that site activities have compromised ground water integrity, but Phase I results of the 1992 ground water brine and hydrocarbon contamination survey will be scrutinized, and areas identified as potentially contaminated will be examined in 1993.

6.7 WEST HACKBERRY

The Chicot Aquifer, which flows closest to the surface in the Hackberry area, contains predominantly fresh water with salinity increasing with proximity to the Gulf of Mexico. The majority of the ground water pumping from the Chicot Aquifer takes place in the Lake Charles area. The pumping is so great that a cone of depression has been created which has reversed the flow direction to the north. The fresh/saline water interface is approximately 200 m (700 ft) below ground surface.

There are 12 monitoring wells and 14 recovery wells (Figure 6-4) on the West Hackberry site. Three of the monitoring wells have been sampled since 1982. A fourth, well PB1, was plugged and abandoned in 1989. Eight wells were installed in 1988, two in 1989, five in 1990, and eight in 1991. Well logs and background information on construction and installation are lacking for wells installed prior to 1982, but are available for wells constructed later. All wells are used to monitor or control brine contamination known to exist beneath the brine pond system.

Wells P1S and P3S were fitted with recovery pumps in 1989, and well P5S received a recovery pump in 1990. In 1992 wells P1S and P3S were pumped almost continuously for recovery of brine. Well P5S was pumped intermittently during the year due to electrical problems.

Compared to 1991 data, ground water salinity decreased substantially in 1992 at wells P1S and P5-S and decreased slightly at well P3S. Salinity trends for these three wells are declining.

The 1991 ground water study identified the brine pond as the source of the brine plume. As a result, the brine pond was cleaned, cracks in the walls and floor were grouted, and wells P1D, P3D, P4S, P4D, RW1S, RW1D, RW2S, RW2D, RW3D, RW4D, and RW5D around the pond system were prepared for recovery service in February 1992. Of these wells, the majority of recovery was performed by RW1S and RW2S.

Highly mineralized ground water (up and down gradient) rapidly and repeatedly damaged pumps. In addition, electrical protective devices shut down the pumps prematurely when pump production began to decrease. The system design will be reviewed and modified in 1993 to improve recovery performance.

Well salinities observed during limited pumping were greater in the shallow zone than the deep zone with the exception of well P4D. A brine plume in the shallow zone extends from the southwest corner of the brine pond east-northeastward. Salinities of deep well P4D were greater than that of any shallow well. The brine source captured by this well may be different from that captured by other wells. Salinities of all other deep zone recovery wells were near ambient conditions (generally less than 3 ppt). Further examination and ground water chemical analyses are needed to understand ground water flow characteristics.

WEST HACKBERRY

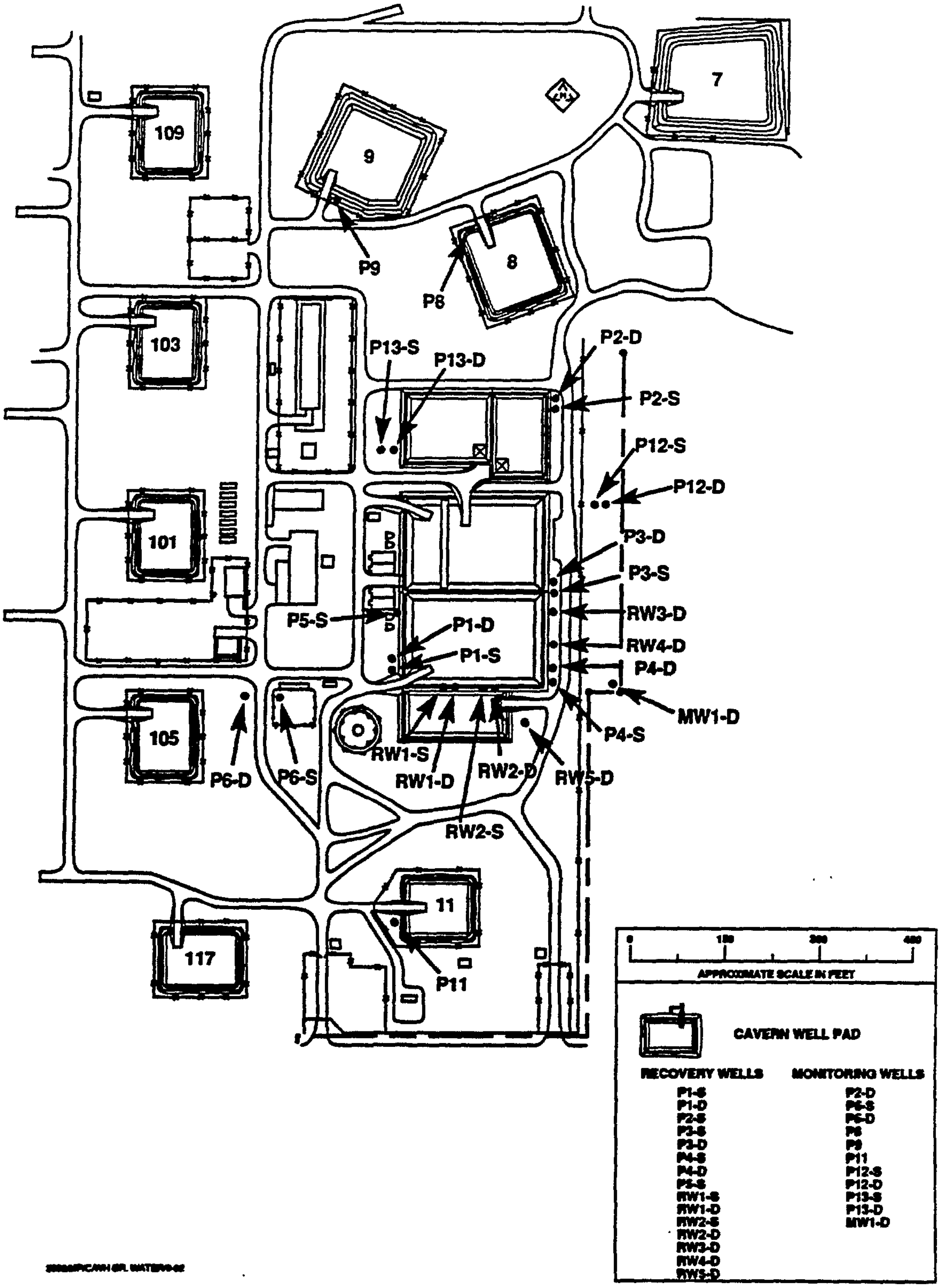


Figure 6-4. West Hackberry Ground Water Monitoring Wells

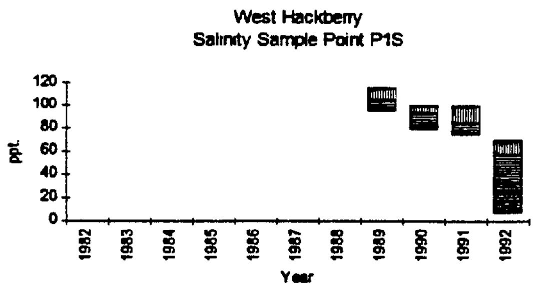
Quarterly sampling of monitoring wells P8, P9, and P11 at caverns 8, 9, and 11, respectively, continued in 1992. Although out of the vicinity of the brine pond ground water contamination plume, these wells that represent ambient ground water conditions, showed an average increase in salinity of 0.3 ppt, 0.2 ppt, and 1.4 ppt, respectively. The increases were consistent at wells P8 and P9, suggesting that a single point source of contamination is not the cause. The greater increase at P11 is believed to be from brackish water lost from a chronic, buried leak in an adjacent fire water system.

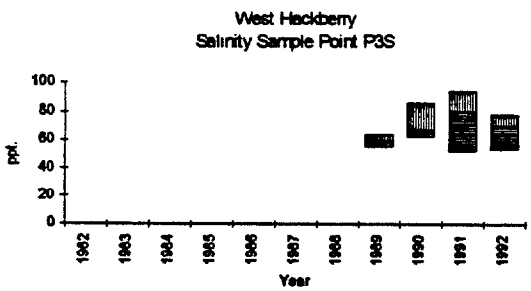
Quarterly sampling of shallow monitoring wells P2S, P6S, P12S, and P13S and deep monitoring wells P2D, P6D, P12D, P13D, and MW1D began in June. Over a six-month period, decreases in salinity were observed in shallow well P2S and deep wells P6D and P13D. Well P2S was initially used for recovery, but when pumping was stopped (due to low salinities observed), the brine plume receded from the capture zone, allowing ambient ground water to replace it. Salinity changes at wells P6D and P13D were believed to be natural fluctuation of ambient conditions. Salinity at all other monitoring wells did not change.

Well P12S east of the brine pond system was the only monitoring well that exhibited brine contamination. The well is located within the shallow brine plume that extends from the southwest corner of the brine pond. No contamination was observed in the deep zone east of the brine pond.

The measuring of well piezometric surfaces revealed that cones of depression were created in both zones despite limited recovery success. The differences in shallow and deep zone elevations and the immediate drop in the piezometric surface during pumping suggest that the two zones are confined.

Further sampling and testing will disclose trends and cycles and locate other sources of contamination if they exist.


West Hackberry
Salinity Sample Point P1S
ppt.
120
100
80
60
40
20
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


West Hackberry
Salinity Sample Point P3S
ppt.
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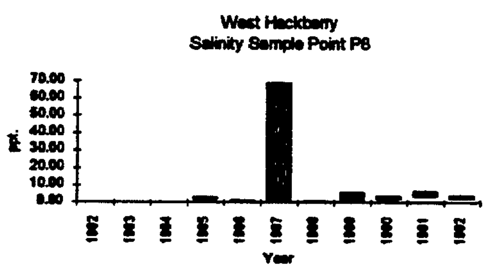
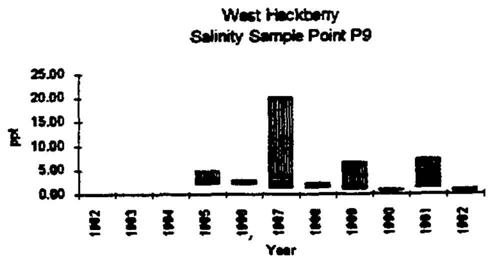
80
60
40
20
0
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


West Hackberry
Salinity Sample Point P6
ppt.
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Year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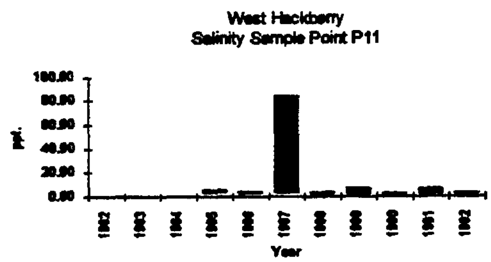
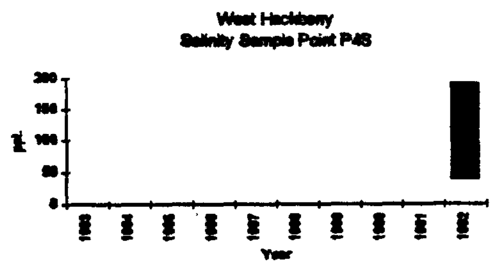
Salinity Sample Point P9
25.00
20.00
15.00
10.00
5.00
0.00
ppt
Year


West Hackberry
Salinity Sample Point P11
100.00
80.00
60.00
40.00
20.00
0.00
ppt
Year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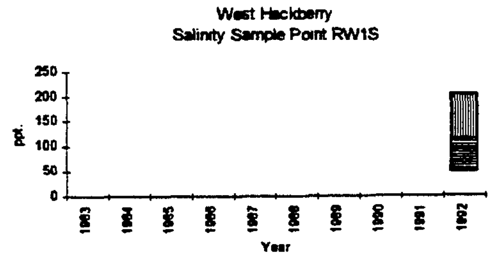
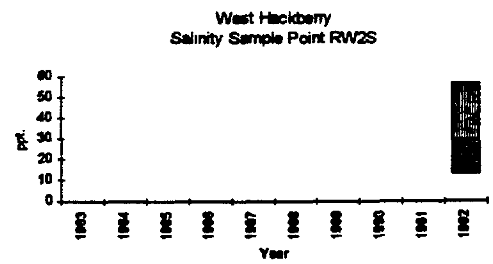
Salinity Sample Point P4S
200
150
100
50
0
ppt
Year


West Hackberry
Salinity Sample Point RW1S
250
200
150
100
50
0
ppt.
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year


West Hackberry
Salinity Sample Point RW2S
60
50
40
30
20
10
0
ppt.
1983
1984
1985
1986
1987
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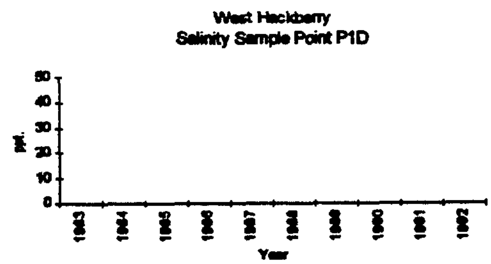
1989
1990
1991
1992
Year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Salinity Sample Point P1D
50
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30
20
10
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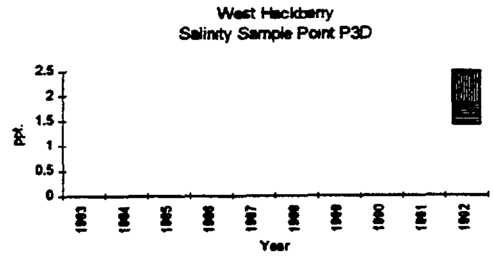
ppt.
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
Year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ppt.
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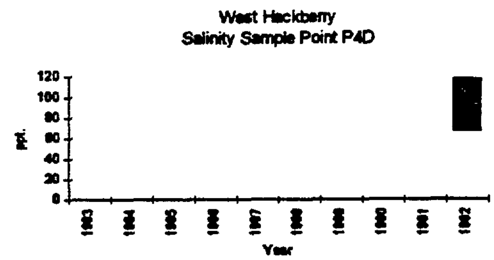
1.5
1
0.5
0
Year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ppt.
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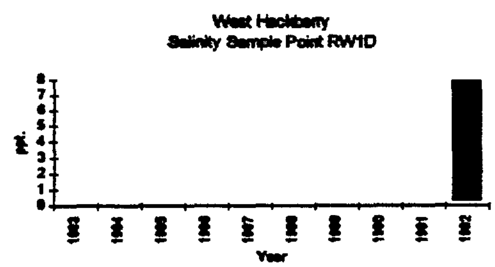
100
80
60
40
20
0
Year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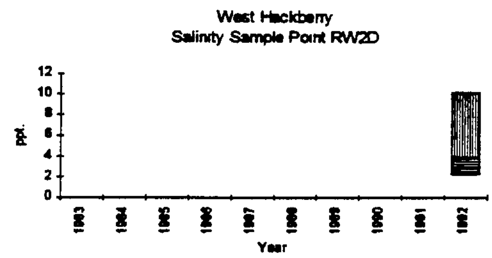
Salinity Sample Point RW1D
ppt.
8
7
6
5
4
3
2
1
0
Year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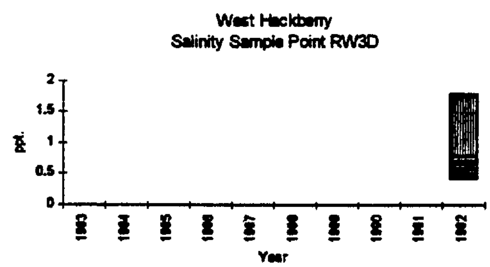
Salinity Sample Point RW2D
ppt.
Year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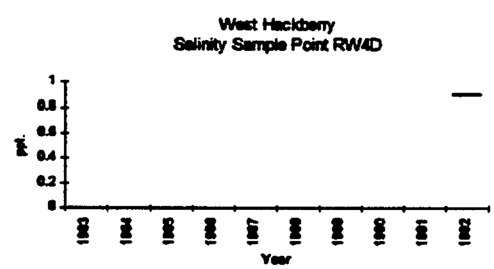
ppt.
Year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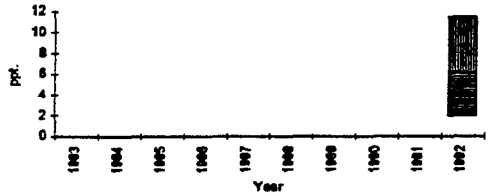
ppt.
Year

West Hackberry
Salinity Sample Point P2S



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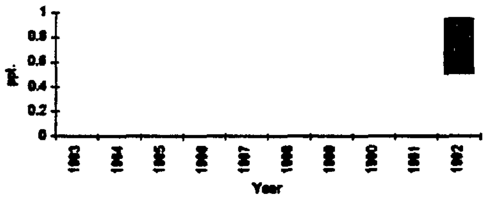

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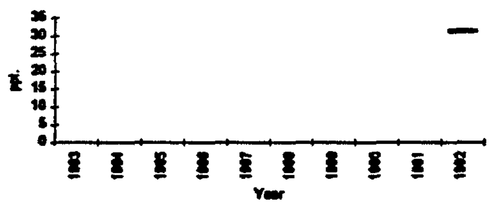

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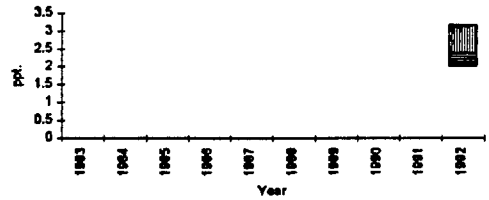

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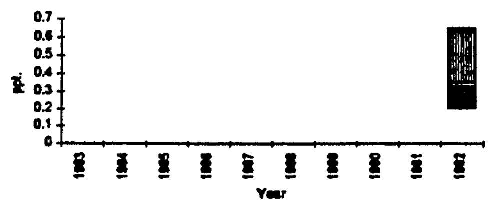

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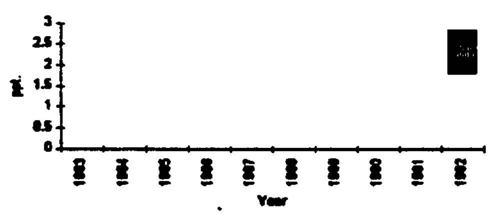
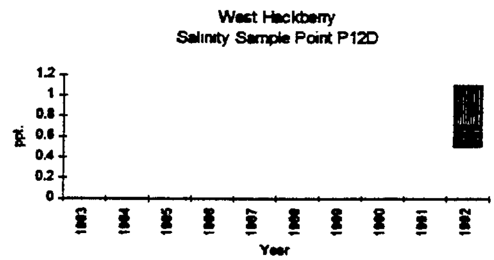
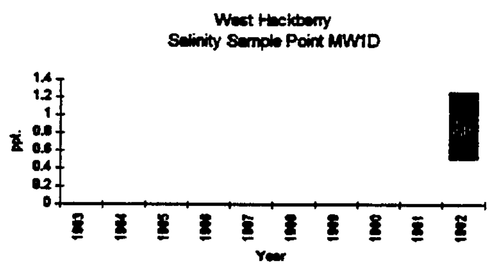



West Hackberry
Salinity Sample Point P12D
1.2
1
0.8
0.6
0.4
0.2
0
ppt.
Year


West Hackberry
Salinity Sample Point MW1D
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ppt.
Year

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7. QUALITY ASSURANCE

The SPR sites undergo periodic evaluation throughout the year in the form of yearly internal audits as well as audits by outside Federal and state agencies. The structured laboratory quality assurance program has continued through the systematic application of acceptable accuracy and precision criteria at SPR laboratories. Compliance with this and other environmental program requirements was reviewed and evaluated at each site by means of the M&O contractor's annual audits and audits at select sites by state and Federal environmental agencies.

7.1 FIELD QUALITY CONTROL

All field environmental monitoring and surveillance activities are performed in accordance with standard procedures contained in the contractor's Environmental Programs and Procedures Manual. These procedures include maintenance of chain-of-custody, collection of quality control (QC) samples, and field documentation.

7.2 EPA DISCHARGE MONITORING REPORT QUALITY ASSURANCE STUDY

The EPA entered the 12th year of its Discharge Monitoring Report Quality Assurance (DMR-QA) program. Through this program EPA ensures verifiable and consistent data generation by providing analytical laboratories of major NPDES dischargers blind samples of permit parameters for analysis. The Big Hill, Bryan Mound, and West Hackberry sites, classified as minor dischargers, participated in the study in 1992.

7.3 SPR LABORATORY ACCURACY AND PRECISION PROGRAM

The SPR laboratory quality assurance program is based on the U.S. EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories. This program focuses on the use of solvent or standard and method blanks, check standards, and for instrumental methods, final calibration blanks and final calibration verification standards with each analytical batch to verify quality control. Additionally, replicate and spiked samples are analyzed at a 10% frequency to determine precision and accuracy, respectively. Analytical methodology is based on the procedures listed in Table 7-1. Several hundred of these quality assurance analyses were performed in addition to the 1992 discharge compliance and water quality analyses to verify the continuing high quality of SPR laboratory data.

The EPA quality control document advocates use of quality control charts to maintain and evaluate accuracy and precision data. The SPR uses a computer program to allow rapid and exact determinations of accuracy and precision without the necessity of quality control chart preparation.

Standard deviation is used to monitor changes in the accuracy and precision of specific analyses at specific sites. A Trend 7 analysis is applied to this standard deviation data (per the EPA Handbook for Analytical Quality Control) to identify degradation of accuracy and precision. Identification of a trend 7 error, or a tendency towards it, causes the chemist to examine procedures, instrumentation, and reagents for the source of error.

Table 7-1. SPR WASTEWATER LABORATORY ANALYTICAL METHODOLOGY

Analysis Determination	Method	Source*	Description
Biochemical Oxygen Demand	5210(B)	SM-17	5 Day, 20°C
	405.1	EPA-1	5 Day, 20°C
Chemical Oxygen Demand	D1252-88(B)	ASTM	Mico Spectrophotometric Proc.
	410.4	EPA-1	Colorimetric, Manual
	5220(D)	SM-17	Closed Reflux, Colorimetric
Fecal Coliform	Part III-C-2	EPA-2	Direct Membrane Filter Method
	9222(D)	SM-17	Membrane Filter Procedure
Residual Chlorine	4500-Cl(G)	SM-17	DPD Colorimetric
	330.5	EPA-1	Spectrophotometric, DPD
	8021	Hach	DPD Method
Oil & Grease	413.1	EPA-1	Gravimetric Separatory Funnel Extraction
	5520(B)	SM-17	Partition - Gravimetric
Total Organic Carbon	415.1	EPA-1	Combustion or Oxidation
	D4839-88	ASTM	Persulfate - UV Oxidation, IR
	5310(C)	SM-17	Pesulfate - UV Oxidation
Dissolved Oxygen	D888-87(D)	ASTM	Membrane Electrode
	360.1	EPA-1	Membrane Electrode
	360.2	EPA-1	Winkler Method
	4500-O(C)	SM-17	Winkler Method
	4500-O(G)	SM-17	Membrane Electrode
Hydrogen Ion Conc. (pH)	D1293-84(A&B)	ASTM	Electrometric
	150.1	EPA-1	Electrometric
	4500-H+(B)	SM-17	Electrometric
Total Dissolved Solids	160.1	EPA-1	Gravimetric, 180°C
	2540(C)	SM-17	Gravimetric, 180°C
Total Suspended Solids	160.2	EPA-1	Gravimetric, 103-105°C
	2540(D)	SM-17	Gravimetric, 103-105°C

EPA-1 = U.S. Environmental Protection Agency, Methods for Chemical Analysis of Water and Wastes, Document No. EPA - 600/4-79-020, March 1983.

SM-17 = American Public Health Association, et al., Standard Methods for the Examination of Water and Wastewater, 17th Ed., 1989.

EPA-2 = U.S. EPA, Microbiological Methods for Monitoring the Environment: Water and Wastes, Document No. EPA-600/8-78-017, December 1978.

ASTM = American Society for Testing and Materials, Annual Book of Standards, Section 11 - Water, Volumes 11.01 and 11.02, 1990.

Hach = Hach Company, Hach Water Analysis Handbook, 2nd Ed., 1992

7.4 ENVIRONMENTAL AUDITS AND INSPECTIONS

In addition to Federal and state regulatory agency audits, the M&O contractor conducts an annual environmental audit at each site. Internal audits are conducted in accordance with a detailed audit checklist which addresses the pertinent aspects of all environmental programs and activities. Each audit is performed over a two to four-day period followed by an outbriefing with site management and preparation of a formal audit report with specific recommendations as appropriate. Audit areas include environmental records, laboratory procedures and records, site housekeeping, operating procedures, training, environmental response equipment, and permit regulatory compliance. A general field inspection of the site environs is also conducted to assess the general site conditions, changes attributable to site impacts, and the potential effects of planned and proposed site construction modifications.

The 1992 environmental audit at each SPR site demonstrated the overall implementation and execution of the SPR Environmental Program to be excellent.

Those areas noted as needing improvement have generally been in missing reports, standardization, and recordkeeping. Specific corrective actions are tracked through completion.

Audits and inspections were conducted in 1992 by the LDNR, RCT, LDEQ, and DOE. Findings reported during 1992 by those state and Federal regulatory agencies that performed compliance inspections were generally consistent with SPR findings. The areas identified by regulatory agencies have all been resolved and are discussed in detail below. Such positive findings are attributed to the high level of environmental awareness exhibited among all site personnel and the emphasis SPR management has placed on fulfilling the intent and conditions of the SPR Environmental Program.

The LA DNR inspected the WH brine pond system and cavern well heads. No findings were expressed during the inspection

The RCT inspected the cleanup of Bryan Mound well pad 111. There was some concern with stained soil on the pad. Verbal agreement was reached on allowing photo and microbial degradation to proceed with continued water flushing. The RCT conducted a follow-up inspection and was satisfied with the results. No letter was issued on the inspection.

LDEQ conducted an air quality inspection at the St. James Terminal and Weeks Island facilities. Tank seal inspection records and one of the storage tanks were inspected for compliance. No written inspection report was prepared, and the inspectors stated that they had no findings at St. James. The Weeks Island inspection was in response to a complaint from a citizen. The inspection revealed that the complaint was unfounded however, the permit required modification to reflect new equipment on site (emergency generators and others). The permit was modified accordingly.

The Weeks Island site was inspected by LDEQ. The auditors asked that analytical discharge data currently maintained at the Bayou Choctaw laboratory be maintained at Weeks Island. The requested file was established at Weeks Island.

The West Hackberry wastewater laboratory was inspected by LDEQ and found to be satisfactory.

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