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

Site Environmental Report

for

Calendar Year 1994

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

June 14, 1995

Distribution:

SITE ENVIRONMENTAL REPORT FOR 1994 - STRATEGIC PETROLEUM RESERVE

Enclosed for your information is a copy of the Site Environmental Report for Calendar Year 1994 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 1994 environmental monitoring program.

If you have any questions or desire additional information, please contact David Brine of the Project Management Office Environmental, Safety and Health Division at (504) 734-4277.

Sincerely,

William C. Gibson, Jr.
Project Manager

Enclosure

DISCLAIMER

STRATEGIC PETROLEUM RESERVE

SITE

ENVIRONMENTAL REPORT

FOR

CALENDAR YEAR 1994

Document No. ASE5400.48 Rev. AO

Prepared for the Department of Energy
Strategic Petroleum Reserve Project Management Office
under Contract No. DE-AC96-93PO18000

DYNMCDERMOTT PETROLEUM OPERATIONS COMPANY
850 South Clearview Parkway
New Orleans, Louisiana 70123

May 31, 1995

LIST OF EFFECTIVE PAGES

Section	Pages	Revision	Effective Date
List of Effective Pages	i	0	5/31/95
Table of Contents	ii-iv	0	5/31/95
List of Figures	v	0	5/31/95
List of Tables	vi-vii	0	5/31/95
Abbreviations and Acronyms	viii-xii	0	5/31/95
Executive Summary	xiii-xiv	0	5/31/95
Questionnaire/Reader Comment Form	xv	0	5/31/95
Section 1	1-20	0	5/31/95
Section 2	1-20	0	5/31/95
Section 3	1-16	0	5/31/95
Section 4	1	0	5/31/95
Section 5	1-55	0	5/31/95
Section 6	1-31	0	5/31/95
Section 7	1-4	0	5/31/95
References	1-2	0	5/31/95

TABLE OF CONTENTS

TABLE OF CONTENTS

(continued)

TABLE OF CONTENTS

(continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

(continued)

ABBREVIATIONS AND ACRONYMS

ac	acre
adj	adjacent
ADM	Action Description Memorandum
AFFF	aqueous film forming foam
AO	Administrative Order
ARCO	Atlantic Richfield Company
As	arsenic
AST	above ground storage tanks
ASTM	American Standard Testing Methods
avg	average
bbl	barrel(s) (1 bbl = 42 gallons)
BC	Bayou Choctaw
BDL	Below Detectable Limit
BH	Big Hill
bldg	building
bls	below land surface
BM	Bryan Mound
BPM	Best Management Practices
BOD_5	five day biochemical oxygen demand
CAA	Clean Air Act
CAP	corrective action plan
°C	degrees celsius
CEQ	Council for Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	conditionally exempt small quantity generator
CFR	Code of Federal Regulations
Ci	Curies
cm	centimeter
CO	carbon monoxide
COD	chemical oxygen demand
COE	United States Army Corps of Engineers
CV	coefficient of variation
CWA	Clean Water Act

CX	categorial exclusion
CY	calendar year
DM	DynMcDermott Petroleum Operations Company, Inc.
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
EIQ	Emissions Inventory Questionnaire
EIS	environmental impact statement
EO	Executive Order
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERT	Emergency Response Team
ERO	Emergency Response Organization
ESA	Endangered Species Act
ES&H	Environmental Safety & Health
F&WS	United States Fish and Wildlife Service
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding Of No Significant Impact
FRP	Facility Response Plan
ft	feet
GLO	General Land Office
ha	hectare
HAP	Hazardous Air Pollutant
H_g	mercury
HPP	high pressure pump pad
HQ	headquarters
HW	hazardous waste
ICW	Intracoastal Waterway
in	inch
km	kilometers
LA	Louisiana

lab	laboratory
LAC	Louisiana Administrative Code
lbs	pounds
LDEQ	Louisiana Department of Environmental Quality
LPE	Laboratory Performance Evaluation
LWDPS	Louisiana Water Discharge Permit System
LDNR	Louisiana Department of Natural Resources
LDOTD	Louisiana Department of Transportation and Development
LDWF	Louisiana Department of Wildlife and Fisheries
m^3	cubic meters
m/sec	meters per second
maint	maintenance
max	maximum
MBI	Methylenebis
mCi	millicuries
mg/l	milligrams per liter
mi	miles
M&O	Management & Operations contractor
MMB	million barrels
NAAQS	National Ambient Air Quality Standards
NE	northeast
NEPA	National Environmental Policy Act
NFRAP	No Further Remedial Action Plan
NHPA	National Historic Preservation Act
NORM	naturally occurring radioactive material
NO_x	nitrogen oxide
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List (CERCLA)
NRC	National Response Center
NSR	New Source Review
NV	not a valid or statistically meaningful number
NW	northwest
NWP	Nationwide Permit
O&G	oil and grease

OPA	Oil Pollution Act
Ops	operations
OVA	organic vapor analyzer
PCB	polychlorinated biphenyls
pH	negative logarithm of the hydrogen ion concentration (acidic to basic on a scale of 0 to 14, 7 is neutral)
PM_{10}	Particulate Matter (larger than 10 microns)
PMO	Project Management Office
PPA	Pollution Prevention Act of 1990
ppt	parts per thousand
PREP	Preparedness for Response Exercise Program
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RCT	Railroad Commission of Texas
RPX	Recovery Pump Exercise
ROW	Right-of-Way
RWIS	raw water intake structure
SAL	salinity
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
Se	selenium
SE	southeast
SIP	State Implementation Plan
SJ	St. James
SOC	Security Operations Center
SO_2	sulfur dioxide
SOW	Statement of Work
SPCC	Spill Prevention Control and Countermeasures Plan
SPR	Strategic Petroleum Reserve
SQG	small quantity generator
STP	sewage treatment plant
S.U.	standard units
SW	southwest

TDH	Texas Department of Health
TDH&PT	Texas Department of Highways and Public Transportation
TDS	total dissolved solids
TNRCC	Texas Natural Resource Conservation Commission
TOC	total organic carbon
TPDES	Texas Pollution Discharge Elimination System
TPQ	Threshold Planning Quantity
tpy	tons per year
TSCA	Toxic Substance Control Act
TSS	total suspended solids
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
yd	yard

EXECUTIVE SUMMARY

The purpose of this Site Environmental Report (SER) is to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts. The SER, provided annually in accordance with Department of Energy (DOE) Order 5400.1, serves the public by summarizing monitoring data collected to assess how the Strategic Petroleum Reserve (SPR) impacts the environment. This report (SER) provides a balanced synopsis of non-radiological monitoring and regulatory compliance data and affirms that the SPR has been operating within acceptable regulatory limits.

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 1994. Two of these highlights include decommissioning of the Weeks Island facility (disposition of 73 million barrels of crude oil inventory) as well as the degasification of up to 144 million barrels of crude oil inventory at the Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry facilities. The decision to decommission the Weeks Island facility is a result of diminishing mine integrity from ground water intrusion. Degasifying the crude oil is required to reduce potentially harmful emissions that would occur during oil movements. With regard to still another major environmental action, 43 of the original 84 environmental findings from the 1992 DOE Tiger Team Assessment were closed by the end of 1994. Spills to the environment, another major topic, indicates a positive trend. Total volume of oil spilled in 1994 was only 39 barrels, down from 232 barrels in 1993, and the total volume of brine spilled was only 90 barrels, down from 370 barrels in 1993. The longer term trend for oil and brine spills has declined substantially from 27 in 1990 down to nine in 1994. There was also a release of a CERCLA listed hazardous material when a contractor spilled three pounds while making a pipe connection. All of the spills were reported to appropriate agencies and immediately cleaned up, with no long term impacts observed.

Two SPR sites were inspected by an outside agency (Louisiana Department of Environmental Quality) during 1994 and neither received significant findings. Even though ten minor noncompliances were self reported under state and federal discharge permits for all SPR sites during 1994, no Notices of Violation were received. The SPR continues to address ground water contamination from the brine pond and buried piping at West Hackberry with positive results. Also, the SPR is in the process of removing its underground storage tanks (USTs) and replacing them with above ground storage tanks.

The SPR sites generally operate as either Conditionally Exempt Small Quantity Generators (CESQG) in Texas, or Small Quantity Generators (SQG) in Louisiana (the smallest level generator in each state). The SPR sites do not treat, store, or dispose of hazardous wastes. Superfund Amendments and Reauthorization Act (SARA) Title III Tier Two reports are prepared and submitted to agencies every year detailing the kinds and amounts of hazardous substances on SPR facilities.

National Pollutant Discharge Elimination System (NPDES) permit renewal applications were found administratively complete by the Environmental Protection Agency (EPA) in 1994 allowing applicable sites to continue to operate. Further, each SPR site operates in accordance with a Pollution Prevention Plan prepared in accordance with the storm water general permits. The SPR has also adopted the National Preparedness for Response Exercise Program (PREP) during 1994. PREP specifies a comprehensive drill and exercise program, evaluation procedures, and performance based training.

The SER also characterizes environmental management performance and programs pertinent to the SPR. 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.

QUESTIONNAIRE/READER COMMENT FORM

The 1995 Strategic Environmental Report, slated for publication in 1996, will be updated with new and pertinent user comments.

Please submit your questions/comments on a photocopy of this page and forward it to the following address:

DynMcDermott Petroleum Operations Company
Environmental Department, EF-83
850 South Clearview Parkway
New Orleans, LA 70123

A copy of your comments will be sent to the originator for response.

Date: _____

Name of Submitter: _____

Street or P.O. Box: _____

City/State/Zip code: _____

Organization (if applicable): _____

Comments:

_____

_____

_____

_____

_____

_____

(Attach other sheets as needed)

(for originator's use)

Subject Matter Expert (SME): _____ Date: _____

SME's Response to

Comment: _____

_____

_____

THIS PAGE INTENTIONALLY BLANK

1. INTRODUCTION

The purpose of this Site Environmental Report is to present summary environmental data so as to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts.

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 mitigate 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). Figure 1-1 is a regional map showing the relative location of SPR facilities.

Three of the five storage sites were acquired with existing solution-mined caverns, two of which have had additional solution mining. The fourth site is a room and pillar salt mine, previously created by mechanical underground mining techniques and converted by the SPR to storage. The fifth storage site was created entirely by solution mining.

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 and LOCAP Pipeline Terminal from LOOP (St. James, Louisiana), the Texas 22 to Lake Charles refineries and the SPR St. James Terminal. The sites are also capable of distributing crude oil via tank ships. 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.

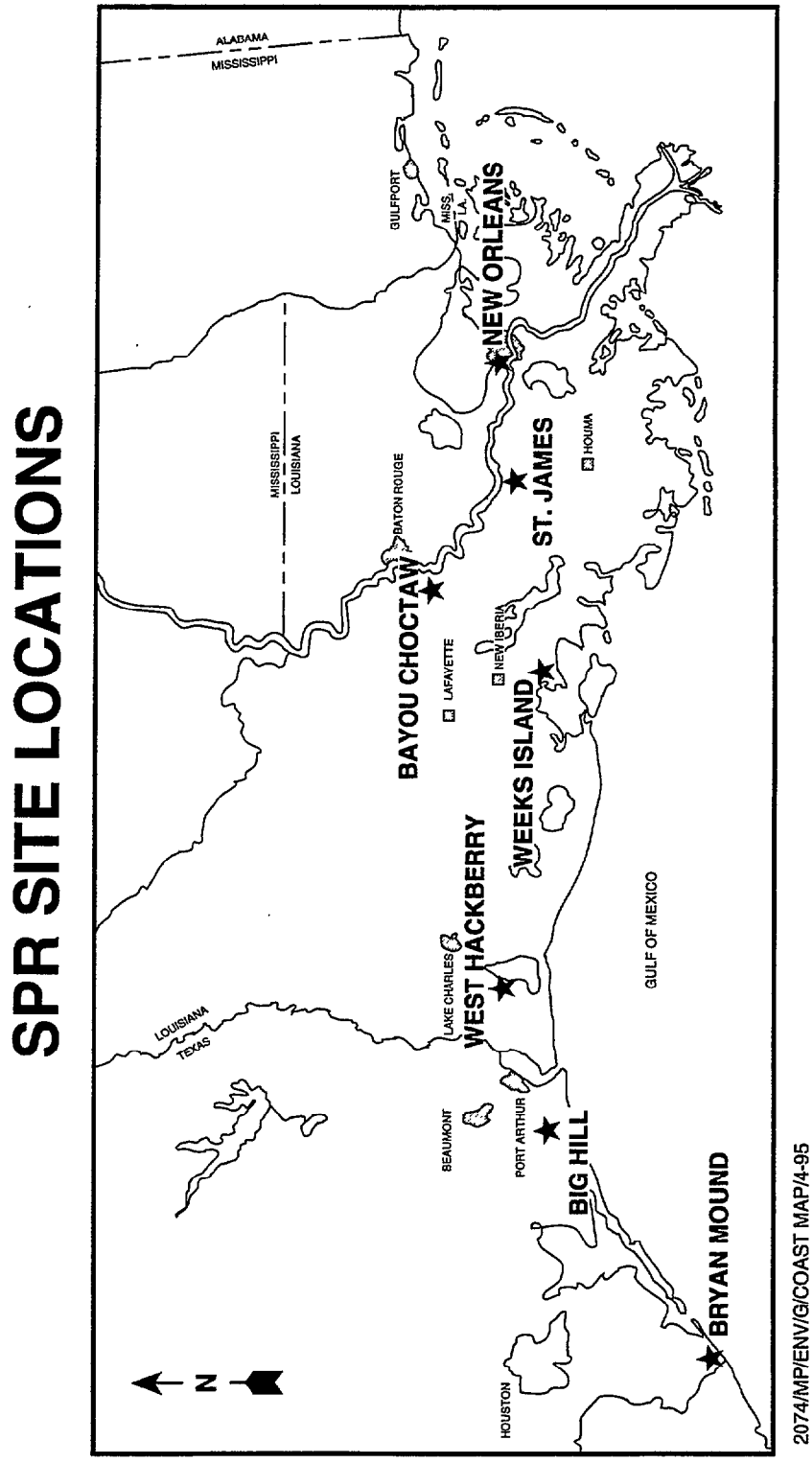


Figure 1-1. SPR Site Locations

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 hectacres (ha) (168 and 200 acres (ac)) respectively. The area surrounding the site is rural, with a number of people living in small settlements along the nearby highways. The nearest communities are Addis, to the northeast, and Plaquemine, to the southeast. Baton Rouge, the Louisiana State Capital 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 ha (12 ac) 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 baldcypress, sweetgum, water 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. Raptors are commonly observed perching in the area. The southern bald eagle, an endangered species, has one nest within one mile of the Bayou

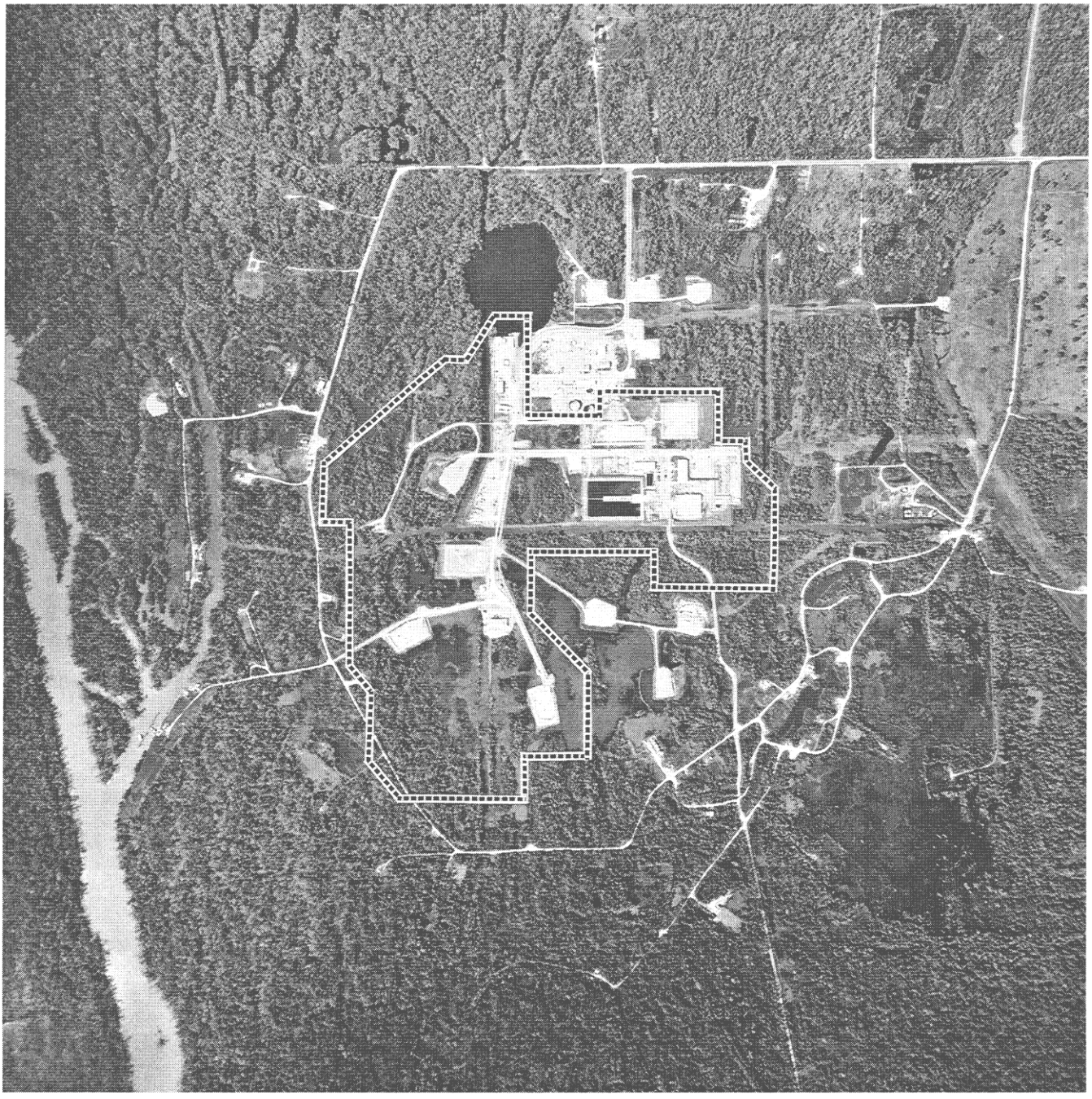


Figure 1-2. Bayou Choctaw SPR Site

Choctaw - St. James crude oil pipeline, and a second has been identified within the regional area of the site. Other endangered species of raptors may occasionally appear near the Bayou Choctaw facility or along its pipeline right-of-ways. 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, classified as "threatened by similarity of appearance," is frequently found in and adjacent to the site.

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 91 cm (36 in) crude oil pipeline 58 km (36 mi) long that connects 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 from the local area, with the remainder moving into the area or commuting from Beaumont or Port Arthur. 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.

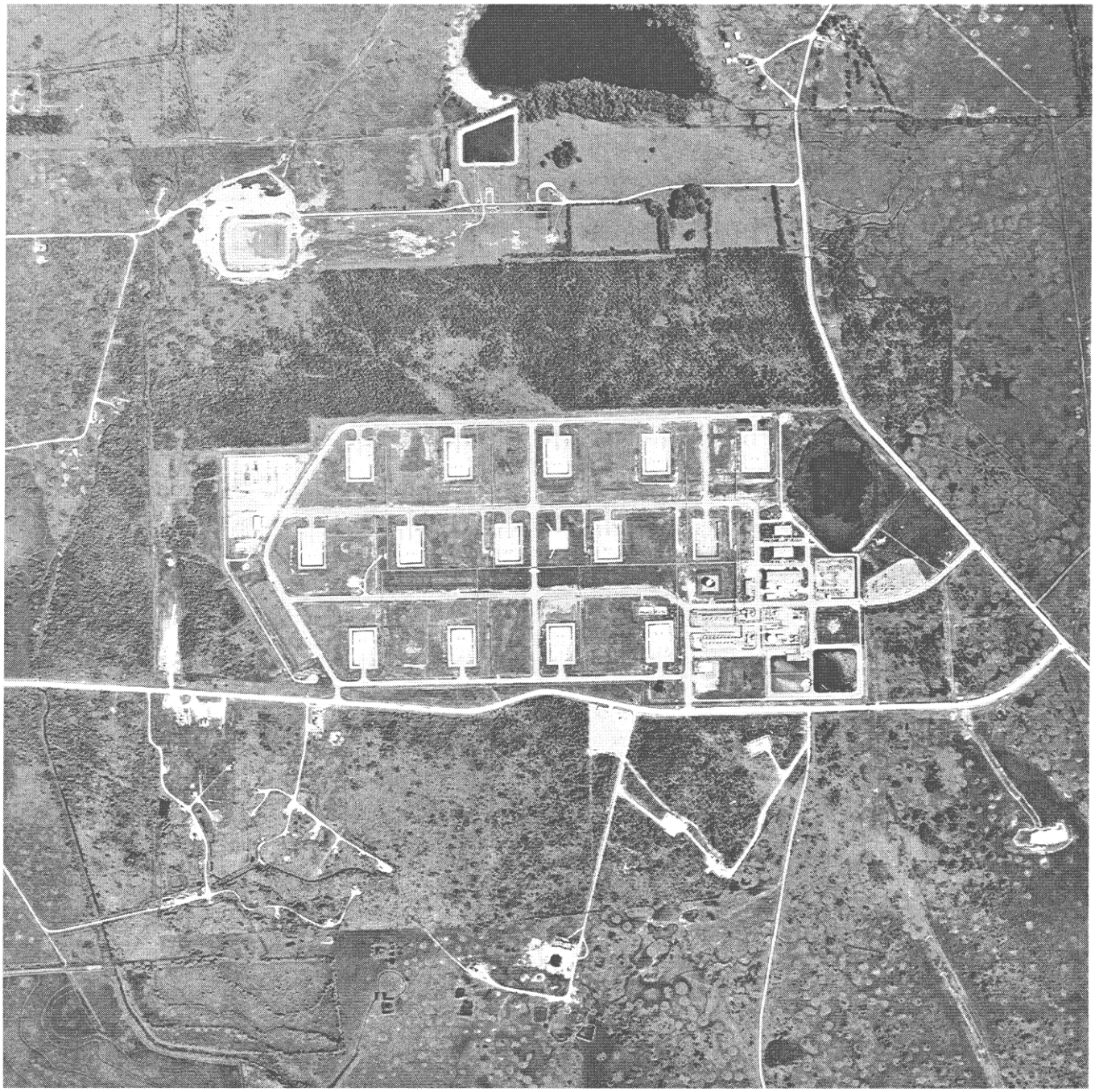


Figure 1-3. Big Hill SPR Site

No rare, threatened or endangered species habitat is identified in the vicinity of the Big Hill site on the Texas Natural Resource Conservation Commission (TNRCC) 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, pocket gophers, 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. No known species that frequent the site are endangered or threatened. The McFaddin National Wildlife Refuge located south of the site provides important habitat for over-wintering waterfowl.

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 5.24 miles away on the Intracoastal Waterway with a 107 cm (48 in) pipeline extending to the site, a 107 cm (48 in) brine disposal pipeline extending 15.1 km (9.37 miles) onshore and 7.627 km (4.74 mi) offshore in the Gulf of Mexico, and a 39.33 km (24.44 miles) 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.

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 (3 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 202.3 ha (500 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. 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 meters (15 ft) above the surrounding wetlands. Although Blue Lake is within the protective triangle formed by the levee system (with excess rainwater 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. 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 tidal waters 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

Figure 1-4. Bryan Mound SPR Site

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 occurring just across the Brazos River Diversion Channel to the southwest of the site.

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.

Bryan Mound has a total storage capacity of 35.9 million m^3 (226 MMB) of crude oil in 20 solution-mined caverns. Appurtenant facilities include a 91 cm (36 in) old brine disposal pipeline extending 22.4 km (13.9 mi) offshore into the Gulf of Mexico and 4.5 km (2.8 miles) onshore 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. Construction on a new brine disposal pipeline began during the middle of 1994. It will extend 3.5 nautical miles offshore into the Gulf of Mexico. Construction was unfinished as of December 31, 1994.

1.4 ST. JAMES TERMINAL

The St. James Terminal (SJ) consists of six aboveground storage tanks with a total capacity of 0.3 million m^3 (2 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 the local labor pool. 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 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 two species could be present near the site or the Mississippi River: the pallid sturgeon (endangered) and the Arctic peregrine falcon (threatened). No federally endangered or threatened species are found on site; however, a southern bald eagle (endangered) was reported flying along the Mississippi River 1994. 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.

Figure 1-5. St. James SPR Terminal

1.5 WEEKS ISLAND

The Weeks Island (WI) site 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 aboveground facility, shown in Figure 1-7, occupies approximately three ha (seven ac). The 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 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) diameter, 108 km (67 mi) long crude oil pipeline connecting the site to the St. James Terminal.

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,

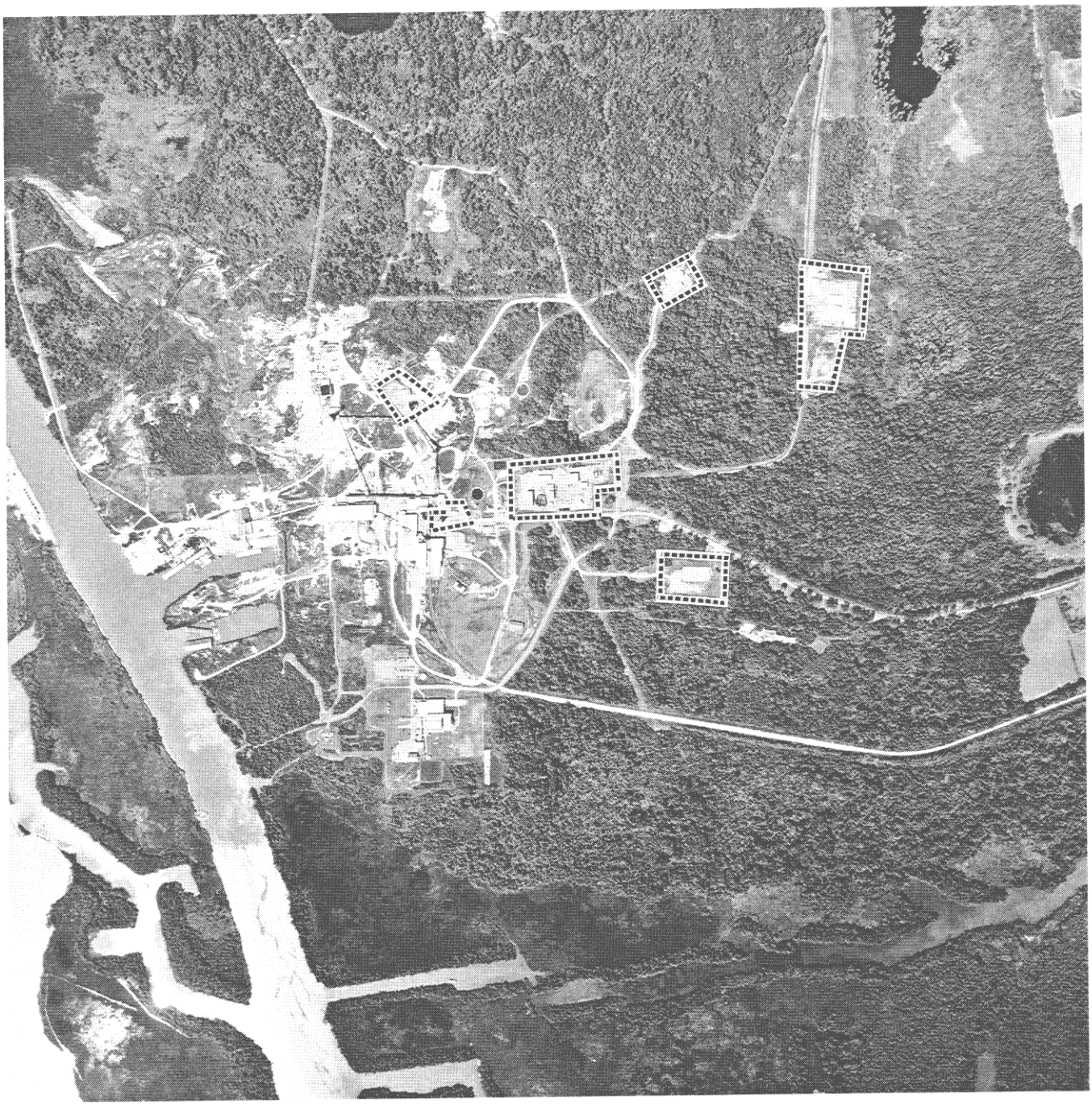


Figure 1-6. Weeks Island SPR Site

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 as 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 frequented by a variety of endangered or threatened avian species, including the brown pelican, bald eagle, peregrine falcon, 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.

Headquarters DOE announced on December 15, 1994, that the Weeks Island site will be de-commissioned. Oil stocks will be drawn down and transferred to other SPR sites beginning in 1995. The de-commissioning process is expected to take in excess of three years to complete.

1.6 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

Figure 1-7. West Hackberry SPR Site

a distinct mounded overburden on its western portion, with elevations up to 6.5 m (21 ft), the highest elevation 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 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 oakspecies, 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 brackish 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 and 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 near the brine disposal pipeline. 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 southern bald eagle, Arctic peregrine falcon, and brown pelicans. These species also inhabit the lands through which the SPR pipelines pass.

Also inhabiting 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. 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 currently transported and disposed by injection into eight active brine disposal wells. The 91 cm (36 in), 42 km (26 mi) brine pipeline that goes to an area 11 km (seven mi) south of Holly Beach, Louisiana, in the Gulf of Mexico is currently out of service. 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.

1.7 NEW ORLEANS HEADQUARTERS

The main office for SPR operations is housed in three adjacent office buildings in Harahan, a suburb of New Orleans, Louisiana. Unlike the crude oil reserve sites, activities conducted at the New Orleans office complex are administrative. Office space is rented, not owned by the Department of Energy.

2. COMPLIANCE SUMMARY

General

The Strategic Petroleum Reserve (SPR) operates in conformance with requirements established by Federal and state statutes and regulations; Executive Orders; and Department of Energy (DOE) Orders. The SPR has been managed and operated by DynMcDermott Petroleum Operations Company while under contract to DOE since April 1, 1993. Compliance status in this year's report reflects compliance activities conducted by DOE personnel, and DynMcDermott Petroleum Operations Company.

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 U.S. Army Corps of Engineers (COE), the Louisiana Department of Environmental Quality (LDEQ), the Louisiana Department of Natural Resources (LDNR), the Railroad Commission of Texas (RCT), and the Texas Natural Resource Conservation Commission (TNRCC). These agencies issue permits, review compliance reports, inspect facilities and operations, and oversee compliance with regulations.

DOE Orders/Directives

The SPR follows and operates in conformance with numerous DOE Orders applicable to its operation. Some of the major orders include General Environmental Protection (5400.1), National Environmental Policy Act (NEPA) Compliance Program (5440.1D), and Environment, Safety, and Health (ES&H) Program for Department of Energy Operations (5480.1B). The orders establish some of the policies of the SPR-PMO.

In 1994, the SPR prepared an Environmental, Safety, and Health Management Plan including environmental budgetary needs for core, compliance, and improvement activities over the next seven years. The final document, scheduled for completion in

early 1995, is expected to reflect SPR ES&H budgetary needs for core, compliance, and improvement activities over the next seven years.

2.1 COMPLIANCE STATUS (JANUARY 1, 1994 THROUGH DECEMBER 31, 1994)

The SPR did not receive any Notices of Violation from regulatory agencies during 1994. Ten minor noncompliances with state and federal discharge permits for all SPR sites during 1994 were submitted to regulatory agencies under the permit self-reporting provisions. These are discussed further in Section 2.3. Much of the SPR's compliance program deals with meeting regulations under the Clean Water Act. The SPR sites have a total of 102 wastewater and storm water discharge monitoring stations. The SPR is also required to meet many requirements under the Clean Air Act and the Safe Drinking Water Act. Site waste management activities are conducted in accordance with the Resource Conservation and Recovery Act (RCRA). The SPR sites do not routinely generate large quantities (over 2,200 pounds) of hazardous waste and therefore typically operate as either Conditionally Exempt Small Quantity Generators (CESQG) in Texas, or Small Quantity Generators (SQG) in Louisiana (the smallest level generator in each state). The SPR sites do not treat, store, or dispose of hazardous wastes, and therefore are not RCRA permitted facilities. Each site is identified by an EPA generator number that is used to track the manifesting of hazardous waste for off-site treatment or disposal. None of the SPR sites are identified on the National Priority Listing (NPL) under CERCLA. Polychlorinated biphenyl (PCB) contaminated oils and friable asbestos wastes were not generated at SPR sites in 1994.

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

Clean Water Act (CWA)

The SPR sites comply with the CWA through permitting with the National Pollution Discharge Elimination System (NPDES) program and following the Spill Prevention, Control and Countermeasures (SPCC) program, both of which are regulated by EPA.

Six expired NPDES permit renewal applications were found administratively complete by EPA in 1994, allowing those sites to continue to operate under their existing permits until the new permits are issued. Region VI EPA has indicated that the priority for working the renewal applications will commence with those sites with offshore diffusers (Bryan Mound, Big Hill and West Hackberry) with the remaining sites (Bayou Choctaw, St. James Terminal, and Weeks Island) given a secondary priority. Bryan Mound, because of the construction of the replacement brine line and associated diffuser, received EPA permitting attention during the latter part of 1994. In order to facilitate use of the new diffuser should its construction be completed prior to renewal of the old permit, Region VI EPA issued an interim Administrative Order (AO) on September 28, 1994.

Draft permits for the LA Water Discharge Permit System for the West Hackberry and Weeks Island sites were finalized in 1994. Bayou Choctaw received a final LDEQ permit during early 1994. Big Hill received its state discharge permit from the Railroad Commission of Texas (RCT) in September 1994 (Bryan Mound received its RCT permit in 1993). The LDEQ has been unable to process the St. James permit due to revised priorities; however, a 1995 processing date is anticipated.

Each SPR site has an SPCC plan that addresses prevention and containment of oil spills. During 1994, DM started the process of updating all site SPCC Plans. The Louisiana consolidated

hazardous substance on site provisions were included. As of December 31, 1994, three site SPCC Plans were re-written. All of the SPR spill plans are current in accordance with 40 CFR 112.

Pollution Prevention Act of 1990 (PPA)

Each SPR site operates in accordance with a Pollution Prevention Plan prepared in accordance with the storm water general permits. The EPA Storm Water Pollution Prevention Plan requirement was met by creating a multimedia document that consolidated the EPA requirement with the more general DOE required Pollution Prevention Plan and the related Waste Minimization and Solid Waste Management Plans. Each of the renewed LWDPS water discharge permits contains a requirement for development and implementation of a state Best Management Practices (BMP) Plan within six months of the permit effective date. This requirement was satisfied by adding a BMP Plan cross reference to the SPR Pollution Prevention Plan avoiding production of a redundant document.

Clean Air Act (CAA)

The six SPR facilities comply with the applicable provisions of the CAA and State Implementation Plans (SIP). All of the SPR facilities are located in attainment areas for all National Ambient Air Quality Standards (NAAQS) pollutants with the exception of ozone. Weeks Island and West Hackberry are located in attainment areas for ozone; therefore, are regulated by the Prevention of Significant Deterioration (PSD) permitting program. Big Hill, Bryan Mound, and Bayou Choctaw are located in nonattainment areas for ozone. Therefore, the New Source Review (NSR) permitting program applies. St. James is located in a transition area for ozone awaiting EPA determination. None of the SPR facilities are considered to be major sources during normal operations under PSD, NSR, and Title III hazardous air pollutant regulations. All of the facilities

operate in accordance with the provisions of the applicable state air permits.

The Bryan Mound and West Hackberry facility air permits required amendments during 1994. The Bryan Mound air permit amendment was submitted to the Texas Natural Resource Conservation Commission in January 1994 and the permit has been issued. The West Hackberry air permit amendment was submitted to Louisiana Department of Environmental Quality in February 1994 and is awaiting approval.

Because it is located in a severe nonattainment area for ozone, the Texas Natural Resource Conservation Commission required the Bryan Mound facility to participate in an employee trip reduction program. Bryan Mound prepared and submitted the requisite trip reduction plan in 1994 and achieved the mandated reduction by changing from a standard five to a compressed four day work week.

During 1994, DOE decided to control the emissions from gassy oil during normal operations and drawdown by degasing the crude oil prior to any drawdown. Two degasing plants were designed to remove the methane and ethane from selected crude oil inventories at Bryan Mound, West Hackberry, Bayou Choctaw, and Big Hill. One degasing plant will remain at Bryan Mound for three years while the other will move from West Hackberry (nine months of operation) to Bayou Choctaw (three months of operation) and finish at Big Hill (nine months of operation). Since these degasing plants will emit regulated pollutants (VOC, NO_x, SO_2, and HAPs) during their 2 year operational period, additional air permits will be required prior to constructing and operating these plants. DM visited the TNRCC Air Quality Board in November 1994 and the LDEQ Office of Air Quality Division in December 1994 to pre-plan the permitting strategy for these degasing units. It was agreed by DM and the TNRCC that the degasing units for Bryan Mound and Big Hill

could be handled under Standard Permit which is for processes that reduce emissions. A Standard Permit application for the Bryan Mound Facility was prepared in late December 1994. Since the same unit is going to move from West Hackberry after degasing that site to Bayou Choctaw, LDEQ suggested that it be issued as a Mobile Permit which was prepared at the end of 1994.

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 Region VI; and, all SPR sites are considered as No Further Remedial Action Plan (NFRAP) sites to reflect the findings in the reports.

Superfund Amendments and Reauthorization Act (SARA)

SARA Title III Tier Two reports, also known as Emergency Planning and Community Right-to-Know Act (EPCRA) Section 312 reports, were prepared and distributed as required, by March 1st, to 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 EPA has given primacy under the SDWA to both Louisiana and Texas UIC programs, which regulate underground hydrocarbon storage, related brine disposal, and oil field wastes. The SPR operates 21 salt water disposal wells in Louisiana and none in Texas. The 1994 Annual Report Form

OR-1 was completed and submitted on schedule to the Louisiana Department of Natural Resources.

An August 3, 1994, letter from LDNR indicated a list of nine concerns relative to operational and mechanical aspects of the wellheads at the West Hackberry storage site. The letter followed SPR submittal of a report on the bi-annual self inspection performed on July 19 - 21, 1994. After a meeting between DOE, DM, and LDNR personnel held in Baton Rouge on August 11, 1994, all concerns were amicably resolved with the understanding that the SPR would report back to the state upon completion of all of the work items.

Closure actions for three anhydrite storage pits permitted for the West Hackberry site concluded on October 12, 1994. A letter report detailing the construction work and in-place closure activities was filed with LDNR on January 10, 1995.

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. The West Hackberry facility negotiated a corrective action plan (CAP) for a leaking brine pond with LDNR in February 1992. The CAP requires ground water recovery pumping, ground water monitoring, and submission of quarterly monitoring reports. Monitoring in 1994 indicates that the brine contaminated plume remains localized around and east of the pond system with no indications of any off site migration. Affected ground waters at both sites are naturally brackish and not suited for domestic or agricultural use. This use limitation is a significant factor in determining whether additional action will be needed in the future.

A baseline ground water survey is being conducted in two phases at all sites. Phase I was completed in 1993 and consisted of a non-intrusive survey of site soils using electrical

conductivity and soil gas sensing as indicators of potential brine and oil contamination. The Phase I report was used to prepare a statement of work (SOW) for a Phase II contamination verification survey. The SOW was developed and technically reviewed in 1994. Completion of the verification field studies is scheduled for 1995.

Resource Conservation and Recovery Act (RCRA)

SPR wastes associated with underground hydrocarbon storage activities continue to be considered under the RCRA exclusion for drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy. Other wastes generated at SPR facilities in conjunction with construction, operations, and maintenance activities are considered for characterization under RCRA. The SPR sites have never operated as treatment, storage, or disposal facilities.

In 1994, the SPR manifested hazardous waste from the Big Hill, Bryan Mound, St. James, West Hackberry, and Weeks Island SPR sites for off site incineration. The wastes consisted primarily of spent paint solvent, solvent contaminated oils, and lab wastes. The SPR submitted notification forms of regulated waste activity to the EPA for all SPR sites. In 1994, accumulated monthly waste volumes exceeded the SQG generator monthly limits once at Bryan Mound, St. James, West Hackberry, and Weeks Island

The SPR has underground storage tanks (USTs) that are used for the storage of diesel and unleaded gasoline. There are two USTs at Bayou Choctaw, three at Big Hill, and two at St. James. All are registered under the corresponding state UST programs. In-line pressurized piping leak detection systems required for the Big Hill vehicle gasoline and diesel dispensing station were installed in early 1994.

All SPR USTs are under a state and federal mandated leak detection program consisting of monthly product inventory control and annual tank tightness testing. In addition to inventory control and tank tightness testing, the Big Hill program requires annual integrity testing of the pressurized piping.

Two UST systems (gasoline and diesel fuel) were removed at Weeks Island in 1994 and replaced with above ground tank vault systems, providing integral secondary containment without creating an additional stormwater retention outfall. Closure was conducted in accordance with the state UST program. Indications of a gasoline release (free product, hydrocarbon odor, and stained soil) were found in the UST area. Affected soil was excavated and disposed at an off-site landfill approved for UST clean-up wastes.

Plans are underway to remove the remaining seven SPR USTs in 1995 and replace them with above ground storage tanks.

Toxic Substances Control Act Construction (TSCA)

Friable asbestos construction materials were not found at SPR sites in 1994. The small amount of asbestos (less than 1,000 pounds) in use on the SPR is nonfriable. All nonfriable asbestos (such as gaskets and insulation board) is disposed as it is taken out of service, in accordance with applicable solid waste regulations, at local municipal landfills. No liquid-filled electrical equipment used on the SPR has been identified as PCB equipment or PCB contaminated under TSCA. The SPR hydraulic equipment continues to be tested for the presence of PCB as opportunity avails. No SPR hydraulic equipment has been identified as PCB equipment or PCB contaminated.

National Environmental Policy Act (NEPA)

In 1992, the SPR issued a draft Environmental Impact Statement (EIS) on the proposed expansion of the SPR to a one billion barrel reserve. A decision to suspend expansion planning for the SPR was made and the draft EIS will, therefore, not be finalized until there is a decision to proceed with the proposed expansion.

In 1994, an Environmental Assessment (EA) was developed for the gassy oil project to remove intruded methane gas from the crude oil. As a result of the EA process, a Finding of No Significant Impact (FONSI) was issued on September 1, 1994.

In 1994, delegation of signatory authority for NEPA Categorical Exclusions (CXs) and EAs was transferred from the SPRPO to the SPRPMO project manager. As a result of this delegation, the processing time of NEPA CXs was reduced from about four working weeks to two.

An EA for use of herbicides along SPR crude oil pipeline rights-of-way was begun in December 1992 and development continued through 1993 and 1994; however, the EA was determined unnecessary when DM eventually opted for mechanical control of vegetation along the rights-of-way.

A decision was made to conduct an Environmental Assessment for the decommissioning of the Weeks Island SPR site.

One hundred and four projects were submitted for NEPA review action in 1994. All resulted in a CX from further NEPA action. An Environmental Assessment on the leasing for the SPR St. James Terminal was begun in July, 1994. A FONSI is expected to be issued in 1995.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

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

The SPR encompasses 1849 acres and uses only uses small quantities of pesticides and herbicides (approximately 12,000 pounds)to control weeds, insects, and rodents on site.

Endangered Species Act (ESA)

The Weeks Island site, along with neighboring facilities, is working with the U. S. Fish and Wildlife Service (F&WS), Louisiana Department of Wildlife and Fisheries (LDWF), and the Louisiana Nature Conservancy to prevent harm to the resident Louisiana black bear and to ensure worker safety.

A biological assessment for the clearing of vegetation at Weeks Island and its effect on the threatened Louisiana black bear was coordinated with the F&WS in conjunction with subsidence studies at the site.

National Historic Preservation Act (NHPA)

No site activities performed in 1994 required coordination with State Historical Preservation Offices.

Oil Pollution Act (OPA) of 1990

During the period from January 1, 1994, through December 31, 1994, the SPR received letters from EPA, DOT, and the USCG relative to Facility Response Plans (FRP) issued the previous year.

In response to queries by the USCG concerning the Saint James Terminal Marine Transportation Related FRP, supplemental information was submitted during the fourth quarter FY 94. On December 30, 1994, the FRPs for all sites were submitted to EPA for review and approval.

A significant addition to the SPR discharge readiness program is the regulatory requirement for implementation of an extensive drill and exercise program. As recommended in the regulations, the SPR has adopted the National Preparedness for Response Exercise Program (PREP) during 1994 which was recognized by each of the regulatory agencies promulgating rule making concerning OPA 90. PREP specifies a comprehensive drill and exercise program, evaluation procedures, and performance based training.

Additional program enhancements include the establishment of new SPR Emergency Response Organization (ERO) positions in order to more effectively respond to the changing regulatory environment. These new positions include the SPR Spill Manager and the Spill Management Support Team which would be committed to provide on-scene tactical support during a discharge requiring ERO activation.

Executive Orders (EO)

The M&O contractor began compliance with Executive Order 11988, "Floodplain Management" 11990, "Protection of Wetlands" by training individuals in 1994 under the new wetlands delineation guidance criteria as a precursor to developing detailed wetlands delineation maps for each SPR site in 1995.

In accordance with all applicable pollution control standards, the SPR, a Federal facility, complies with E.O. 12088 "Federal Compliance with Pollution Control Standards" by implementing the SPR Pollution Prevention Plan. The plan includes goals for hazardous and nonhazardous waste reduction and for recycling.

Executive Order 12873, "Federal Acquisition, Recycling, and Waste Prevention," requires federal facilities to establish affirmative procurement programs for certain products containing recovered materials. The SPR purchases recycled

paper, the only listed product that is purchased in significant quantities (approximately 150,000 pounds per year).

In response to Section 5-501 of E. O. 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," all SPR sites were listed in the Potential Facilities Listing prepared by DOE on 4/13/94 for potentially meeting reporting requirements under EPCRA Sections 304 and 311-312 requirements. Reporting under Section 313 (Form R) does not apply to the SPR. The SPR Pollution Prevention Plan has been implemented since 1993.

Executive Order 12898, "Environmental Justice." During 1994 a draft report was prepared on the social economic condition outlook for Iberia Parish, Louisiana, in consideration of the Weeks Island decommissioning activity and its impact on minorities and the economic under-privileged.

DOE Orders/Directives

Phase I of the expanded baseline ground water surveillance field work, required by DOE Order 5400.1, was conducted in 1993 at all SPR sites. Phase II will begin in 1995 and will include installation of ground water monitoring wells to verify potential contamination where indicated by the phase I conductivity and soil gas survey. It will be performed as necessary in accordance with the ground water protection management program plan.

2.2 MAJOR ENVIRONMENTAL ISSUES AND ACTIONS

Gassy Oil

The SPR confirmed in 1993 that the crude oil stored at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry presented environmental problems during oil movements greater than 500,000 barrels per year. One of the problems was volatile organic compounds (VOC) emissions at storage tanks and docking facilities at both SPR and private terminals greater than 25

tons per year. Methane gas (non-regulated) from the salt dome has migrated into the stored crude oil. As the oil reaches atmospheric pressure in a vessel, the methane escapes from the oil stripping the regulated pollutants (VOC) from the oil and venting it to the atmosphere. This is a natural phenomenon that occurs at oil production facilities which are typically equipped with gas separating and collecting equipment. During 1994, the SPR evaluated the different options to remove the methane from the crude oil. The best option was to remove enough methane gas from some of the crude oil inventory and blend it with other untreated oil during drawdown in order minimize the impact to air quality. SPR procured and is in the process of installing equipment to separate and collect the gas. Air quality permits will be required for the above mentioned sites.

The second problem is elevated crude oil vapor pressures exceeding regulatory limits for storage in tanks caused by relatively storage temperatures greater than 100^{0}F in the caverns. During 1994, the SPR procured and is installing heat exchangers to cool the oil sufficiently when removed from the caverns so that the vapor pressures are within regulatory limits.

The Weeks Island Sinkhole

In 1992 a surface sinkhole was discovered over the southern edge of the Weeks Island crude oil storage area. By late 1993 the size of the sinkhole had begun to increase measurably, and an increase in brine inflow into the mine was detected. A major diagnostic effort was completed to identify the cause of the sinkhole, and develop possible mitigative options. The diagnostics were successful in locating a significant leached zone or crevasse in the salt below the sinkhole and measuring downward flow of partially saturated brine and sediments well below the top of salt. Simultaneously, the brine inflow into the fill hole sump of the crude oil storage chamber was

significantly increasing with the volume of fill material added to the sinkhole. A geotechnical investigation (drilling, geologic, geophysical and hydrologic) was completed and indicates (1) the sinkhole is a surface expression of nearly vertical chimney(s) or crevasse(s) in the top of salt into which overlying sediment has flowed, (2) the geometry of a funnel/chimney-like sediment filled feature has been estimated through geophysics and drilling, (3) sediment is currently estimated to be flowing downward at about 1 inch/day, (4) water in the sediment is flowing predominately downward at a rate of approximately 1 foot/day, (5) water in the fill hole sump is becoming more meteoric (i.e., water coming from another source other than interstitial) with time, and (6) there exists enough evidence to indicate a direct connection between the storage chamber and the surface sinkhole. Saturated brine is being introduced into the sinkhole chimney at about 70 feet below the top of salt at a rate slightly higher than the inflow into the mine. This mitigative action appears to have significantly slowed the growth of the pathway and subsequently the rate of inflow into the mine. Further ground water control efforts, i.e., ground freezing, are being pursued to further control water inflow into the mine.

In the fall of 1994, as a result of the data gathered relative to this sinkhole phenomenon, the Weeks Island Risk Reassessment Committee, recommended the decommissioning of the WI facility to the SPR PMO. The SPR PMO, in-turn, endorsed the committee's recommendation and proposed decommissioning WI to the DOE Program Office in Washington, D.C. On December 15, 1994, DOE HQ announced the decision to decommission WI. The Plan to draw down and decommission WI will commence in 1995 and take approximately 40 months to complete.

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 for each finding and approved by headquarters.

In June 1994, the SPR evaluated the existing Tiger Team findings and corrective action plans (CAP) and consolidated some of the corrective action to more efficiently correct the findings. Of the 84 original environmental findings, 16 were closed prior to the rebaselining effort. As a result of the rebaselining effort, another 30 were closed and the other 38 were combined into 16 open CAPs. This was accomplished by combining similar open CAPs for the purpose of increasing the efficiency and cost effectiveness in closing them.

As of December, 1994, 43 of the original 84 environmental findings have been closed.

A new self-assessment plan performed by site and New Orleans environmental groups was implemented in 1994. Site self-assessments are reviewed annually for adequacy through independent internal assessments. Findings are tracked to completion in the Consolidated Corrective Action Plan (PMO) and the Master Action Tracking System (contractor).

Regulatory Inspections

The LDEQ performed inspections of West Hackberry and Bayou Choctaw in 1994. Both inspections included a review of records. At West Hackberry the inspection of lab data books, DMR's, storm water outfalls, the SPCC Plan, and the STP produced no findings. At Bayou Choctaw the LWPDS program was the subject of scrutiny by LDEQ's Office of Water Resources. The site's permit compliance was determined to be in order.

The Big Hill Discharge Prevention and Response Plan (DPRP) was re-certified by the Texas General Land Office (GLO) in 1994.

Bryan Mound was visited by the Texas General Land Office in 1994 and subsequently certified under the Texas Oil Spill Prevention and Response Act.

EPA's Office of Federal Facilities performed a regulatory oversight of the environmental programs at the St. James Terminal and Bayou Choctaw facility. EPA visited these two facilities and compared their environmental programs to other federal facilities. A draft report was issued which gave these facilities an exemplary acknowledgment of their programs.

LDOTD visited the SPR New Orleans headquarters in 1994 to review the water well registrations with the agency. Several minor inconsistencies were found and corrected.

LDEQ performed an oversight visit of the Weeks Island facility in 1994. After the two underground storage tanks (gasoline and diesel) were removed, LDEQ came to the site to provide guidance on the clean up of the gasoline and diesel contaminated soil around the tanks. LDEQ recommended that the soil be aerated to allow the hydrocarbons to volatize so that it can be used at a later date.

LDEQ Groundwater Protection Division visited the Weeks Island facility in 1994 to observe the placement of dye into the sink hole. This action was conducted to determine if the source of water intrusion into the mine was from the sink hole.

Non-Routine Releases

In 1994, the six SPR sites reported seven oil spills and two brine spills in quantities greater than the one barrel (42 gallons) or as required by regulation (see Section 3.4 for more details). One gallon of a hazardous material, polymeric diphenylmethane diisocyanate (MDI) was spilled on the ground. The material contains Methylenebis phenylisocyanate (MBI) which is a CERCLA regulated compound with a one pound reportable

quantity. Enough MDI was spilled to result in the release of three pounds of the hazardous component MBI.

Total volume of oil spilled in 1994 was only 39 barrels down from 232 barrels in 1993 and the total volume of brine spilled was only 90 barrels down from 370 barrels in 1993. Oil spills are reported to the National Response Center (NRC) if they cause a film or sheen on navigable waters. During 1994, four SPR incidents required notifications of the NRC. The incidents included a 20 gallon leak of crude oil to a wetland area from a pin-hole sized pipeline break in a 40-inch diameter line east of Bryan Mound; a 17 gallon leak of hydraulic oil from an air compressor to the batture (wetlands) along the Mississippi River at St. James; a 15 gallon release of hydraulic oil to the surf of the Gulf of Mexico at Bryan Mound from a pile driving machine hose; and a hazardous materials release of a CERCLA reportable quantity to a pipeline excavation at Bryan Mound. State agencies require notification if an oil spill exceeds one bbl (LA) or five bbls (TX) or if the potential for impact is recognized by making required NRC notifications. Brine spills are reported if they may affect water quality. All of the specified oil and brine spills were reported to appropriate agencies and immediately cleaned up, with no long term impacts observed.

The longer term trend for spills and releases has declined substantially from 27 in 1990 to 13 and 14 in 1991 and 1992, respectively, and down to 12 in 1993. The continued improvement in spill prevention and response was realized in 1994 with a total of only 10 spills or releases. No long-term adverse environmental impact resulted from any spill or release.

2.3 SUMMARY OF PERMITS (JANUARY 1, 1994 THROUGH DECEMBER 31, 1994

General

Permits currently in effect include six NPDES permits, six 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.

Permit Compliance

Routine compliance reports (monthly and quarterly NPDES Discharge Monitoring Reports (DMR) were submitted to appropriate agencies in accordance with deadlines. Several state permits were renewed during 1994 some with new reporting and testing requirements.

All air monitoring and reporting requirements have been conducted in accordance with the permit requirements. Quarterly VOC monitoring of all valves and pump seals in service continues to be performed at the Big Hill and Bryan Mound sites as required by the permits. VOC monitoring at the four Louisiana sites is not required by regulation or permits. An Emissions Inventory Questionnaire (EIQ) is submitted annually for the Bryan Mound site in accordance with the TNRCC regulations. The EIQ establishes the amount of air pollutants (VOC and other regulated pollutants) that were emitted by the various sources in the site and can be compared to the permitted limits. The other sites do not require EIQ submission because their VOC emissions are below the regulatory limit for the ozone attainment classification in those areas.

Other routine environmental reports and notifications have been submitted as required by applicable codes and permits.

Noncompliances

A total of ten National Pollutant Discharge Elimination System (NPDES) permit noncompliances occurred out of a total of 10,260

permit related analyses performed in 1994 (see Section 5.3 for more detail). These noncompliances involved permit exceeding permit limits at the sewage treatment plants and storm water outfalls, or were caused by sampling error, mechanical failures, and operator error. Exceeding permit limitations represented 50% and failure to take a proper sample resulted in 40% of the noncompliances, with mechanical failure resulting in the remaining 10% of the noncompliances. The ten noncompliances produces an overall project-wide 99.9% compliance rate for 1994. All noncompliances were of short duration and immediately resolved, causing no observable adverse environmental impact.

Notices of Violation (NOV)

During 1994, the SPR maintained a status of low risk to the environment. NOVs have declined significantly from 10 (all administrative) in 1990 to zero in 1994.

3. ENVIRONMENTAL PROGRAM OVERVIEW

The environmental program is implemented by a prime contractor for the SPR on behalf of DOE (permittee). 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, air, and water bodies.

The monitoring and inspection program, originally developed under guidance of the SPR Programmatic Environmental Action Report and Site Environmental Action Reports, now conforms with the monitoring program by DOE Order 5400.1. This program includes monitoring permitted NPDES outfalls and air emissions, conducting other required Federal and state inspections, and surveillance 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 emissions monitoring and reporting, NPDES compliance, water quality monitoring, and ground water monitoring, for 1994 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, and site-specific Spill Prevention, Control, and Countermeasures Plans. The Ground Water Protection Management Plan, and the Environmental Monitoring Plan, was reviewed during 1994. The Environmental Protection Implementation Plan was reviewed for revision during 1994.

3.2 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.

3.2.1 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. Verbal notification and associated written follow-ons to the appropriate regulatory agencies occurs as required. Final written reports from the site are submitted after cleanup, unless otherwise directed by the DOE or appropriate regulatory agency.

3.2.2 Discharge Monitoring Reports

Wastewater discharges from SPR sites are authorized by EPA through the NPDES Program; through the LDEQ by the Louisiana Water Discharge Permitting System (LWDPS); and through the Railroad Commission of Texas (RCT) by the Texas Pollution Discharge Elimination System (TPDES) Program. Depending on site specific permit requirements, discharge sample analyses are reported monthly to EPA for Big Hill, Bryan Mound, and West Hackberry and quarterly for the remaining SPR sites. All state permits issued to the SPR require quarterly reporting to the appropriate state agency (LDEQ and RCT). Included in each report is an explanation of the cause and actions taken to correct any noncompliance or bypass that may have occurred during the reporting period. Permits received during 1993 and 1994 indicate that the states are reducing the frequency of testing and reporting for all SPR water discharge source.

3.2.3 Other Reports

The SPR contractor provides several other reports to or on behalf of DOE. Table 3-1 contains a comprehensive list of environmental plans and reports.

Table 3-1. Federal, State, and Local Reporting Requirements

Regulation, Statute or Directive	Regulated Area	Enforcement Agency	Types of Required Permits, Applications, or Documentation	Routine Reporting Requirements
Clean Water Act as amended (FWPCA)	Wastewater Discharges	U.S. EPA, Region VI	NPDES Permit	Quarterly & monthly monitoring reports
		Louisiana Department of Environmental Quality (LDEQ)	Water Discharge Permit	Quarterly & monthly monitoring reports
		Railroad Commission of Texas (RCT)	Water Discharge Permit	Quarterly monitoring reports
	Spill Prevention, Control and Countermeasures (SPCC)	U.S. EPA, U.S. Coast Guard, U.S. Dept. of Transportation LDEQ	SPCC Plan	Submit existing plan when spills on navigable waters exceed 1000 gallons or occur two or more times in 1 year.
	Dredging, maintenance, and any construction in wetlands for structures.(Section 404 & 10)	U.S. Corps of Engineers (COE)	Construct & Maintain Permit, Maintenance Notifications	Two week advance of work start, notice suspension, and end.
	Wildlife Refuges	U.S. Fish and Wildlife Service	Right-of-Way for Construction and Maintenance	None
Oil Pollution Act of 1990 (amendment of FWPCA)	Oil Spill Response	U.S. EPA, LDEQ, USCG, TNRCC	Facility Response Plan Oil Spill Response Certification	None
		U.S. Dept. of Transportation	Pipeline Response Plan	None
Oil Spill Prevention and Response Act of 1991	Oil Spill Response in Texas Coastal Zone	General Land Office	Discharge Prevention and Response Plan	Report spills of oil as required
			Discharge Prevention and Response Facility Cert.	None
Safe Drinking Water Act	Cavern formation, well workovers, and salt-water disposal wells	Louisiana Dept. of Natural Resources (LDNR). Office of Conservation, Underground Injection and Mining Division	Well Workover Permit (WH-1)	Well Workover Report.
			Cavern Inspection (29-M)	Semi-Annual Cavern Inspection Report
			Saltwater Disposal (UIC-10)	Annual Saltwater Disposal Well Report
			Cavern Integrity Test Report	Annual Cavern Integrity
			Oil Wells Integrity (W-10)	Annual Oil Well Status Report
		Railroad Commission of Texas (RCT)	Brine Injection Permit (H-10)	Annual Disposal/Injection Well Reports

Table 3-1 (Continued). Federal, State, and Local Reporting Requirements

Regulation, Statute or Directive	Regulated Area	Enforcement Agency	Types of Required Permits, Applications, or Documentation	Routine Reporting Requirements
Safe Drinking Water Act (continued)	Underground Storage Tanks	LDNR, TNRCC	Registration Number	Spills
Clean Air Act	Control of hydrocarbon emissions from tanks, valves, and piping	LDEQ, TNRCC	Air Emissions Permit	Annual Emissions Inventory Questionnaires
		TNRCC	Air Emissions Permit Special Requirement	Quarterly Tank Emissions report
Resource Conservation and Recovery Act	Haz. Waste generation and disposal	LDEQ	Annual Generators Report	Annual report to agency
			LA Notification of HW Activity	New Waste stream, change in generator status
			LA Uniform HW Manifest	Complete and submit form with disposal
	Hazardous Waste Disposal	TNRCC	TX Uniform HW Manifest	Complete and submit form with disposal
	Used Oil Burned for Recovery	LDEQ, TNRCC	Uniform HW Manifest (Recycling)	Complete and submit form with disposal to state
	Nonhazardous Oil Field Waste Disposal	LDNR	Non-Haz. Oil Field Waste Shipping Control Ticket	Complete and submit form with disposal
		RCT	Minor Permit	Complete and submit for non-RCT permitted disposal facilities
			Non-Haz. Oil Field Waste Shipping Paper	Complete and submit form with disposal
	Nonhazardous Special	LDEQ, TNRCC	Shipping Paper	Complete and submit form with disposal
Superfund Amendment Reauthorization Act	Reporting of inventories of hazardous substances and materials stored on site	Louisiana Department of Public Safety and and Corrections, Texas Dept. of Health	Title III, Tier II	Annual Inventory Report
Pollution Prevention Act of 1990	Strategy to incorporate pollution prevention into ES&H goals.	EPA, DOE	Pollution Prevention Plan Waste Min. Plan, Waste Management Plan, Stormwater Pollution Prevention Plan	Annual Inspection and Update of Plan (re-write every 3 years)
Toxic Substances Control Act	PCB Storage and Use Asbestos	EPA	Plan	None
National Environmental Policy Act	Review of proposed projects for environmental considerations	U.S. Council on Environmental Quality (CEQ)	Environmental Impact Statements, Environmental Assessments	Only when not covered under other EIS or EA.
			Categorical Exclusions	For projects that require consent.

Table 3-1 (Continued). Federal, State, and Local Reporting Requirements

Regulation, Statute or Directive	Regulated Area	Enforcement Agency	Types of Required Permits, Applications, or Documentation	Routine Reporting Requirements
Miscellaneous State Environmental Regulations	Use of Salt Domes	LDNR	Permit for Use of Salt Domes for Hydrocarbon	None
	Water withdrawal from coastal areas	TNRCC	Water Appropriation Permit	Annual Usage Report
	Pipeline Usage	RCT	Pipeline and Gathering System Certification (T-4C)	Annual Certification
	Storage of Oil in Underground Salt Domes	LDNR, RCT	Storage Permit	None
	Operation of Brine Ponds	LDNR, RCT	Operate and Maintain Permit	None
Miscellaneous Reports	Environmental Monitoring (5400.1)	DOE	Environmental Protection and Implementation Plan	Annual revision
	Environmental Monitoring (5400.1)	DOE	Ground Water Protection Management	Annual review (revision every 3 years)
	Environmental Monitoring (5400.1)	DOE	Environmental Monitoring Plan	Annual review (revision every 3 years)
	Environmental Monitoring (5400.1)	DOE	Site Environmental Report	Annual revision
	Environmental Monitoring	DOE	Performance Indicator	Quarterly Report
	Waste Management	DOE	Annual Report on Waste Generation and Waste Minimization Progress	Annual summary wastes of all
	Waste Management	DOE	Affirmative Procurement Report	Annual report
	Waste Management	LDEQ, TNRCC	Monthly Waste Inventory Form	Complete form for documentation
	Waste Management	LDEQ, TNRCC	Weekly waste inspection Form	Complete form for documentation
	General	DOE	ES&H Management Plan	Annual update

3.3 ENVIRONMENTAL PERMITS

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

3.3.1 Bayou Choctaw

Table 3-2 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 review LWDPS discharge permit was issued with an effective date of March 6, 1994 and was fully implemented commencing April 1, 1994. An NPDES renewal application was forwarded to Region VI, USEPA in November 1993, which was accepted as administratively complete on January 3, 1994. A Nationwide Permit (NWP) authorization to construct additional cable trays along various site piping routes was received in November 1994 from the New Orleans District of Corps of Engineers (NODCOE). Additional work requiring similar permitting is planned for the 1995 calendar year.

Table 3-2. Active Permits at Bayou Choctaw

PERMIT NUMBER	ISSUING* AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0053040	EPA	NPDES	1/03/94		(1)
LAR00A280	EPA	NPDES*	12/31/92	12/31/97	(2)
WP0179	LDEQ (Disch.)	Water	3/06/94	3/05/99	(3)
1280-00015-00	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	Constr. & Maintain	9/26/77	-	(6)
LMNOD-SP	COE	Constr. &	1/30/79	-	(7)

Table 3-2 (continued). Active Permits at Bayou Choctaw

PERMIT NUMBER	ISSUING* AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
(Bull Bay) 3		Maintain			
LMNOD-SP (Iberville Parish Wetlands) 7	COE	Constr. & Maintain	9/26/77	-	(8)
LMNOD-SP (Iberville Parish Wetlands) 10	COE	Constr. & Maintain	6/12/78	-	(9)
LMNOD-SP (Iberville Parish Wetlands) 17	COE	Constr. & Maintain	11/6/78	-	(10)
LMNOD-SP (Iberville Parish Wetlands) 31	COE	Constr. & Maintain	5/27/80	-	(11)
LMNOD-SP (Iberville Parish Wetlands) 102	COE	Constr. & Maintain	9/26/77	-	(12)

(1) Renewal application of 11/24/93 accepted as administratively complete on 1/3/94.
(2) NPDES* General Permit for Storm Water Associated with Industrial Activity effective 12/31/92; Notice of Intent made 9/30/92.
(3) Renewal permit effective 3/6/94. Fully implemented on 4/1/94.
(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) Maintain Bull Bay 24" brine disposal pipeline recorded with applicable Registrar of Deeds.
(8) Construct and maintain well pads (brine disposal wells).
(9) Enlarge existing well pads and construct access roads (brine disposal Wells 1, 2, & 3.)
(10) Construct and maintain access road to brine disposal well area. NOTE: brine disposal pipeline was constructed under NWP authority and maintenance is allowed in conjunction with the access road permit.
(11) Construct and maintain well pad, levees, access road & appurtenances to cavern 102 and additional bank stabilization, warehouse pad and culvert per additions of 1983.
(12) Construct and maintain ring levee, drill site and appurtenances, Well 101.

3.3.2 Big Hill

Table 3-3 lists the active permits at Big Hill. The Big Hill site has an amendment to its TNRCC 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 1994, the site appropriated 0.898 million m^3 (728.12 acre-feet) of water from the Intracoastal Waterway exclusive of water for fire protection. This represents only 0.61% of the total allowable withdrawal for a year. Also, in late 1994, Big Hill connected to the City of Winnie water supply. The water will be certified for potable use in early 1995, however, the immediate change resulted in replacing the on-site supply of fire fighting water.

Table 3-3. Active Permits at Big Hill

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
TX0092827	EPA	NPDES	12/22/93		(1)
TXR00B608	EPA	NPDES*	12/31/92	12/31/97	(2)
SWGCO-RP 16536 (01,02,03)	COE	Constr. & Maintain	01/11/84	-	(3)
P-7	F&WS	Constr.	07/31/86	07/31/88	(4)
		Operate	07/31/86	06/30/36	(5)
9256	TNRCC	Air	05/17/83	5/16/98	(6)
02937 & 02939	RCT	Operate	11/28/83	Open	(7)
P000226A & P000226B	RCT	Operate/ Maintain	09/19/84	Open	(8)
0048295	RCT	Operate	05/09/83	Open	(9)
0048320		-	06/23/83	Open	
UHS-006	RCT	Water (Disch.)	09/01/94	08/31/99	(10)
4045A	TNRCC	Water(Use)	11/14/83	Open	(11)

(1) Renewal submitted 11/24/93 - accepted as administratively complete 12/22/93.
(2) NPDES* General Permit for Storm Water Associated with Industrial Activity effective 12/31/92; Notice of Intent made 9/30/92.
(3) Permits to construct and maintain RWIS, raw water 48" pipeline, brine disposal 48" pipeline, crude oil 36" pipeline. Maintenance dredging clause renewed as needed.
(4) Completion of raw water, brine disposal, and crude oil pipeline extended. Amended to install offshore pipeline by trenching.
(5) Completion of pipeline construction extended. (48" Brine Pipeline)
(6) While under construction.
(7) Valid until ownership changes, system changes, or other physical changes are made in the system.
(8) Permits to operate and maintain anhydrite and brine/oil pits.
(9) Permits to create, operate, and maintain an underground hydrocarbon storage facility consisting of 14 caverns.
(10) Corresponds to TX0092827 (EPA-NPDES). Permit renewed by RCT with an effective date of 9/01/94.
(11) Permit amended in 1990 to allow for annual diversion of no more than 117,291 acre feet of water and to authorize diversion until termination of the project as a SPR operation.

Big Hill provided the RCT with a complete renewal application, as required for an expiring TPDES water discharge permit in December 1993. The RCT responded with the issuance of a renewed TPDES permit with an effective date of September 1, 1994. Also, an NPDES renewal application was forwarded to Region VI, EPA in November 1993, which was accepted as administratively complete on December 22, 1993.

3.3.3 Bryan Mound

Table 3-4 lists the active permits for the Bryan Mound site. The Bryan Mound site has a second TNRCC 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 1994, the site used a total of 0.066 million m^3 (52.83 acre/feet) of water

from the Brazos River Diversion Channel. A total of 147.146 million m^3 (119,289 acre-feet) of water has been appropriated to date for site activities which represents 32.5% of the total volume permitted.

Maintenance dredging was performed in 1994 under permit 12347(as amended). A renewal application to extend the RWIS maintenance dredging clause was filed prior to the expiration date of December 31, 1994. The modification request also includes a spoil area expansion petition. Replacement brineline construction continued throughout 1994. An expanded construction window was later issued for the beach crossing phase as a result of a survey that showed on piping plover ability in the construction area.

Bryan Mound received a finalized (renewed) TPDES discharge permit from the RCT in August 1993, (effective date October 1, 1993). A petition to remove the metals testing requirement from the TPDES permit was made to the RCT after a full year of data indicated that the metals in question were absent from the site's stormwater discharges. The RCT concurred with the petition in a December 1994 amendment, with an effective date of January 1, 1995. Also, an NPDES renewal application was forwarded to Region VI, EPA in November 1993, which was accepted as administratively complete on January 3, 1994. EPA was also informed of the SPR plans to temporarily cancel brineline integrity testing on the old diffuser section in June 1994. In December, EPA was informed of the proposed final flow of the old diffuser in order to affect the closure that line.

Table 3-4. Active Permits at Bryan Mound

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
TX0074012	EPA	NPDES	1/03/94		(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)

Table 3-4. Active Permits at Bryan Mound (continued)

3681A	TNRCC	Water	7/20/81	Open	(7)
UHS-004	RCT	Water	10/01/93	09/30/98	(8)
6176B	TNRCC	Air	2/23/87	02/22/02	(9)
82-8475	TDH&PT	Constr.	01/01/83	Open	(10)
SWGCO-RP-11666	COE	Constr. & Maint.	10/15/77	-	(11)
SWGCO-RP-12112	COE	Constr. & Maint.	07/25/77	-	(12)
SWGCO-RP-12062	COE	Constr. & Maint.	10/10/78	-	(13)
SWGCO-RP-14114(01)	COE	Constr. & Maint.	05/18/85	-	(14)
SWGCO-RP-16177	COE	Constr. & Maint.	09/07/82	-	(15)

(1) Renewal submitted 11/24/93. Accepted as administratively complete 1/3/94.
(2) NPDES* General Storm Water permit effective 12/31/92; Notice of Intent sent 9/30/92.
(3) Maintenance dredging of raw water intake extended to 12/31/94. (SWGCO-RP 12347 authorized constr. of RWIS). Maintenance dredging extension request and mod. for spoil area addition sent to GALCOE on 12/20/94.
(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 acted on permit in August, 1993; effective 10/1/93)
(9) Major amendment submitted December 30, 1993
(10) Corresponds with SWGCO-RP-16177.
(11) for 30-inch crude oil pipeline to 3 miles SW from Freeport
(12) for 30-inch crude oil pipeline to 2 miles S from Freeport
(13) for 36-inch brine disposal pipeline & diffuser Revision/amendment (01) approved construction of 24 inch replacement pipeline in January, 1993.
(14) general permit for pipeline crossings by directional drilling in navigable waters
(15) place an 8-inch water line (PVC, potable)

3.3.4 St. James

Table 3-5 lists the active permits at St. James Terminal. A maintenance notification was made to the COE regarding work commencing in 1993 on the pipeline and docks covered by permit LMNOD(Mississippi River)998. The work was completed in 1994.

An NPDES renewal application was forwarded EPA to Region VI, EPA in November 1993, and was accepted as administratively complete on January 3, 1994.

The outstanding LWDPS renewal application of 1990 was updated and revised at the request of LDEQ. This application update was forwarded to LDEQ on June 6, 1994. In the interim, until a new permit is issued, conditions of the old permit remain in-force.

Table 3-5. Active Permits at St. James Terminal

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0054674	EPA	NPDES	1/03/94		(1)
LAR00A276	EPA	NPDES*	12/31/92	12/31/97	(2)
LMNOD-SP(Mississippi River) 998	COE	Constr.& Maintain	03/20/78	-	(3)
WP 0929	LDEQ	Water (Disch.)	05/04/90	05/03/95	(4)
2560-00034-01	LDEQ	Air	07/25/78	Open	(5)

(1) Permit renewal submitted 11/24/93. Accepted as administratively complete 01/03/94.
(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. Maintenance dredging clause renewed as needed.
(4) LDEQ Water Permit renewal submitted.
(5) Requires annual operating report. (EIQ and permit being revised for 1994/95)

3.3.5 Weeks Island

The active permits for Weeks Island are listed in Table 3-6. A LWDPS renewal application was submitted to LDEQ and accepted for review on July 24, 1992. A draft LWDPS permit was received in January 1994 and finalized on June 26, 1994. The renewed permit was fully implemented commencing on July 1, 1994.

Table 3-6. Active Permits at Weeks Island

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0056243	EPA	NPDES	12/22/93		(1)
LAR00A278	EPA	NPDES*	12/31/92	12/31/97	(2)
LMNOD-SP(Atchafalaya Floodway) 251	COE	Constr. Maintain	07/12/78	-	(3)
1105	LDEQ	Air	01/30/79	Open	(4)
SDS-8	LDNR	Injection	02/16/79	Open	(5)
PERMIT	ISSUING	PERMIT	EFFECTIVE	EXPIRATION	
WP1051	LDEQ	Water (Disch.)	01/17/87	01/16/92	(6)

(1) Renewal submitted 11/24/93. Accepted as administratively complete 12/22/93.
(2) NPDES* General Storm Water permit effective 12/31/92; Notice of Intent made 9/30/92.
(3) Recorded permit and amendments with applicable Parish Registrar of Deeds. Maintenance dredging clause renewed as needed.
(4) Requires annual operating report.
(5) Approval for use of salt dome cavities for storage of liquid hydrocarbons.
(6) Permit interpreted via LAC to expire 1/16/93; LWDPS renewal submitted for June 1992; accepted for review on 7/24/92. Draft permit received 1/10/94, currently processing.

Several projects at Weeks Island required permitting actions from the Coastal Management Division (CMD) and LDNR relating to the drilling of explorational boreholes for the sinkhole

investigations. Consistency determinations from the CMD were received on the drilling of exploratory holes and for potential grouting holes; in addition a consistency was received for the construction (clearing) of a sinkhole observation path around the island. LDNR permitted several exploratory borings conducted into salt (and beyond) for the purpose of investigating the configuration of and grouting potential of the sinkhole. One of these borehole permits (for borehole BH-7A) was amended by LDNR to allow for brine/saltwater introduction as a mitigative measure against continued sinkhole growth (from additional salt dissolution). This mitigative action was effective in limiting the continued growth of the sinkhole and also slowing the resulting increase of water in-flow into the storage cavity.

As part of the sinkhole investigations, tracer dye studies were proposed and implemented with agency concurrence, particularly with the prior input from the Groundwater Protection Division of LDEQ. The studies have remained inconclusive during the calendar year 1994.

3.3.6 West Hackberry

Active permits for West Hackberry are listed in Table 3-7. A concurrence for Nationwide Permit coverage was received from the COE for security fence relocation work in wetlands adjacent to the main site. This work was successfully completed in 1994, in conjunction with erosion protection (rip-rap addition) maintenance work, covered by permit LMNOD(Black Lake)43. Permit LMNOD(Black Lake)31 was modified in late 1993 to accommodate the deepening and lengthening of the boat slip access channel. This action involved Coastal Zone Management concurrence and spoil placement mitigation and was successfully completed in 1994. The work was performed in a "piggy-back" fashion by the same contractor used with the routine maintenance dredging of the RWIS, which required a separate maintenance notification under the existing permit.

Wetlands construction was successfully performed in 1994 under NWP authorization for the re-establishment of cover over an SPR crude oil pipeline crossing at Burton Shell Slip, located north

Table 3-7. Active Permits at West Hackberry

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
LA0053031	EPA	NPDES	01/03/94	01/02/99	(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	09/39/96	(4)
LMNOD-SP (Black Lk) 43	COE	Constr.& Maintain	07/26/84	-	(5)
LMNOD-SP (Gulf of Mexico) 2574	COE	Constr.& Maintain	08/11/80	-	(6)
LMNOD-SE (LTCS) 40	COE	Constr.& Maintain	05/25/88	-	(7)
LMNOD-SP (Cameron Parish Wetlands) 162	COE	Constr. & Maintain	03/09/78	-	(8)
None	LDNR	Injection	08/07/79	Open	(9)
971198-9	LDNR	Injection	10/06/83	Open	(10)
WP1892	LDEQ	Water (Disch.)	03/10/94	03/09/99	(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 11/24/93. Accepted as administratively complete 1/3/94.
(2) NPDES* General Storm Water permit effective 12/31/92; Notice of Intent made 9/30/92.
(3) Maintenance dredging for raw water intake.
(4) Maintenance dredging for fire water canal and extended boat slip access amendment of 1993.
(5) Construction of erosion control dike completed in 1986. Maintenance dredging open until 7/26/94; addition of rip-rap amendment of 1993 open until 1995.
(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. Permit renewal issued with an effective date of 3/10/94; fully implemented on 4/1/94.
(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)

and west of the site. A wetlands delineation received in October 1994 from the COE indicated that wet areas on the north side of the West Hackberry site were not considered jurisdictional and therefore, were exempted from permitting requirements for construction.

Applications were made for permit amendments and/or permitting actions for the following West Hackberry projects in 1994: the in-place abandonment of the brineline from the site to the Gulf of Mexico; the modification of and additions to the RWIS (pump-recycle project); and the relining of and life extension additions to the brine disposal pipeline connecting the site with the SPR saltwater disposal wells to the south.

A state LWDPS draft (temporary) permit was received for West Hackberry in October which expired in January 1994. This temporary permit was issued to cover discharges from the recovery pump discharges occurring in November 1994. A finalized (renewal) permit was issued on March 10, 1994 and was fully implemented commencing April 1, 1994. An NPDES renewal application was forwarded to Region VI, EPA in November 1993, and accepted as administratively complete on January 3, 1994.

3.4 WASTE MINIMIZATION PROGRAM

The waste minimization program reduces the generation of all wastes including hazardous, and nonhazardous sanitary wastes. The most significant SPR-wide waste minimization accomplishments during 1994 were:

a) Added waste minimization review to petty cash requests to restrict materials entering the SPR.
b) Updated Qualified Products List as part of the waste minimization review prior to purchase.
c) Revised Exhibit 6.6 General Environmental Regulations for contracts, requiring contractors who generate waste on the SPR to submit a Waste Management Plan including planned waste minimization activities.

The SPR generated only RCRA hazardous and sanitary (nonhazardous industrial, nonhazardous oil field, and municipal) wastes during 1994. The SPR sent 11,279 lbs. of hazardous waste off site for incineration during 1994.

The SPR sent 1,380 tons of solid and 14,120 barrels of liquid sanitary waste off site for disposal during 1994. Paper, used oil burned for energy, antifreeze, scrap metals, and laser printer cartridges were reclaimed or recycled off site. The SPR collected 53,973 lbs. of paper and 4,250 lbs. of cardboard for reclamation off site. The SPR generated 9,227 gallons of used oil burned for energy during 1994.

The Environmental Department staff distributed Pollution Prevention mugs and educational wheels on water and energy conservation to all employees. The SPR Pollution Prevention Interdepartmental Team conducted SPR-wide monthly conference calls to discuss pollution prevention topics, thus increasing its scope of activity. Pollution prevention information appeared in the ES&H Communiqué, an SPR-wide publication.

Interdepartmental meetings, including environmental representatives, were held to review product acquisitions. Efforts continue to search for new methods of pollution prevention.

3.5 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 SPCC Plans, Facility Response Plans, and compliance awareness. ERT personnel from all sites participate in annual spill response refresher training currently provided by the Texas A&M University, Engineering Extension Service. Onsite drills and exercises are

also provided to practice spill cleanup and sharpen control skills. Site response personnel are trained to rapidly and effectively contain and cleanup oil, brine, and hazardous substance spills under the circumstances typical at each SPR site.

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. on Pollution Prevention Waste Minimi-tion, SARA Title III Tier Two, and Hazardous Waste Handling, and Environmental Regulations affecting the SPR (Title 40 CFR) training were also provided in 1994.

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 74 nuclear density gauges (SGH Model Nos. 5190, 5191, and 5202) are located on pipelines within the Bayou Choctaw, West Hackberry, 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 gauges for the Bayou Choctaw pipelines will be removed in 1995. The gauges at West Hackberry and Bryan Mound will be removed as part of life extension projects. The DOE is a general licensee under the manufacturer, Texas Nuclear. No radiation leakage has been detected from any of the gauges to date.

4.2 NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM)

A 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 by state regulations. No future monitoring is required due to the negative results of this 1991 NORM survey.

THIS PAGE INTENTIONALLY BLANK

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 surveillance monitoring (separate from discharge permit effluent 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

The regulated air pollutants emitted by the SPR facilities are either hazardous in nature or have an impact on the ambient air quality (ozone). The non-hazardous pollutants that have an impact on air quality are non-methane/ethane volatile organic compounds (VOC), nitrous oxides (NO_x), sulfur dioxides (SO_2), carbon monoxide (CO), and particulate matter (PM_{10}). The hazardous air pollutants (HAP) are benzene, toluene, ethylbenzene, and xylene. As crude oil that was stored under pressure in caverns is moved to surface facilities, its individual components vaporize emitting VOCs and hazardous pollutants from such sources as valves, pumps. seals, storage tanks, tankers, and brine ponds. These emissions do not occur from functional pressured systems such as the storage caverns. All of the facilities are equipped with emergency generators that emit less than one ton per year of NO_x, SO_2, CO, and PM_{10} during periodic equipment testing.

There are three types of air monitoring required at the SPR facilities. They are organic vapor release testing, emission inventory calculations, and tank seal inspections.

The two Texas facility permits (Big Hill and Bryan Mound) require screening all valves and pump seals for VOC leaks. This is done quarterly at both sites with an organic vapor analyzer (OVA). Currently, the Louisiana facility permits do not require this type of screening; however, it may be required with the new air permits. In order to use more accurate calculation factors these components need to be screened for effectiveness in minimizing VOC releases.

The second type of monitoring is required by the Texas and Louisiana regulations. If a facility in a nonattainment area for ozone emits more than the federally mandated limit for the ozone area, it must submit annual Emission Inventory Questionnaires (EIQ). These EIQs reflect the amount of pollutants emitted from the facility using industry acceptable calculations during a calendar year. Currently, the only facility required to submit an EIQ in 1994 was Bryan Mound because it is over the threshold of 10 tons per year.

The third type of monitoring is seal inspection of the internal and external floating roof tanks. St. James, Big Hill, and Bryan Mound have floating roof tanks that require inspection of the primary (every five years) and secondary (once a year with the exception of Big Hill that requires semi-annual) seals. The inspections involve checking the seals for visible tears, holes, or cumulative gaps that exceed a regulatory limit.

5.1.1 Bayou Choctaw

Bayou Choctaw, located in a serious nonattainment area for ozone, operated in accordance with all 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 and EIQ submission. There were no major configuration changes which would have resulted in additional

air emissions during 1994. The only monitoring required at Bayou Choctaw is visual inspection of the valves in crude oil service on the cavern pads to determine visual leaks. No air quality monitoring using actual monitoring equipment was required or conducted during 1994.

5.1.2 Big Hill

The Big Hill facility, located in a serious nonattainment area for ozone, operated in accordance with applicable air quality regulatory requirements and all conditions of the air quality permit. Quarterly monitoring of all valves and pump seals in crude oil service, as required by the permit, using an organic vapor analyzer (OVA), began in 1990 when crude oil fill was initiated. The secondary tank seals for the surge tank BHT-7, inspected semi-annually in accordance with state regulations, were within regulatory limits. An EIQ is not required at Big Hill because total VOC emissions are less than 10 tpy which is the regulatory limit for having to submit an EIQ. No other form of monitoring is required at Big Hill.

5.1.3 Bryan Mound

The Bryan Mound facility, located in a severe nonattainment area for ozone, operated in accordance with all air quality regulatory requirements throughout 1994. The ongoing quarterly fugitive emissions monitoring program, as required by the TNRCC permit, did not identify any leaking components for 1994. The air permit also requires that monthly calculations of the VOC emissions from the four internal floating roof tanks be submitted to the TNRCC quarterly. The permit requires that these calculations be done with AP-42 methodology which uses the true vapor pressures of the stored crude oil and its throughput for each storage tank.

Since the facility is permitted to emit 18.78 metric tpy (20.7 tpy) of VOC emissions, it must submit an annual EIQ for facilities over the threshold of 10 tpy. Current estimates

indicate that the VOC emissions for BM are below the enforceable permit levels.

5.1.4 St. James Terminal

St. James Terminal, located in a transitional attainment area for ozone, operated in accordance with all air quality permit and regulatory requirements during 1994. The permitted emissions during stand-by are 27.2 metric tons per year of VOC (30 tons per year) with allowance to exceed 90.72 metric tons per year (100 tons) through a variance during drawdown. Yearly secondary seal gap measurements are the only type of monitoring required at St. James. The secondary seals on all six external floating roof tanks were within required limits. No air quality monitoring was required or conducted during 1994.

5.1.5 Weeks Island

Weeks Island is one of two SPR sites in an attainment area for ozone. The current air permit reflects the stand-by emissions at the site as 5.53 metric tpy (6.1 tpy) of VOC and 9.11 metric tpy of nitrous oxides (10.04 tpy). The site operated within these permitted limits. Air quality monitoring using actual monitoring equipment was neither required nor conducted during 1994. No other form of air monitoring is required at the site.

5.1.6 West Hackberry

West Hackberry, located in an ozone attainment area, operated in accordance with all air quality permit and regulatory requirements during 1994. Hydrocarbon emissions were well below the 50.4 metric tpy (55.4 tpy) permitted for filling operations. During 1994, an air permit modification application was submitted to LDEQ to reflect current operational conditions which changes normal operating conditions to the standby mode. The amount of allowable VOC emissions from the site will change to about 36 metric tpy (40 tpy) during standby mode.. This is due to additional sources identified at the facility such as fugitive emissions during

workovers and identification of additional valves, pump seals, and flanges as well as elimination of insignificant sources from the permit. It also accounts for more recent data regarding emissions from the brine pond. It is expected that these components will have to be screened annually for leaks to comply with new requirements.

5.2 SURFACE WATER QUALITY MONITORING

During 1994, surface waters of the Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry SPR sites were sampled and monitored for general water quality according to the SPR Environmental Monitoring Plan. Monitoring is conducted to provide early detection of surface water quality degradation resulting from SPR operations. It 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 at these three sites. Table 5-1 identifies frequency of specific parameters measured at each SPR site for both DMR and surface water quality.

Data are presented statistically by site in Tables 5-2 to Table 5-5 instead of graphically in figures. All observed values that were below detectable limit (BDL) were evaluated as one-half the detection limit for statistical calculation purposes. In addition to commonly used statistical methods, the coefficient of variation (CV) was incorporated to evaluate the data. The coefficient of variation is a mathematical tool used quickly to identify data sets with a high incidence of variation. Values approaching or exceeding 100% indicate that one standard deviation from the stated mean encompasses zero. Such occurrences invalidate the data from a statistical utility standpoint. The usefulness of this treatment is to draw

Table 5-1. Physicochemical Parameters

PHYSICO-CHEMICAL PARAMETERS	SAMPLE IDENTIFICATION AND FREQUENCY BY SITE													
	DAILY					WEEKLY		MONTHLY						QRT
	BC	BH	BM	SJ	WH	BH	BM	BC	BH	BM	SJ	WI	WH	
pH	15, 17-20 101 HPP SWD1 SWD2 SWD3	003	101-116 1,2 4,5 TX-002	001	001 6-9 11 101-117 HPP SOT		TX-003 & other storm water	001 002 A-F	001 002 004 A-G TX-003 & other storm water	001 A-J		01A 01B 002	002 A-F 001 004 Veh. Rinse TX-22	SJ002, 003
SALINITY			001		001 HPP		TX-003 & other storm water	A-F	A-G 001 TX-003 & other storm water	A-J			A-F	
TEMP.			001		001			A-F	A-G 001	A-J			A-F	
TOTAL DISSOLVED SOLIDS					001	001	001						A-F	
TOTAL SUSPENDED SOLIDS					001	001 002	001	001 002	004	002*		01B 002 003	002, A-F Veh. Rinse	SJ002, 003
DISSOLVED OXYGEN		*** 001	001		001			A-F	A-G	A-J		A-F		
BOD5							001	001 002	004	002*		01B 002	002	SJ002, 003
COD			TX-002						004	A-J				
OIL & GREASE	15,17-20, 101, HPP, SWD1 SWD2 SWD3	001 003	001 101-116 1,2 4,5 TX-001	001	001 101-117 HPP		TX-003 & other storm water		TX-003 & other storm water			01A	004 Veh. Rinse TX-22	
TOC		003		001	6-9,11 101-117 HPP, SOT		001, TX-003 & other storm water	A-F	A-G	A-J TX-003 & other storm water		E	A-C, E-F, 004 Veh. Rinse	WH TX-22
METALS: As, Hg, Se										TX-003 & other storm water				
FECAL COLIFORM												01B, 002	002	
RESIDUAL CHLORINE			TX-002											
FLOW	001, 002 15,17-20, 101, HPP, SWD1 SWD2 SWD3	001	TX-001, 002 001	001	001 HPP**	002 004**	TX-002			002* 004	002, 003	01A, 01B, 002, 003	002 004 Veh. Rinse TX-22	

* Sampling performed twice per indicated period.
** Sampling performed 5 days/week
***Sampling performed daily except weekends and holidays when injecting oxygen scavenger chemical

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

attentionto highly variable data sets for further evaluation as to the source or cause of the variability. Extremely low values of CV (approaching or equal 0.0) indicate little or no variation which may be caused by a preponderance of measurements below the method limit of detectability. A quick cross-check for a data set with a low CV and a large quantity of BDLs would confirm that the measurements made were near or below detection limit throughout the year.

5.2.1 Bayou Choctaw

Samples were collected and analyzed monthly where possible for seven surface water monitoring stations. Monitoring stations A through G are identified in Figure 5-1. Parameters monitored include pH, salinity, temperature, dissolved oxygen (DO), oil and grease, and total organic compound (TOC) (Table 5-2). A discussion of each parameter follows.

5.2.1.1 Hydrogen Ion Activity (pH)

The annual median values of pH for all the monitored stations ranged from 7.3 to 7.5. This indicates that natural waters are slightly basic. Fluctuations observed are attributed to environmental and seasonal factors such as variations in rainfall, temperature, and aquatic system flushing.

5.2.1.2 Salinity (SAL)

In 1994, average annual salinities remained 1.0 ppt or less at all stations except B, C, and E which averaged 5.6, 1.2, and 1.2 ppt, respectively. Similar to last year, several spikes were observed throughout the year at these stations that could possibly be due to offsite contamination (station B in particular), traces of historical contamination, or the result of evaporation where dissolved salts were concentrated.

5.2.1.3 Temperature

Observed temperature ranged from 9.0° C in late winter to 32.0° C in mid summer. Temperature fluctuations were consistent among all stations and are attributed solely to meteorological conditions since Bayou Choctaw produces no thermal discharges.

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 below 2.0 mg/l at various times are attributed to high temperature and high organic loading combined with low flow and minimal flushing typically observed in a wetland environment. Peak levels above 9.0 mg/l are attributed to high primary productivity.

5.2.1.5 Oil and Grease

Oil and grease levels were below detectable levels (<5 mg/l) at all stations throughout 1994. The data favorably reflect continued good site housekeeping and effective site spill prevention, control, and response efforts.

5.2.1.6 Total Organic Carbon (TOC)

Average annual TOC concentrations ranged from 6.9 to 11.5 mg/l. High TOC readings correlate with high organic loading which is usually found in stagnant or sluggish water bodies of limited volume, such as an evaporating pool of water. No relationship was found between TOC and temperature or dissolved oxygen; TOC did not appear to vary seasonally.

BAYOU CHOCTAW

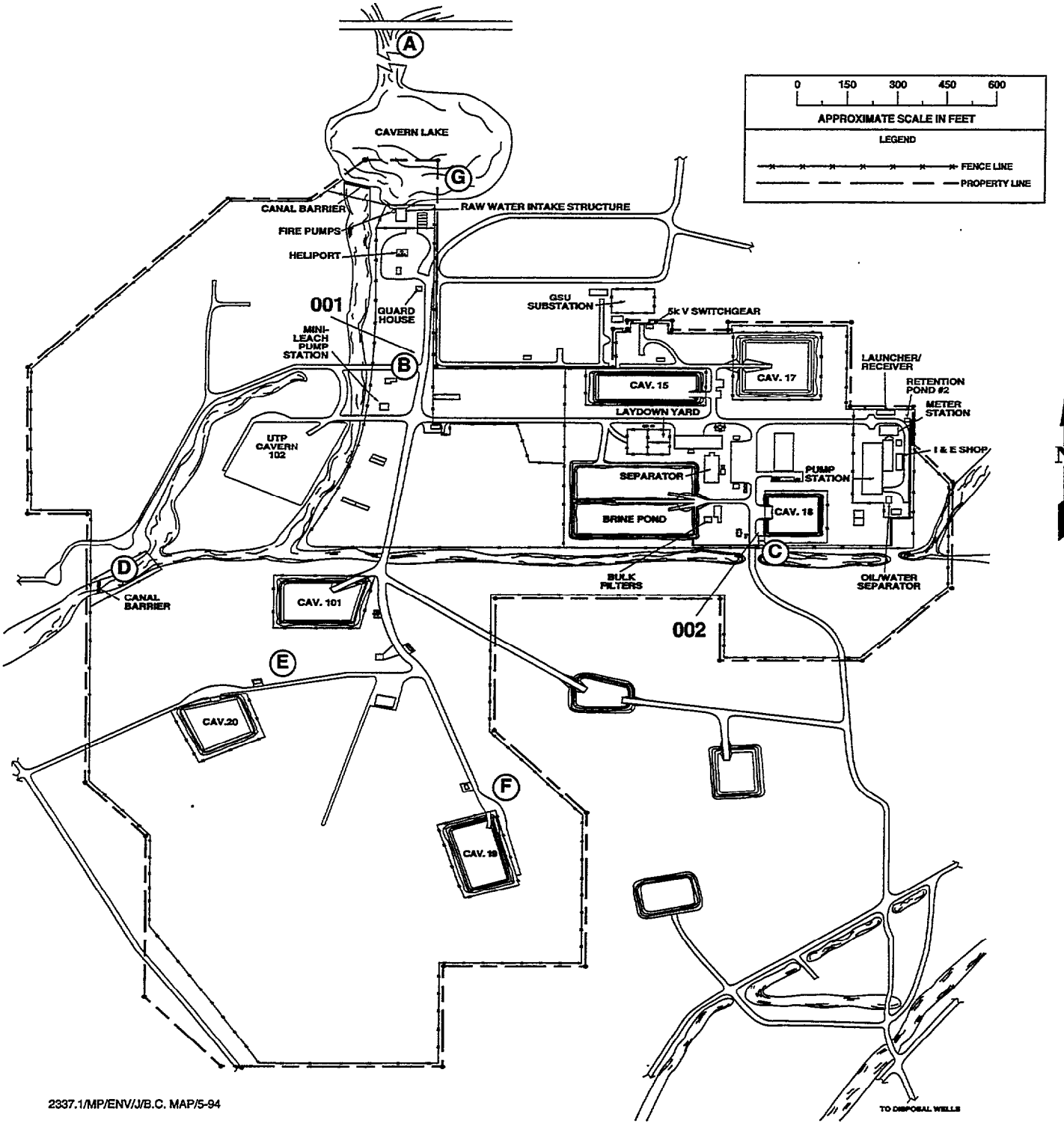


Figure 5-1

(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

Table 5-2. Data Summary for Bayou Choctaw Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Dissolved Oxygen	Total Organic Carbon
A							
	Sample Size	12	12	12	4	12	12
	Number of BDL			10	4		
	Maximum	8.1	30.0	1.0	2.5	5.9	14.7
	Minimum	7.0	10.0	0.5	2.5	0.4	6.7
	Mean	NV	21.3	0.6	2.5	3.2	10.3
	Median	7.3	22.0	0.5	2.5	3.0	9.5
	Standard Deviation	NV	6.2	0.2	0.0	1.6	2.3
	Coefficient of Variation	NV	28.9	33.4	0.0	49.4	22.5
B							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	7.8	32.0	30.0	2.5	14.1	26.4
	Minimum	7.0	10.0	1.0	2.5	2.1	1.4
	Mean	NV	20.8	5.6	2.5	6.0	8.7
	Median	7.5	20.5	3.5	2.5	4.8	8.0
	Standard Deviation	NV	6.6	7.8	0.0	3.8	6.1
	Coefficient of Variation	NV	31.6	139.2	0.0	62.8	69.9
C							
	Sample Size	12	12	12	4	12	12
	Number of BDL			4	4		
	Maximum	7.5	29.0	3.0	2.5	8.9	30.6
	Minimum	7.0	10.0	0.5	2.5	3.1	5.8
	Mean	NV	20.9	1.2	2.5	5.0	11.5
	Median	7.3	21.5	1.0	2.5	4.5	9.9
	Standard Deviation	NV	6.2	0.8	0.0	1.9	6.4
	Coefficient of Variation	NV	29.4	66.7	0.0	38.6	56.0
D							
	Sample Size	12	12	12	4	12	12
	Number of BDL			10	4		
	Maximum	7.8	30.0	1.0	2.5	5.8	10.2
	Minimum	7.0	11.0	0.5	2.5	1.0	5.2
	Mean	NV	21.7	0.6	2.5	3.8	7.7
	Median	7.4	23.0	0.5	2.5	4.0	7.8
	Standard Deviation	NV	6.0	0.2	0.0	1.4	1.3
	Coefficient of Variation	NV	27.6	33.4	0.0	36.7	16.3
E							
	Sample Size	10	10	10	3	10	10
	Number of BDL			3	3		
	Maximum	7.6	28.0	3.0	2.5	4.8	10.4
	Minimum	7.0	9.0	0.5	2.5	1.2	4.8
	Mean	NV	20.3	1.2	2.5	2.9	6.9
	Median	7.3	21.0	1.0	2.5	3.1	7.2
	Standard Deviation	NV	6.9	0.9	0.0	1.2	1.8
	Coefficient of Variation	NV	33.9	71.4	0.0	40.4	26.6

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Dissolved Oxygen = mg/l; Total Organic Carbon = mg/l

Table 5-2 (Continued). Data Summary for Bayou Choctaw Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Dissolved Oxygen	Total Organic Carbon
F							
	Sample Size	9	9	9	3	9	9
	Number of BDL			4	3		
	Maximum	7.7	30.0	3.0	2.5	7.9	10.2
	Minimum	7.1	10.0	0.5	2.5	1.8	6.0
	Mean	NV	20.1	1.0	2.5	4.9	8.2
	Median	7.3	22.0	1.0	2.5	5.2	8.7
	Standard Deviation	NV	6.8	0.8	0.0	1.7	1.3
	Coefficient of Variation	NV	33.9	79.1	0.0	35.0	16.3
G							
	Sample Size	12	12	12	4	12	12
	Number of BDL			12	4		
	Maximum	9.1	32.0	0.5	2.5	12.1	13.0
	Minimum	7.1	12.0	0.5	2.5	0.4	6.4
	Mean	NV	22.3	0.5	2.5	5.6	9.5
	Median	7.5	23.0	0.5	2.5	4.9	9.1
	Standard Deviation	NV	6.2	0.0	0.0	3.8	2.1
	Coefficient of Variation	NV	27.7	0.0	0.0	67.6	22.6

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Dissolved Oxygen = mg/l; Total Organic Carbon = mg/l

An unusually high TOC value (26.4 mg/l) was found at station B when salinities were elevated from a nearby off site brine release. High TOC could be caused by high salinity impact and subsequent breakdown of organic material.

5.2.1.7 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 to slightly basic pH.

b. Except for one excursion at station B, observed salinities remained generally low. Elevated salinities observed in 1994 were not attributed to SPR activity.

c. Temperature variations were caused by seasonal changes. There are no thermal processes used at any SPR site.

d. Low DO levels occasionally observed are attributed to high temperatures, high organic loading, and low flow and minimal flushing typically observed in backwater swamp areas.

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

5.2.2 Big Hill

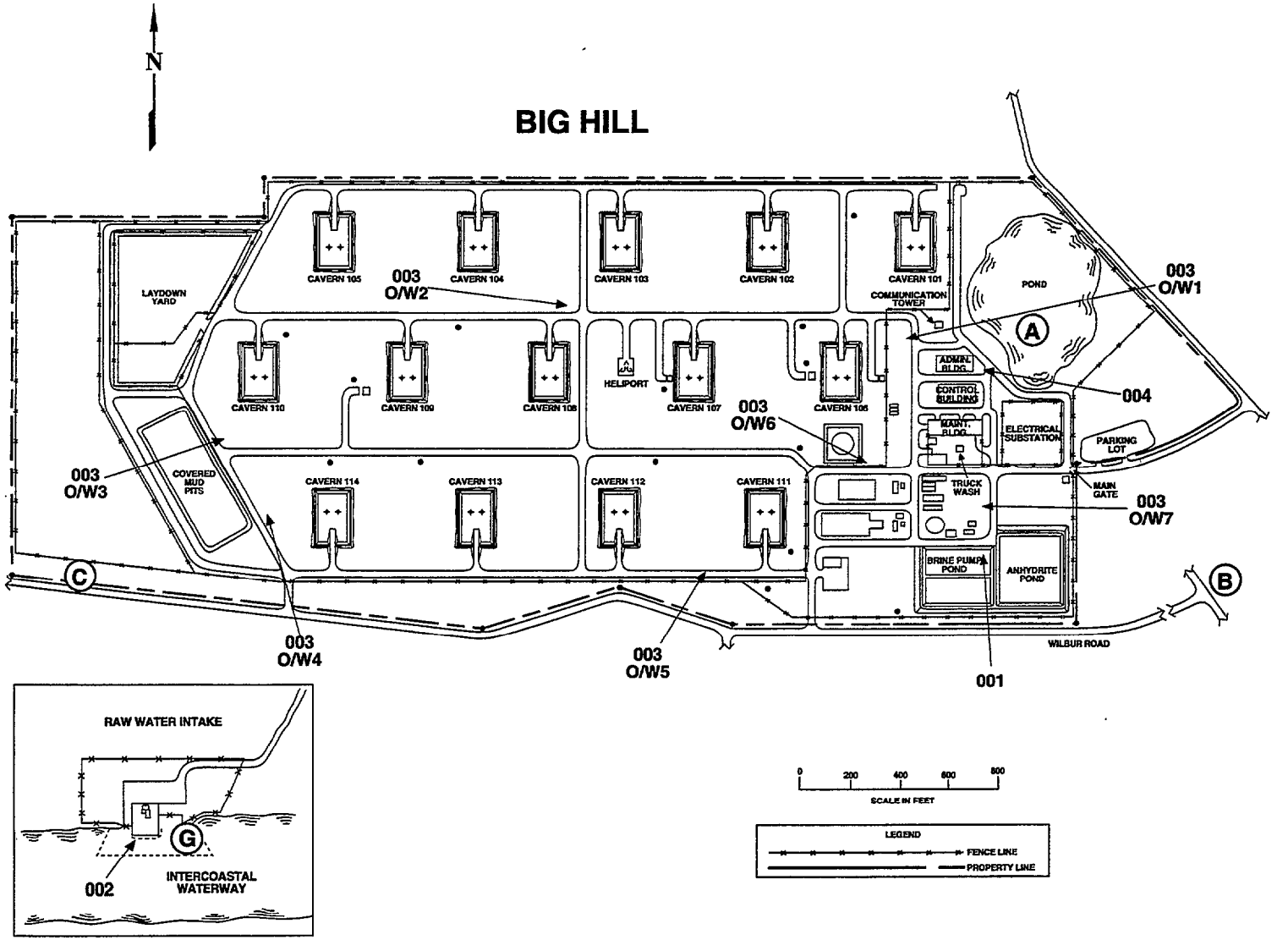
Monitoring stations were established at five locations (Figure 5-2) to assess site-associated surface water quality and to provide early detection of any surface water quality degradation that may result from SPR operations. Parameters including pH, temperature, salinity, oil and grease, dissolved oxygen, and total organic carbon were monitored (Table 5-3).

5.2.2.1 Hydrogen Ion Activity (pH)

The 1994 data show the pH of site and surrounding surface waters remained between 6.1 and 8.0. The annual median values of pH for each of the monitored stations ranged from 6.5 to 7.4. No seasonal trend was observed, but there was a relationship between increased salinity an pH. The pH was generally higher throughout the year at the brackish Intracoastal Waterway (ICW) than at any other station. Brackish water occasionally found at the Wilber Road and Gator Hole stations also had elevated pH.

5.2.2.2 Salinity (SAL)

Annual average salinities were generally low, ranging from fresh on site throughout the year to 10.0 ppt at the ICW during late summer. It was observed that the further south the station location, the slightly higher the salinity. The fresh water environment evident at the STP



2071/MP/ENV/J/B.H. MAP/5-94

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 (RCT only)

Water Quality Monitoring Stations

A Pond receiving effluent from site sewage treatment plant (STP)

C Wilber Road ditch - southwest of site

E Pipkin Reservoir

F Culvert crossover (Gator Hole) on RWIS road

G RWIS at Intracoastal Waterway

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

Table 5-3. Data Summary for Big Hill Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Dissolved Oxygen	Total Organic Carbon
Gator Hole							
	Sample Size	12	12	12	12	12	12
	Number of BDL			6	12		
	Maximum	7.3	30.0	4.3	2.5	7.3	25.9
	Minimum	6.1	7.0	0.5	2.5	0.5	11.3
	Mean	NV	22.0	1.3	2.5	3.9	18.4
	Median	6.6	25.0	0.8	2.5	3.4	18.1
	Standard Deviation	NV	7.6	1.1	0.0	2.2	4.5
	Coefficient of Variation	NV	34.5	91.8	0.0	56.2	24.6
Pipkin Reservoir							
	Sample Size	12	12	12	12	12	12
	Number of BDL			12	12		
	Maximum	6.9	29.0	0.5	2.5	5.9	25.8
	Minimum	6.1	7.0	0.5	2.5	0.1	11.0
	Mean	NV	21.3	0.5	2.5	2.2	19.1
	Median	6.6	23.5	0.5	2.5	2.4	19.0
	Standard Deviation	NV	6.7	0.0	0.0	1.9	4.3
	Coefficient of Variation	NV	31.5	0.0	0.0	87.7	22.7
RWIS							
	Sample Size	12	12	12	12	12	12
	Number of BDL			1	12		
	Maximum	7.6	31.0	10.0	2.5	9.7	15.5
	Minimum	6.5	13.0	0.5	2.5	3.8	0.5
	Mean	NV	23.5	4.6	2.5	6.6	10.4
	Median	7.4	24.0	3.9	2.5	6.5	12.7
	Standard Deviation	NV	6.5	3.5	0.0	1.5	4.9
	Coefficient of Variation	NV	27.5	75.8	0.0	23.1	47.1
STP Pond							
	Sample Size	12	12	12	12	12	12
	Number of BDL			12	12		
	Maximum	7.1	30.0	0.5	2.5	12.3	24.6
	Minimum	6.2	9.0	0.5	2.5	0.2	3.6
	Mean	NV	22.7	0.5	2.5	3.7	9.0
	Median	6.5	25.5	0.5	2.5	2.8	7.9
	Standard Deviation	NV	7.2	0.0	0.0	3.7	5.3
	Coefficient of Variation	NV	31.6	0.0	0.0	99.4	59.1
Wilber Ditch							
	Sample Size	12	12	12	12	12	12
	Number of BDL			5	12		
	Maximum	8.0	32.0	5.4	2.5	11.4	23.7
	Minimum	6.4	11.0	0.5	2.5	1.5	6.3
	Mean	NV	22.8	2.2	2.5	5.8	15.9
	Median	7.0	25.5	1.6	2.5	4.6	16.1
	Standard Deviation	NV	7.1	2.0	0.0	3.5	5.0
	Coefficient of Variation	NV	31.0	91.6	0.0	61.4	31.6

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Dissolved Oxygen = mg/l; Total Organic Carbon = mg/l

pond (station A) and the Pipkin Reservoir (E) transitioned to brackish at the Gator Hole (F) and the ICW (G). Marsh changes from fresh to intermediate regime were evident. A seasonal increase in salinity was observed in the fall at the Gator Hole and the ICW stations which are located in a tidally affected brackish water environment.

Salinity observed in the Wilber Road ditch (C) that flows along the south side of the site were greater than that on site. A possible source of contamination are brine spills from a nearby oilfield tank battery west of the site. The coefficient of variation for salinity readings taken over the year was much higher at the Wilber Road ditch, the Gator Hole, and the ICW than other stations which indicates that salinity is highly variable at these locations.

5.2.2.3 Oil and Grease

Results for all stations at all times were below the detectable limit. No indication of crude oil from SPR activities was found at these stations during sampling episodes.

5.2.2.4 Temperature

Temperatures observed in 1994 ranged from 7.0 °C to 32.0 °C and exhibited the characteristics expected from seasonal meteorological changes. Observed temperatures fell below 20 °C only during the months of January, February, and December. Temperature fluctuations were very similar among all stations.

5.2.2.5 Dissolved Oxygen (DO)

Dissolved oxygen was generally greatest in the winter and spring and lowest from summer through fall. The widest range of DO fluctuation observed during 1994 was at the

site STP pond; however, all stations except the ICW exhibited wide fluctuations indicative of sluggish, shallow water environments. In comparison, greater flow and depth of the ICW provided a more constant dissolved oxygen level.

5.2.2.6 Total Organic Carbon (TOC)

Average annual TOC concentrations ranged from 9.0 to 25.9 mg/l. Elevated TOC levels were observed at both lower temperatures and higher DO levels found during winter and early spring.

5.2.2.7 General Observations

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

a. The fresh surface waters had a near neutral pH, but pH was generally higher in brackish water.

b. Observed salinities were low on site and increased in natural fashion from fresh water at the site to intermediate brackish water regimes at the ICW. Salinities observed in the Wilber Road ditch may be due to brine spills from a nearby oilfield tank battery.

c. Surrounding surface waters were not impacted by SPR crude oil.

d. Temperature variations followed seasonal meteorological changes.

e. Dissolved oxygen and total organic carbon fluctuations were affected by seasonal meteorological changes.

5.2.3 Bryan Mound

Surface waters surrounding the Bryan Mound site were monitored throughout 1994. Blue Lake was sampled at seven stations monthly except during January, February, and August. Mud Lake

was sampled at three stations in April and June only. Low tides restricted access to Mud lake during other sampling periods.

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. Station J, located near the central point of the lake, serves as a control.

Parameters monitored in the Bryan Mound surface waters include pH, temperature, salinity, oil and grease, and TOC.

5.2.3.1 Hydrogen Ion Activity (pH)

In 1994 pH of Blue Lake and Mud Lake was generally neutral to slightly basic, indicative of natural waters devoid of carbon dioxide and generally hard in regard to mineral content. Marine and brackish waters, such as those in Blue Lake and Mud Lake, typically have somewhat elevated pH levels and high mineral content.

Minor pH fluctuations in Bryan Mound surface waters appear to be the result of seasonal and tidal variations rather than site activity.

A relationship between pH and primary productivity (detected as TOC) was observed in Blue Lake. High pH was usually accompanied with high primary productivity (high TOC) and low pH with low primary productivity (low TOC).

BRYAN MOUND

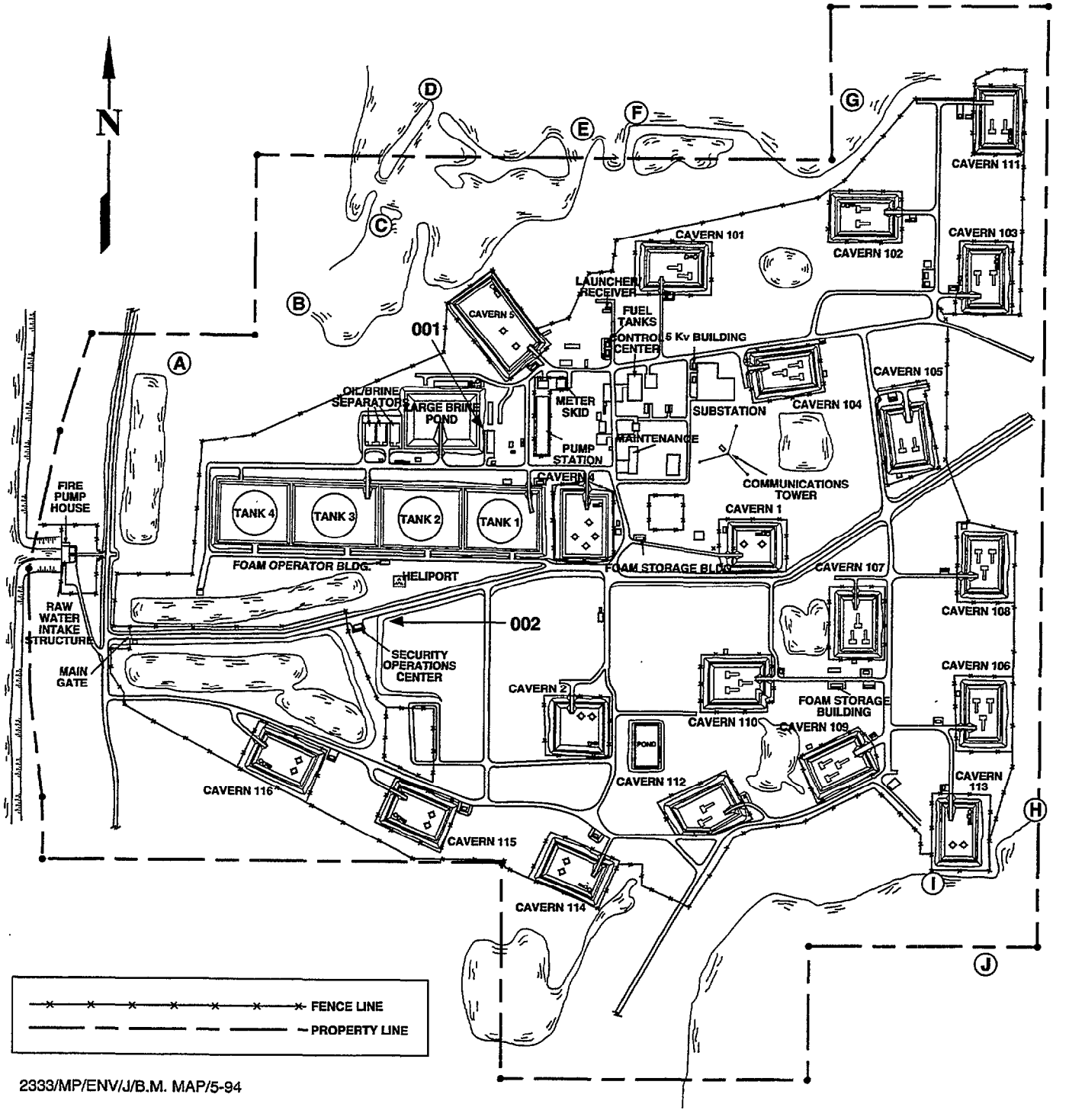


Figure 5-3

(Sheet 1 of 2). Bryan Mound Environmental Monitoring Stations

Discharge Monitoring Stations

001 Brine disposal

002 Discharge from the sewage treatment plant

003 Stormwater discharges

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

Runoff from the high-pressure pump pad

Runoff from transfer pump pad

Runoff from surge tank area

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

Table 5-4. Data Summary for Bryan Mound Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Total Organic Carbon
A						
	Sample Size	8	8	8	3	7
	Number of BDL				3	
	Maximum	9.3	31.0	5.7	2.5	50.4
	Minimum	8.0	15.0	2.0	2.5	20.1
	Mean	NV	25.0	4.1	2.5	29.9
	Median	8.5	26.0	3.9	2.5	27.7
	Standard Deviation	NV	5.2	1.2	0.0	10.0
	Coefficient of Variation	NV	20.8	28.7	0.0	33.5
B						
	Sample Size	8	8	8	3	7
	Number of BDL				3	
	Maximum	9.4	31.0	6.0	2.5	49.3
	Minimum	8.1	14.0	2.0	2.5	23.2
	Mean	NV	24.9	4.3	2.5	32.6
	Median	8.6	26.5	3.9	2.5	29.1
	Standard Deviation	NV	5.4	1.4	0.0	9.0
	Coefficient of Variation	NV	21.7	32.2	0.0	27.5
C						
	Sample Size	8	8	8	2	7
	Number of BDL				2	
	Maximum	9.3	31.0	6.0	2.5	50.1
	Minimum	8.2	14.0	2.0	2.5	25.8
	Mean	NV	24.9	4.3	2.5	32.7
	Median	8.8	26.0	3.9	2.5	29.2
	Standard Deviation	NV	5.5	1.4	0.0	9.1
	Coefficient of Variation	NV	22.0	32.3	0.0	27.8
D						
	Sample Size	8	8	8	2	7
	Number of BDL				2	
	Maximum	9.3	31.0	5.8	2.5	45.0
	Minimum	8.1	15.0	2.0	2.5	22.3
	Mean	NV	25.0	4.2	2.5	30.4
	Median	8.7	25.5	3.9	2.5	27.1
	Standard Deviation	NV	5.3	1.3	0.0	8.2
	Coefficient of Variation	NV	21.2	30.5	0.0	26.9
E						
	Sample Size	8	8	8	2	7
	Number of BDL				2	
	Maximum	9.3	31.0	5.8	2.5	44.3
	Minimum	8.2	16.0	2.0	2.5	24.0
	Mean	NV	25.1	4.2	2.5	32.1
	Median	8.6	26.0	3.9	2.5	28.6
	Standard Deviation	NV	4.9	1.3	0.0	7.3
	Coefficient of Variation	NV	19.7	30.1	0.0	22.8

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Total Organic Carbon = mg/l

Table 5-4 (continued). Data Summary for Bryan Mound Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Total Organic Carbon
F						
	Sample Size	8	8	8	2	7
	Number of BDL				2	
	Maximum	9.3	31.0	5.7	2.5	44.2
	Minimum	8.2	16.0	2.0	2.5	24.2
	Mean	NV	25.3	4.1	2.5	31.0
	Median	8.7	26.5	3.9	2.5	28.3
	Standard Deviation	NV	5.2	1.2	0.0	7.3
	Coefficient of Variation	NV	20.5	29.5	0.0	23.6
G						
	Sample Size	8	8	8	2	7
	Number of BDL				2	
	Maximum	9.2	31.0	5.8	2.5	46.9
	Minimum	8.1	16.0	2.0	2.5	25.8
	Mean	NV	25.3	4.2	2.5	32.6
	Median	8.7	26.0	3.9	2.5	29.5
	Standard Deviation	NV	5.0	1.2	0.0	7.3
	Coefficient of Variation	NV	19.9	29.8	0.0	22.4
H						
	Sample Size	2	2	2	0	2
	Number of BDL					
	Maximum	7.8	27.0	10.7	0.0	5.1
	Minimum	7.4	26.0	10.1	0.0	4.2
	Mean	NV	26.5	10.4	NV	4.7
	Median	7.6	26.5	10.4	NV	4.7
	Standard Deviation	NV	0.7	0.4	NV	0.6
	Coefficient of Variation	NV	2.7	4.1	NV	13.7
I						
	Sample Size	2	2	2	0	2
	Number of BDL					
	Maximum	7.8	28.0	16.0	0.0	4.4
	Minimum	7.8	26.0	10.1	0.0	3.9
	Mean	NV	27.0	13.1	NV	4.2
	Median	7.8	27.0	13.1	NV	4.2
	Standard Deviation	NV	1.4	4.2	NV	0.4
	Coefficient of Variation	NV	5.2	32.0	NV	8.5
J						
	Sample Size	2	2	2	0	2
	Number of BDL					
	Maximum	7.8	28.0	16.0	0.0	5.2
	Minimum	7.8	25.0	10.1	0.0	3.8
	Mean	NV	26.5	13.1	NV	4.5
	Median	7.8	26.5	13.1	NV	4.5
	Standard Deviation	NV	2.1	4.2	NV	1.0
	Coefficient of Variation	NV	8.0	32.0	NV	22.0

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Total Organic Carbon = mg/l

5.2.3.2 Salinity (SAL)

Observed salinity fluctuations ranged from 2.0 to 6.0 ppt in Blue Lake and 10.1 to 16.0 ppt in Mud Lake. Salinity fluctuations are attributed to meteorologically induced conditions rather than site operations, since salinities observed at control sample stations D and J were consistent with those found along the site shoreline. The higher salinities in Mud Lake are primarily caused by the strong tidal and wind influence on the lake and its more direct link with the Gulf of Mexico.

5.2.3.3 Temperature

Temperatures observed in 1994 ranged from 14.0 °C to 31.0 °C and exhibited the characteristics expected from seasonal meteorological changes. Mud Lake's slightly cooler summer temperature is attributed to stronger tidal movement there than in Blue Lake.

5.2.3.4 Total Organic Carbon (TOC)

In 1994 observed average TOC in Blue Lake ranged from 29.9 to 32.7 mg/l in Blue Lake. Observed TOC in Mud Lake was much lower (range: 3.8 to 5.2 mg/l) than Blue Lake in April and June when the Mud Lake sample stations were accessible for sampling. Higher TOC measured in Blue Lake is attributed to primary productivity. The TOC levels observed in both lakes are indicative of healthy conditions.

5.2.3.5 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 to slightly basic in Blue Lake and Mud Lake.

b. Temperature and salinity fluctuations observed during the year are attributed to meteorologically induced conditions rather than site operations.

c. High TOC levels observed in Blue Lake are attributed to high primary productivity.

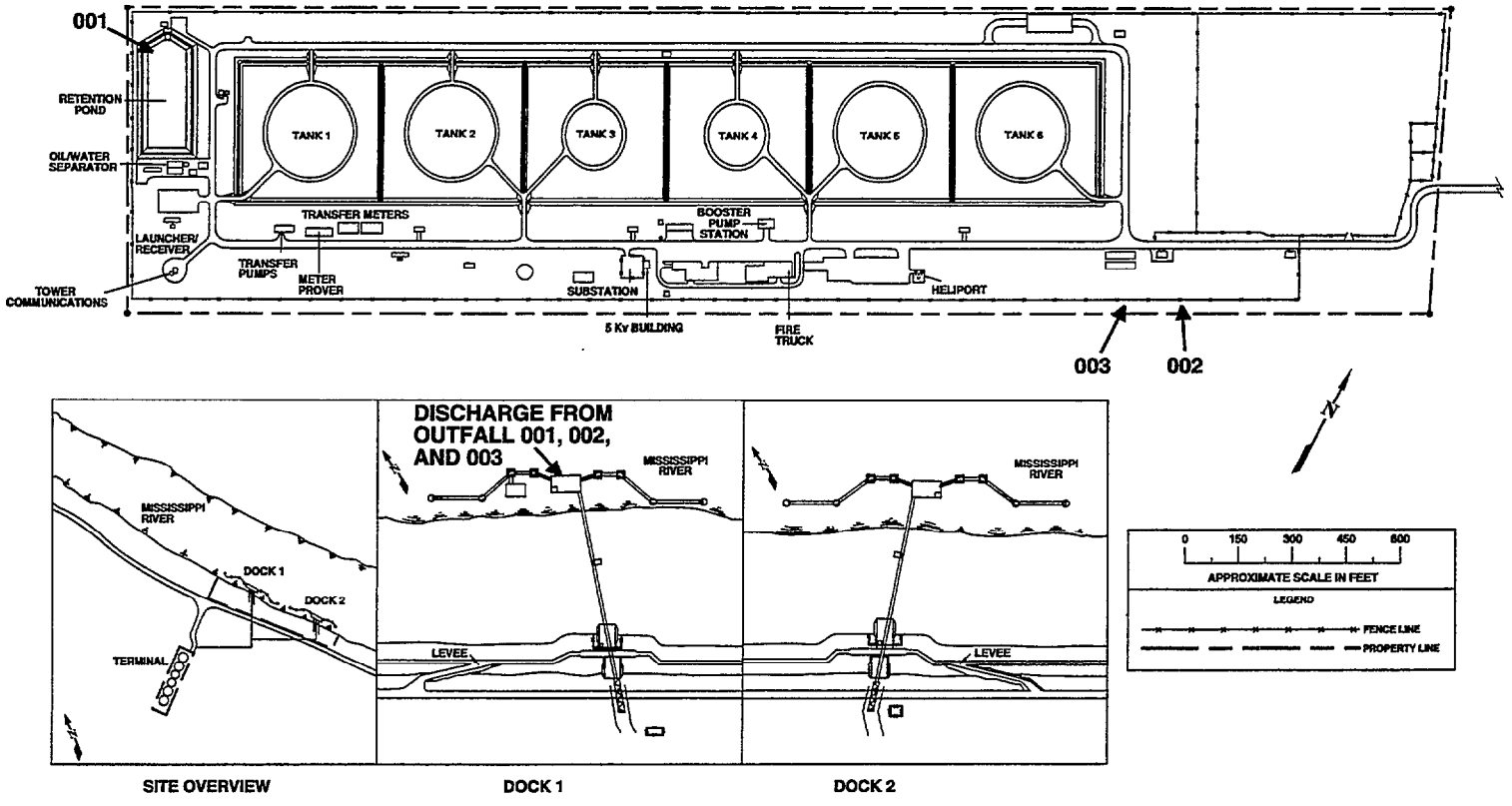
5.2.4 St. James Terminal

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

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



2334/MP/ENV/C/STJ/4-95

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 Terminal.

Figure 5-4

(Sheet 2 of 2). St. James Terminal Environmental Monitoring Stations

5.2.5 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 located outside of SPR boundaries. 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 5-5) discharge small volumes into surface runoff at a substantial distance from receiving waters. The lack of potentially impacted DOE owned surface waters precludes the need for surface water quality monitoring. Outfalls 004 and 01B are discharged with 01A through a single surface drain, similar to the St. James arrangement.

5.2.6 West Hackberry

In 1994, six surface water quality stations (Figure 5-6) were monitored monthly at West Hackberry. Parameters monitored include pH, temperature, salinity, DO, oil & grease, and TOC (Table 5-5).

5.2.6.1 Hydrogen Ion Activity (pH)

The pH of site and surrounding waters ranged between 6.5 and 9.0, and median values ranged from 7.0 to 8.5. Highest readings at all stations were observed during winter. Readings were consistently higher and exhibited less variability at the north foam retention pond on site (station E) than at other locations. Water sampled at the retention pond is primarily phreatic (commonly well water) run-off from the site high-pressure pump pad. Surface water sampled at other stations was meteoric in origin. Fluctuations observed are attributed to environmental and seasonal factors such as variation in rainfall, temperature, algae and biotic growth, and aquatic system flushing.

WEEKS ISLAND SITE MAP

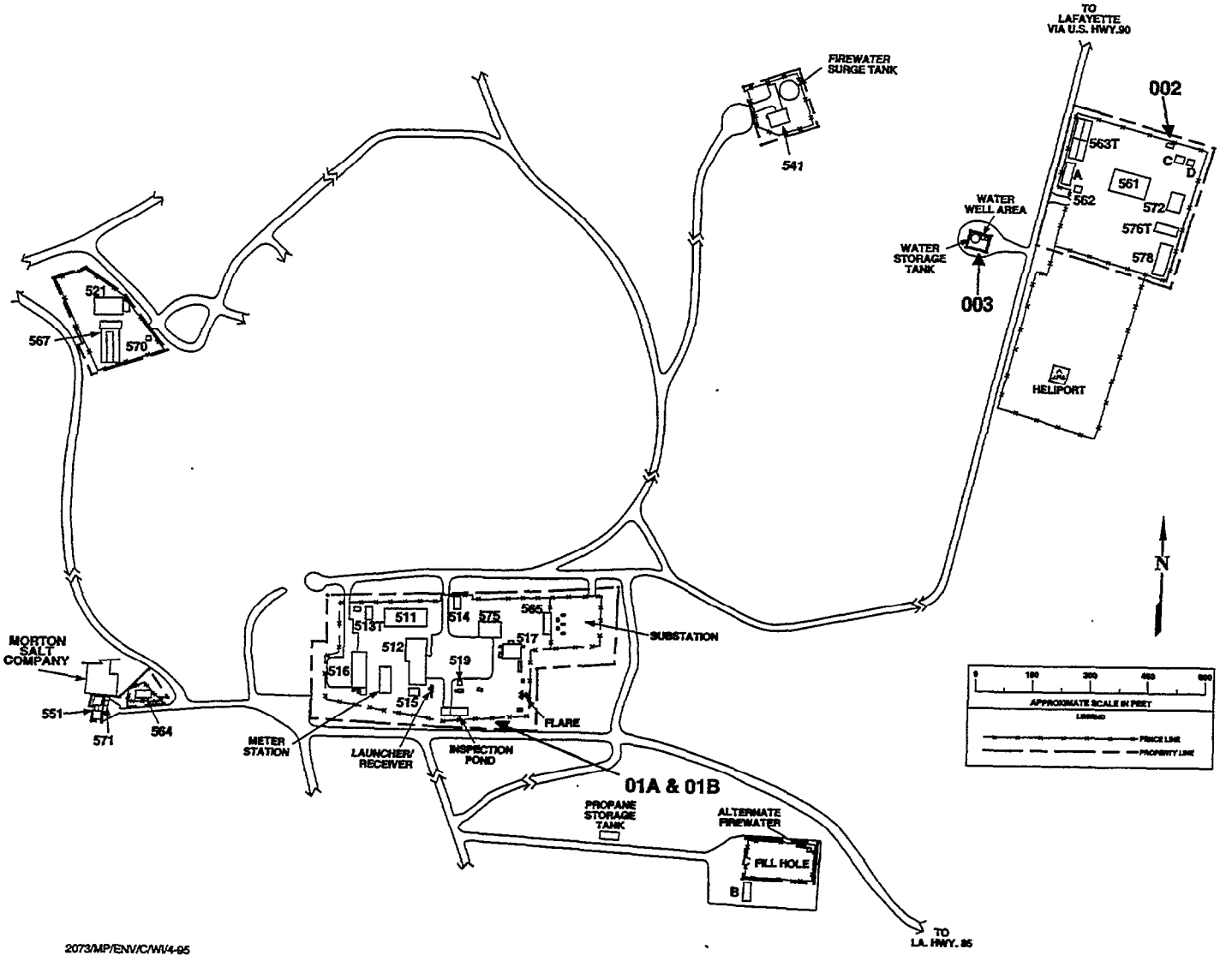


Figure 5-5
(Sheet 1 of 2). Weeks Island Environmental Monitoring Stations

Discharge Monitoring Stations

01A Storm water runoff

01B Discharge from sewage treatment plant

002 Discharge from sewage treatment plant

003 Discharge from iron removal system

004 Discharge from mine air dryer condensate

There are no water quality monitoring stations at Weeks Island

Figure 5-5

(Sheet 2 of 2). Weeks Island Environmental Monitoring Stations

5.2.6.2 Salinity (SAL)

Meteorological factors such as wind, tide, and rainfall contributed to the salinity variation observed in brackish Black Lake and the Intracoastal Waterway (ICW). Salinity ranges observed in these water bodies (3.2 to 14.5 ppt in Black Lake and 0.5 to 13.8 ppt in the ICW) are more conducive to supporting euryhaline organisms and those with sufficient mobility to avoid salinity stresses that occur with seasonal changes. Mean annual salinity observed at the ICW (3.3 ppt) was lower than that of Black Lake (7.5 to 7.7 ppt). This is probably due to sampling methodology. Only surface samples were taken at all stations. The ICW is deeper than well mixed Black Lake, and higher salinity water may have been present on the bottom of the waterway.

Salinities observed at the two upland site stations were affected by surface runoff and not Black Lake. Ditch salinities at the southwest corner of the site (station D) never exceeded 1.0 ppt, suggesting that no detectable brine contamination occurred from site activities within the large area that drains into the ditch. The high coefficient of variation for salinities observed at the foam retention pond (station E) indicates that brine was released from the high pressure pump pad. A salinity of 4.9 ppt was detected in February.

5.2.6.3 Temperature

Observed temperatures in 1994 were consistent with observations at other sites and were indicative of regional climatic effects. No off-normal measurements were observed. Recorded temperatures ranged from 13.0 °C to 30.0 °C and were generally consistent among stations.

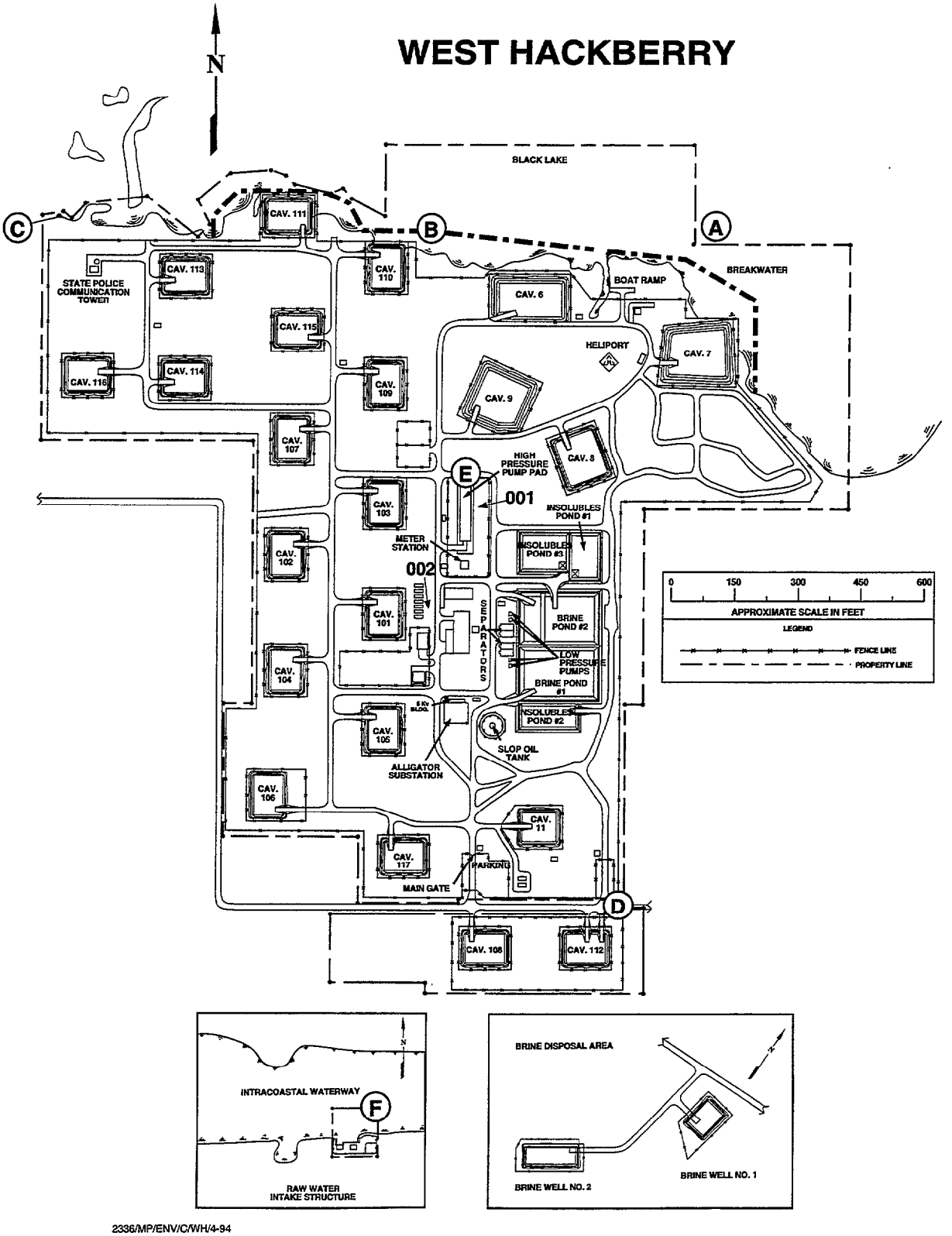


Figure 5-6

(Sheet 1 of 2). West Hackberry Environmental Monitoring Stations

Discharge Monitoring Stations

001 Brine disposal

002 Discharge from sewage treatment plant

003 Storm water and pump flush from high-pressure pump pad Storm water runoff from well pads 6-9, 11, and 101-117

004 Storm water 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 (Intracoastal Waterway)

Figure 5-6

(Sheet 2 of 2). West Hackberry Environmental Monitoring Stations

Table 5-5. Data Summary for West Hackberry Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Dissolved Oxygen	Total Organic Carbon
A							
	Sample Size	12	12	12	4	11	12
	Number of BDL				4		
	Maximum	8.2	30.0	14.5	2.5	13.0	19.6
	Minimum	7.0	13.0	3.5	2.5	5.9	6.4
	Mean	NV	21.8	7.7	2.5	8.3	10.1
	Median	7.3	21.0	6.5	2.5	8.1	9.1
	Standard Deviation	NV	6.1	3.6	0.0	1.8	3.5
	Coefficient of Variation	NV	28.2	46.6	0.0	21.6	34.9
B							
	Sample Size	12	12	12	4	11	12
	Number of BDL				4		
	Maximum	8.1	30.0	14.0	2.5	12.5	12.5
	Minimum	7.0	13.0	3.2	2.5	5.5	6.4
	Mean	NV	22.3	7.6	2.5	8.3	8.8
	Median	7.2	23.0	6.5	2.5	8.1	8.3
	Standard Deviation	NV	6.2	3.5	0.0	1.7	1.9
	Coefficient of Variation	NV	28.0	46.4	0.0	21.2	21.5
C							
	Sample Size	12	12	12	4	11	12
	Number of BDL				4		
	Maximum	8.0	30.0	14.0	2.5	12.5	12.5
	Minimum	7.0	13.0	3.2	2.5	5.5	6.6
	Mean	NV	22.3	7.5	2.5	8.2	9.1
	Median	7.2	23.0	6.3	2.5	7.9	9.2
	Standard Deviation	NV	6.3	3.5	0.0	1.8	1.8
	Coefficient of Variation	NV	28.4	47.1	0.0	21.7	19.6
D							
	Sample Size	10	10	10	3	9	10
	Number of BDL			7	3		
	Maximum	8.8	29.0	1.0	2.5	9.8	14.5
	Minimum	6.7	16.0	0.5	2.5	3.4	7.6
	Mean	NV	24.3	0.7	2.5	7.6	10.8
	Median	7.6	26.0	0.5	2.5	8.5	10.5
	Standard Deviation	NV	4.9	0.2	0.0	2.1	2.0
	Coefficient of Variation	NV	20.1	37.2	0.0	27.8	18.9
E							
	Sample Size	12	12	12	4	11	12
	Number of BDL			6	4		
	Maximum	9.0	30.0	4.9	2.5	12.4	96.6
	Minimum	7.6	17.0	0.5	2.5	5.0	3.2
	Mean	NV	23.7	1.2	2.5	8.9	14.8
	Median	8.5	23.5	0.8	2.5	9.0	5.3
	Standard Deviation	NV	5.4	1.2	0.0	2.4	26.7
	Coefficient of Variation	NV	23.0	104.5	0.0	26.5	180.3

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Dissolved Oxygen = mg/l; Total Organic Carbon = mg/l

Table 5-5 (Continued). Data Summary for West Hackberry Monitoring Stations

Station	Statistical Parameters	pH	Temperature	Salinity	Oil & Grease	Dissolved Oxygen	Total Organic Carbon
F							
	Sample Size	11	11	11	4	10	11
	Number of BDL			5	4		
	Maximum	7.2	30.0	13.8	2.5	9.5	11.9
	Minimum	6.5	14.0	0.5	2.5	4.8	6.4
	Mean	NV	23.3	3.3	2.5	7.0	8.7
	Median	7.0	25.0	1.0	2.5	7.0	8.4
	Standard Deviation	NV	6.3	4.4	0.0	1.3	1.9
	Coefficient of Variation	NV	27.2	131.1	0.0	18.1	22.4

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.
Units: pH = SU; Temperature = deg. C; Salinity = ppt; Oil & Grease = mg/l; Dissolved Oxygen = mg/l; Total Organic Carbon = mg/l

5.2.6.4 Dissolved Oxygen

The DO levels observed at all stations are suitable for aquatic life. Dissolved oxygen was less variable in Black Lake and the ICW than observed at site stations. Greater surface area and water movement through currents and wave action provided continuous aeration of the lake and ICW water. Water movement at the ditch station D and the retention pond became sluggish and stagnant between rain falls and between pump pad use, respectively.

Dissolved oxygen levels were generally higher in winter than at any other time of the year. This trend was more apparent in Black Lake and the ICW than at the site stations.

5.2.6.5 Total Organic Carbon

Average annual TOC concentrations ranged from 8.7 to 14.8 mg/l. Seasonal peaks were observed during winter in Black Lake and the ICW. A second peak occurred in late spring and early summer at the ICW.

Unlike the stations in Black Lake and the ICW, site ditch and retention pond stations did not show seasonal effects. Monthly TOC concentrations were generally

higher at the site ditch station D than at any other station. High TOC concentrations were attributed to high organic loading caused by intermittent periods of stagnation. The retention pond station exhibited the greatest fluctuation in TOC of all stations despite its potable water origin. Potable water that drains into the pond from the high pressure pump pad is not as rich in biomass as natural surface waters in site ditches, Black Lake, and the ICW. Unusually high TOC concentrations observed in the retention pond in March and August were possibly caused by traces of a small fire fighting foam release and high primary productivity, respectively.

5.2.6.6 Oil and Grease

Observed oil and grease levels were below the detectable level (5 mg/l) at all stations throughout 1994. The data reflect effective spill prevention and housekeeping by the site.

5.2.6.7 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 were only affected by seasonal factors.

b. The near fresh water salinity measured in the site ditch indicated that no brine releases occurred on that portion of the site that drained to the ditch. Salinity was detected in runoff from the high pressure pump pad, but the concentrations were lower than that of the Black Lake receiving waters.

c. Oil and grease levels were below the detectable limit at all stations throughout 1994 which is indicative of good housekeeping.

d. Dissolved oxygen levels at site and Black Lake stations were consistently high and did not appear adversely affected by site operations.

e. Total organic carbon concentrations varied seasonally in Black Lake and the ICW but not on site. High levels observed on site were caused by organic loading, primary productivity, and possibly a small fire fighting foam release. However, corresponding high DO suggests minor impacts to water quality.

5.3 WATER DISCHARGE PERMIT MONITORING

The water discharge permit monitoring program fulfills the requirements of the EPA NPDES, and corresponding state TPDES and LWDPS programs. 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 1994. These discharges are grouped as:

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

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

In 1994, a total of 10,260 analyses were performed to monitor wastewater discharge quality from the SPR in accordance with NPDES and corresponding state permits. The SPR was in compliance with permit requirements for approximately 99.9% of the analyses performed. A total of 10 permit noncompliances

were reported (Tables 5-8, 5-10, 5-13, and 5-15) during the calendar year (CY) 1994. Five (50%) of the permit noncompliances experienced on the project were due to sampling, sample handling, or sampling related phenomena. Permit parameter limits were exceeded 4 times accounting for 40% of the noncompliances. The remaining noncompliance, representing 10% of the project total, resulted from problems with a failed gasket allowing hydrostatic test water to leak-by resulting in an unauthorized discharge.

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

5.3.1 Bayou Choctaw

A total of 1129 measurements were performed on permitted outfalls and reporting stations to monitor NPDES and state permit compliance during 1994. Table 5-6 provides the permit required monitoring parameters and limits for the Bayou Choctaw outfalls. There were no noncompliances in 1994; therefore, the site compliance level was perfect for 1994.

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.

A renewed LWDPS permit in final form on March 6, 1994. All conditions of the renewed permit were fully implemented commencing April 1, 1994. An administratively complete NPDES renewal application, submitted in 1993, is pending EPA action, so the site continues to operate in accordance with its previous NPDES.

Table 5-6. Parameters for the Bayou Choctaw Outfalls

Location/Discharge	Parameter	Compliance Range
sewage treatment plants	flow	(report only)
	BOD_5	<45 mg/l max
		<30 mg/l avg
	TSS	<45 mg/l max
		<30 mg/l avg
	pH	6.0 - 9.0
	fecal coliform	<400 col./100 ml
stormwater and vehicle rinsing	flow	(report only)
	oil and grease	<15 mg/l
	pH	6.0 - 9.0
	TOC	<50 mg/l

5.3.2 Big Hill

A total of 2660 measurements were performed to monitor NPDES and state discharge permit compliance during 1994. Table 5-7 provides the permit required monitoring parameters and limits for the Big Hill outfalls. There were two noncompliances during 1994 (Table 5-8) resulting in a 99.9% site compliance performance level.

Water discharges at Big Hill are regulated and enforced through the EPA NPDES permit program and the similar RCT discharge permit program (TPDES). An administratively complete NPDES renewal application, submitted in 1993, is pending EPA action, so the site continues to operate in accordance with its previous NPDES. No significant changes were requested in the latest 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, vehicle rinsing station, and stormwater from well pads and pump pads. There were no discharges during 1994 from the hydroclone blowdown system.

Table 5-7. Parameters for the Big Hill Outfalls

Location/Discharge	Parameter	Compliance Range
brine to Gulf	flow	0.27 million m^3/day
	velocity	> 6.1 m/sec (20 ft/sec)
	oil and grease	< 15 mg/l max
		< 10 mg/l avg
	TDS	(report only)
	TSS	(report only)
	pH	6.0 - 9.0 SU
	DO	detectable (when using O_2 scavenger)
stormwater and car wash	oil and grease	< 15 mg/l
	TOC	< 50 mg/l
	pH	6.0 - 9.0 SU
	salinity	8 ppt (RWIS report only)
sewage treatment plant (TPDES only)	flow	(report only)
	BOD_5	< 45 mg/l max
		< 20 mg/l avg
	COD	< 250 mg/l max
		< 150 mg/l avg
	TSS	< 45 mg/l max
		< 20 mg/l avg
	pH	6.0 - 9.0 SU
hydroclone blowdown (not used)	flow	report
	TSS	report
	pH	6.0 - 9.0 SU

A state water discharge permit renewal application was sent to the Railroad Commission of Texas in December 1993 and a finalized permit was issued with an effective date of September 1, 1994.

Table 5-8. 1994 Permit Noncompliances at Big Hill

Outfall Location	Permit Parameter	Value/ Limit	Cause
001	O&G	no sample	no sample was obtained on a weekend brine flow to the Gulf.
001	TSS	no sample	Sample data were lost in the laboratory during completion of the test procedure.

5.3.3 Bryan Mound

A total of 2938 measurements were made on permitted outfalls for the purpose of monitoring NPDES and state discharge permit compliance during 1994. Table 5-9 provides the permit required

parameters and limits for the Bryan Mound outfalls. There were three noncompliances during 1994 (Table 5-10) resulting in a (99.9%) site compliance performance level.

Table 5-9. Parameters for the Bryan Mound Outfalls

Location/Discharge	Parameter	Compliance Range
brine to Gulf (EPA only for 1994)	flow	0.17 million m^3/day
	velocity	>6.1 m/sec (20 ft/sec)
	oil and grease	<15 mg/l
	TDS	(report only)
	TSS	(report only)
	pH	6.0 - 9.0 SU
stormwater	flow	(report only)
	oil and grease	<15 mg/l
	TOC	<50 mg/l
	pH	6.0 - 9.0
	metals: As, Hg, Se	0.3 mg/l, 0.01 mg/l, & 0.3 mg/l (RCT only)
sewage treatment plant	flow	(report only)
	BOD_5	<45 mg/l max
		<20 mg/l avg
	COD	<250 mg/l max(RCT only)
		<150 mg/l avg
	chlorine	1.0 - 4.0 mg/l
	pH	6.0 - 9.0 SU

Table 5-10. 1994 Permit Noncompliances at Bryan Mound

Outfall Location	Permit Parameter	Value/ Limit	Cause
Stormwater	metals	no sample	A metals sample from a stormwater point was held by the contract lab beyond the recommended holding time invalidating the results.
001	pH	9.1/ 9.0	A discharge of brine to the Gulf had a measured pH of 9.1. The discharge was stopped and additional lower pH raw water was added to the brine pond prior to recommencing the discharge.

Water discharges at Bryan Mound are regulated and enforced through the EPA NPDES permit program and the similar RCT discharge permit program for state waters (TPDES). An administratively complete NPDES renewal application, submitted

in 1993, is pending EPA action, so the site continues to operate in accordance with its previous NPDES. 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.

5.3.4 St. James

A total of 81 measurements were performed on permitted outfalls to monitor NPDES and state discharge permit compliance. Table 5-11 provides the permit required monitoring parameters and limits for the St. James outfalls. There were no noncompliances in 1994 giving the site a perfect (100%) compliance level. An administratively complete NPDES renewal application, submitted in 1993, is pending EPA action, so the site continues to operate in accordance with its previous NPDES.

Outfall 001 consists of stormwater from the site retention pond. Outfalls 002 and 003 are for the two site package sewage treatment plants. All three outfalls discharge through a common pipe to the Mississippi River.

Table 5-11. Parameters for the St. James Outfalls

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

5.3.5 Weeks Island

A total of 274 measurements were performed on permitted outfalls to monitor NPDES compliance during 1994. Table 5-12 provides the permit required monitoring parameters and limits for the Weeks Island outfalls. There were two noncompliances in 1994 (Table 5-13) resulting in a site compliance performance level of 99.3%.

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 on site retention pond (Figure 5-7). There was no discharge from the iron removal unit (outfall 003) in 1994. The water condensing unit for the mine air (outfall 004) operated continuously in 1994.

A renewed LWDPS renewal was issued on June 24, 1994, and was fully implemented commencing July 1, 1994. An administratively complete NPDES renewal application, submitted in 1993, is pending EPA action, so the site continues to operate in accordance with its previous NPDES. In these renewals the Mine Air Condensate outfall (004) is being proposed for commingling with the 01A (Inspection Pond) discharge.

Table 5-12. Parameters for the Weeks Island Outfalls

Location/Discharge	Parameter	Compliance Range
stormwater	flow	(report only)
	oil and grease	<15 mg/l
	pH	6.0 - 9.0 SU
	TOC	<50 mg/l
	TSS	<45 mg/l
	COD	<125 mg/l
sewage treatment plant	flow	(report only)
	BOD_5	<45 mg/l
	TSS	<45 mg/l
	fecal coliform	<400 colonies/100 ml
	pH	6.0 - 9.0 SU
iron removal unit	flow	(report)
	TSS	<45 mg/l
mine air dryer condensate water	flow	(report)
	pH	6.0 - 9.0 SU
	TOC	(report)

Table 5-13. 1994 Noncompliances/Bypasses at Weeks Island

Outfall Location	Permit Parameter	Value/ Limit	Cause
01B	TSS	65/ 45 max	The 01B STP services the main site. Monthly test results indicated a 65 mg/l value for January. Sufficient samples were obtained to lower the avg. for the month to avoid a second NC. A temporary upset was indicated.
002	TSS	36/ 30 avg	The 002 STP services the WHSE. The monthly sample for DEC. was 36 mg/l which exceeded the avg limit of 30 mg/l. The exceedance was not discovered until the quarterly report was prepared in January.

5.3.6 West Hackberry

A total of 3139 measurements were performed on permitted outfalls to monitor NPDES compliance during 1994. Table 5-14 provides the permit required parameters and limits for the West Hackberry outfalls. Permit noncompliances were identified on three occasions (Table 5-15). These three noncompliances, on a per analysis basis, resulted in a site compliance performance level of 99.9%.

Table 5-14. Parameters for the West Hackberry Outfalls

Location/Discharge	Parameter	Compliance Range
brine to Gulf	flow	<0.17 million m^3/day
	velocity	>7.6 m/sec (25 ft/sec)
	oil and grease	<15 mg/l
	TSS	(report only)
	TDS	(report only)
	pH	6.0 - 9.0 SU
	DO	detectable (when using O_2 scavenger)
sewage treatment plant	flow	(report only)
	BOD_5	<15 mg/l
	TSS	<45 mg/l
	fecal coliform	<400 col./100 ml
	pH	6.0 - 9.0 SU
stormwater	flow	(report only)
	oil and grease	<15 mg/l
	TOC	<50 mg/l
	pH	6.0 - 9.0 SU

Table 5-15. 1994 Noncompliances/Bypasses at West Hackberry

Outfall Location	Permit Parameter	Value/ Limit	Cause
029 LWDPS	TOC	no sample	During April and May discharges from the vehicle rinse station occurred with the TOC samples being inadvertently overlooked producing two NC. The TOC testing requirement was a new addition to this outfall with the issuance of a renewed state permit.
Storm water	Unauthorized discharge	no permit	A gasket failure resulted in the leak by of some 50 bbls. of clean hydro-static test water from a piping test. The leak was not covered under an existing permit and the incident is not considered a spill of a listed material; therefore, it represents an unauthorized discharge. No impacts were observed.

The water discharges at the West Hackberry site are regulated and enforced in accordance with the EPA NPDES permit program and LDEQ's state water discharge program (LWDPS). The three categories of discharges and their parameters (Figure 5-8) at West Hackberry are brine disposal to the Gulf of Mexico; sewage treatment plant effluent; vehicle rinsing, station, and, stormwater runoff from well pads, and pump pads.

5.4 ENVIRONMENTAL OCCURRENCES

The majority of the non-routine releases of pollutants occur with the spills of crude oil and brine into the environment from the SPR operations. Even though the SPR is considered to be in a stand-by mode, small quantities of crude oil and brine are moved throughout site equipment.

5.4.1 OIL SPILLS

There were seven oil spills during 1994 totaling 39 barrels. One spill accounted for 25 barrels and was contained, recovered, and returned to storage. No spills resulted in environmental damage.

In 1994, the total amount of oil moved (received and transferred internally) was approximately 1.9 million m^3 (12.046 MMB). The total number of crude oil spills, total volume spilled, and the percent volume spilled of total volume moved are shown in Table 5-16 for each year from 1982 through 1994.

Table 5-16. 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
1993	6	3.7 (232)	0.0007
1994	7	0.6 (39)	0.0003

The oil spills involving quantities in excess of 0.16 m^3 (1 bbl) that occurred during 1994, both contained and uncontained, are presented in Table 5-17. Oil spills in excess of one barrel are comparable to 1988 levels and are noted as the third lowest (by total volume) spilled during the 13 year period. No spills of oil occurred during the months of March, April, June, July, October, and November.

Each of the seven spills experienced during 1994 had causes. These varied from pinhole leaks discovered after pipeline repair to failure of gaskets or pipe flange failure, to leakage of diesel fuel and hydraulic oils, and to loss of oil during routine valve maintenance. No trend is readily apparent in the low number of event occurrences this year.

Table 5-17. 1994 Oil Spills

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
01/25/94	SJ	0.48 m^3 (3 bbls)	An estimated 3 bbls of crude oil leaked from a pressure relief safety line into an excavation made for a valve repair. The oil was contained and recovered with pumps.
02/12/94	WH	0.76 m^3 (5 bbls)	An estimated 5 bbls of fuel oil leaked from a fuel filter globe supplying a back-up generator. The area was vacuumed/flushed and affected soils were removed for offsite disposal.
05/11/94	BM	0.076 m^3 (0.05 bbls)	An estimated 20 gallons of crude oil was lost to wetland soils at the site of a pipeline repair. The pipeline was depressured and excavated. A pinhole leak was discovered from a weld of a prior repair. Soils were tested and found acceptable to return to the excavation after repairs were completed.
08/08/94	SJ	0.065 m^3 (0.40 bbls)	An estimated 17 gals. of hydraulic oil was released from an air compressor to wetlands (batture) adjacent to the Miss. River. The oil and affected soils were removed for proper disposal.
09/16/94	BM	0.057 m^3 (0.36 bbls)	An estimated 15 gals. of hydraulic oil leaked from a pile driver machine into the surf of the Gulf of Mexico. The oil leakage was observed and the leak source repaired.
12/03/94	BM	0.848 m^3 (2 bbls)	5.3 bbls. of crude oil leaked into an excavation for a pipeline upgrade. The oil was contained and recovered. The source was traced to residual left in a connected portion of line which backflowed out an uncapped tee.
12/21/94	SJ	4.0 m^3 (25 bbls)	An estimated 25 bbls. of crude oil leaked into a plywood lined excavation for a pipeline valve repair. The oil was recovered by vacuum truck and the valve repair completed. Affected soils were excavated as needed.

5.4.2 BRINE SPILLS

During 1994 there were only two brine spills totaling 90 barrels. None of the brine spilled resulted in environmental damage. No long term adverse environmental impact was observed from any CY 94 SPR brine spill as evidenced by subsequent surveys and water quality monitoring.

The SPR disposed of 2.32 million m^3 (14.50 MMB) of brine (mostly saturated sodium chloride solution, some discharges were of lower salinities than normally attributed to brine) during 1994. Approximately 85% of the brine was disposed in the Gulf of Mexico via the Big Hill (80.9% of the total), and Bryan Mound (4.0% of the total) brine disposal pipelines. The remainder was disposed in saline aquifers via injection wells at the Bayou Choctaw (4.5% of the total), and West Hackberry (10.3% of the total) sites. In 1994, 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. Saltwater recirculation was commenced at the Weeks Island site late in the year. The saltwater is taken from sumps within the oil storage chamber and reintroduced at the top of salt near the sinkhole location. This permitted activity has been found to be an effective mitigative factor in preventing continued sinkhole growth and water seepage.

The total number of spills, total volume spilled, and percent volume spilled of total volume disposed are shown in Table 5-18 for each year from 1982 on.

The brine spills involving quantities in excess of 0.16 m^3 (1 bbl), both contained and uncontained, during 1994 are described in Table 5-19. Corrosion/erosion has been the leading cause of 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. During 1994, only one of the two spills was attributed to operator/contractor error. The remaining spill was the result of a suspected below ground failure of a brine disposal pipeline. Each of the two spills accounted for approximately half of the total volume spilled during the year. As provided in Table 5-18, over the period 1982 to 1994, CY '94 experienced the least number of spill incidents and the lowest overall volume spilled, which is attributed to attention to detail and quick site response.

Table 5-18. 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	31,231.6	(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
1993	6	59.2	(370)	0.001
1994	2	14.4	(90)	0.0006

Table 5-19. 1994 Brine Spills

DATE	LOCATION	AMOUNT	CAUSE/CORRECTIVE ACTION
2/13/94	WH	8.0 m^3 (50 bbls)	An estimated 50 barrels of brine was released to site drainage when a hose from a recovery well was misdirected. The pumped water contained 68 ppt salinity and flowed easterly from the site. The affected area was flushed with fresh water and the residual collected by vacuum truck.
9/27/94	WH	6.4 m^3 (40 bbls)	An estimated 30 to 40 barrels of brine was suspected to have leaked from an onsite portion of the 36-inch brineline. The affected area was excavated and investigated with no apparent leaks found. A pressure test was also conducted. Soils were removed for proper disposal.

5.4.3 HAZARDOUS MATERIALS RELEASE

A single release of a CERCLA reportable quantity of hazardous material occurred in 1994. The incident involved the spill of one gallon of pipeline mastic along the ROW, above Bryan Beach, during construction of the new brineline at the Bryan Mound site. The mastic contained an estimated three pounds (by weight) of a CERCLA hazardous component. The responsible contractor responded with the placement of sorbent pads and affected soils were subsequently removed and properly disposed. All required notifications were made as appropriate.

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 1994, for each site. Tables 5-20 through 5-28 list chemical name, maximum daily value (lbs) for regulatory specified ranges, and location of hazardous chemicals on the SPR above Threshold Planning Quantity (TPQ), or 10,000 lbs. for sites in Texas.

There were no extremely hazardous substances in excess of the TPQ in 1994, negating the possibility of reportable releases. Offsite SPR pipelines containing crude oil were reported separately from SPR sites (Table 5-26 and 5-27).

Table 5-20.

LOUISIANA SARA TITLE III TIER TWO SUMMARY AT BAYOU CHOCTAW

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	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 liquid	$\geq$ 1 billion	Six underground storage caverns in salt dome & site piping
Diesel fuel	1,000 - 9,999	Fuel station, flood pump & generators near exit, water pumps near NW entrance
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	1,000 - 9,999	High Pressure Pump Pad area

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-21.

TEXAS SARA TITLE III TIER TWO SUMMARY AT BIG HILL

Chemical Name/Category	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	1,000 - 9,999	Foam storage bldg
Ammonium bisulfite	10,000 - 99,999	Near brine pond
Crude oil, petroleum, flammable and combustible liquid	≥ 1 billion	14 underground storage caverns in the dome, surge tank, and site piping
Diesel fuel	10,000 - 99,999	Fuel station & RWIS
Gasoline	10,000 - 99,999	Fuel station
Oil, flammable and combustible	10,000 - 99,999	Warehouse, lab & RWIS

* Reporting range specified by Texas SARA Title III Tier Two Reporting Requirement

Table 5-22.

TEXAS SARA TITLE III TIER TWO SUMMARY AT BRYAN MOUND

Chemical Name/Category	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	1,000 - 9,999	Fire systems around site, Foam storage bldg, laydown & excess yard
Crude oil, petroleum, flammable and combustible liquid	≥ 1 billion	20 underground storage caverns, 4 surge tanks & site piping
Diesel fuel	10,000 - 99,999	Fuel station & RWIS
Gasoline	10,000 - 99,999	Fuel station
Oil, flammable and combustible	10,000 - 99,999	Laydown yd, flammable storage bldg, & warehouse
Paints, flammable or combustible	10,000 - 99,999	Flammable storage bldg

* Reporting range specified by Texas SARA Title III Tier Two Reporting Requirement

Table 5-23.

LOUISIANA SARA TITLE III TIER TWO SUMMARY AT ST. JAMES TERMINAL

Chemical Name/Category	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	10,000 - 99,999	Fire truck bay, fire systems on main site & dock
Bromotrifluoromethane (Halon 1301)	100 - 999	Control room in ops
Compressed gas (except helium, neon, argon, krypton, xenon)	100 - 999	Lab, meter station, inside & outside of ops bldg
Crude oil, petroleum flammable and combustible liquid	100,000,000 - 499,999,999	Six storage tanks & site piping
Diesel fuel	10,000 - 99,999	Fuel station in laydown area, dock fire pumps, site emergency gen, & fire pump near fuel station
Gasoline	10,000 - 99,999	Fuel station at maintenance bldg area
Hazardous waste, liq or solid N.O.S.	1,000 - 9,999	Laydown yd & satellite areas
Oil, flammable and combustible	1,000 - 9,999	Flammable storage bldg, 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
Potassium bicarbonate	1,000 - 9,999	Fire truck bay in maint bldg
Propane or liquefied petroleum gas supplied as pressurized	100 - 999	Lab, emergency generator, at docks
Thinner, flammable and combustible	100 - 999	Flammable storage bldg
Visco 1152, biocide	1,000 - 9,999	West end of main site

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-24.

LOUISIANA SARA TITLE III TIER TWO SUMMARY AT WEEKS ISLAND

Chemical Name/Category	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	10,000 - 99,999	Fire equipment at maint & foam storage bldg
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control room in ops bldg & mine service shaft
Calcium hydr oxide	100 - 999	Laydown yard
Cement	1,000 - 9,999	Service shaft in mine
Compressed gas (except helium, neon, argon, krypton, xenon)	100 - 999	Flammable storage bldg
Crude oil, petroleum, flammable and combustible liquid	$\geq$ 1 billion	One underground storage cavern in salt dome & site piping
Diesel fuel	10,000 - 99,999	Fuel station in laydown area, fire storage area, production shaft area, & main site near emergency generator
Gasoline	10,000 - 99,999	Fuel station in laydown area
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 or combustible	10,000 - 99,999	Laydown yd paint shed & flammable storage bldg
Phosphoric acid	100 - 999	Laydown yd drum rack & shed
Potassium bicarbonate	1,000 - 9,999	Fire truck area
Propane or liq gas	10,000 - 99,999	Fill site rd, main petroleum site
Thinner, flammable and combustible	1,000 - 9,999	Flammable storage bldg

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-25.

LOUISIANA SARA TITLE III TIER TWO SUMMARY AT WEST HACKBERRY

Chemical Name/Category	*Max Daily Amount (lbs)	Location
FC-600 3M Light-water ATC/ AFFF	10,000,000 - 99,999,999	Foam storage bldg & site fire systems
Ammonium bisulfite, solution	1,000 - 9,999	Oil/brine separator chemical cabinet
Bromotrifluoromethane (Halon 1301)	1,000 - 9,999	Control room & lab
Crude oil, petroleum, flammable and combustible liq	$\geq$ 1 billion	Twenty-two 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
Oil, flammable and combustible	1,000 - 9,999	Warehouse, property yd & flammable storage bldg
Paint, flammable or combustible	1,000 - 9,999	Flammable storage & warehouse bldg
Potassium bicarbonate	1,000 - 9,999	Foam storage bldg

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-26.

LOUISIANA SARA TITLE III TIER TWO SUMMARY 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 Ascension 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 pipelines in Calcasieu Parish, LA
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Offsite pipelines in Cameron Parish, LA
Crude oil, petroleum flammable and combustible liquid	10,000,000 - 49,999,999	Offsite piping in Iberia Parish, LA

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-26. Continued

LOUISIANA SARA TITLE III TIER TWO SUMMARY 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 Iberville Parish, LA
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipeline in St. Martin Parish, LA
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 pipelines in St. James Parish, LA

* Reporting range specified by LA SARA Title III Tier Two Reporting Requirement

Table 5-27.

TEXAS SARA TITLE III TIER TWO SUMMARY IN OFFSITE PIPELINES

Chemical Name/Category	*Max Daily Amount (lbs)	Location
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	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 Jefferson County, TX (Big Hill)
Crude oil, petroleum, flammable and combustible liq	1,000,000 - 9,999,999	Offsite pipeline in Jefferson County, TX (West Hackberry)
Crude oil, petroleum, flammable and combustible liq	10,000,000 - 49,999,999	Offsite pipeline in Orange County, TX

* Reporting range specified by Texas SARA Title III Tier Two Reporting Requirement

THIS PAGE INTENTIONALLY BLANK

6. GROUND WATER MONITORING AND PROTECTION INFORMATION

Ground water monitoring is performed at Bayou Choctaw, Big Hill, Bryan Mound, and West Hackberry. Salinity and the presence of hydrocarbons are monitored although ground water monitoring is not required by any Federal or state regulations or permits at Bayou Choctaw, Big Hill, and Bryan Mound. Monitoring is required at West Hackberry in accordance with a monitoring plan agreed upon by DOE and the LDNR. West Hackberry ground water monitoring and recovery activities were reported quarterly to the LDNR in 1994.

Brine and hydrocarbon contamination of ground water is being surveyed at all sites in a two phase study. Phase I, completed in December 1992, consisted of a non-intrusive ground surface survey where instrumentation was used to detect potential brine contamination through soil electroconductance and hydrocarbon contamination though soil gas analysis. A contract statement of work Phase II activities, verification of contamination, was begun in 1994 with work to be completed in 1995. Phase II will consist of sampling and testing ground water from monitoring wells that will be installed in areas of potential contamination identified in the Phase I survey.

Ground water data collected for the past five years are presented. 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.

There are four monitoring wells (MW1, MW2, MW3, and MW4 at the Bayou Choctaw facility (Figure 6-1). These wells were drilled roughly 30 feet below land surface (bls) to monitor the brine pond and not the deeper Plaquemine Aquifer.

Ground water salinities observed at all four wells (Figure 6-2) are above ambient for a fresh water environment and are presumably elevated by past and possibly present brine handling activities.

All four wells exhibit seasonal salinity fluctuations that are affected by rainfall. Highest salinities have usually occurred in late winter and early spring, and lowest salinities have been observed in late spring and summer.

Surface brine spills may have also affected ground water salinities observed in these shallow wells. The salinity range observed at well MW3 is much greater than that of the other three wells. Ground water surface piezometric data of the wells show that ground water movement is to the southeast. A 1992 brine spill on the nearby low pressure pump pad north of the well may have elevated the salinity in that area, and its movement was captured by MW3.

Long-term salinity trends have been established which, examined within the context of the southeastern ground water movement, assist in identifying possible areas or sources of contamination. Wells MW1 and MW2 exhibit a slight increase in salinity. Both wells are situated upgradient of the brine pond area, with respect to ground water movement. The source of contamination may be residual from historical activity that occurred northwest of the pond. Although it captures the most saline ground water, MW3 is slowly decreasing in salinity over time. The salinity trend observed at MW3 over the past five years differs from that observed at the other wells. This indicates that some other brine source is affecting MW3.

BAYOU CHOCTAW

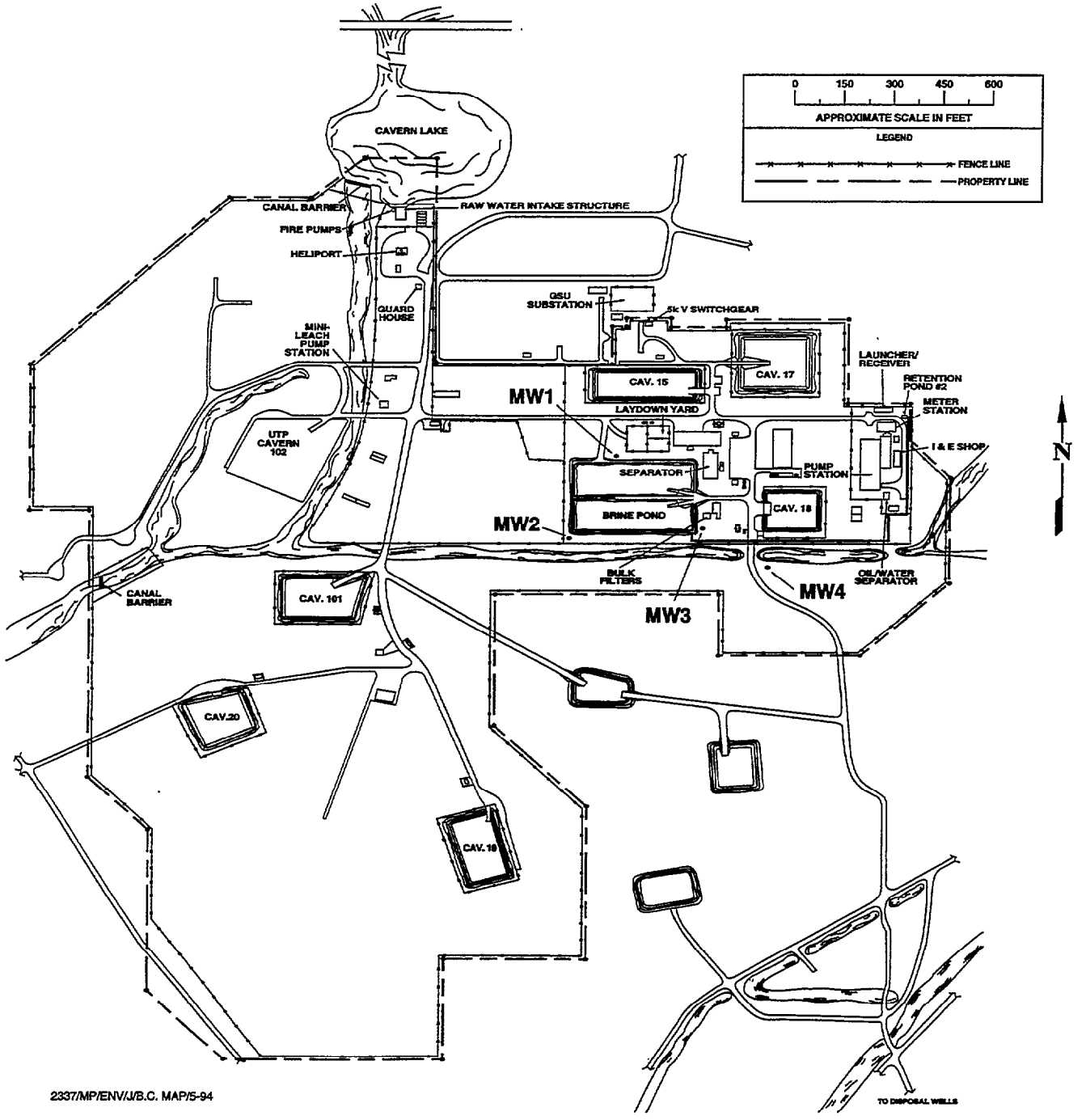


Figure 6-1. Bayou Choctaw Ground Water Monitoring Wells

Despite frequent fluctuations, there is no salinity trend observed at well MW4. This well is situated away from and down gradient of the brine pond and higher salinity well MW3.

Future ground water data, including that of the planned all-sites Phase II verification survey, and on-going inspections of the brine pond and site piping will assist in determining if contamination originated from SPR activities.

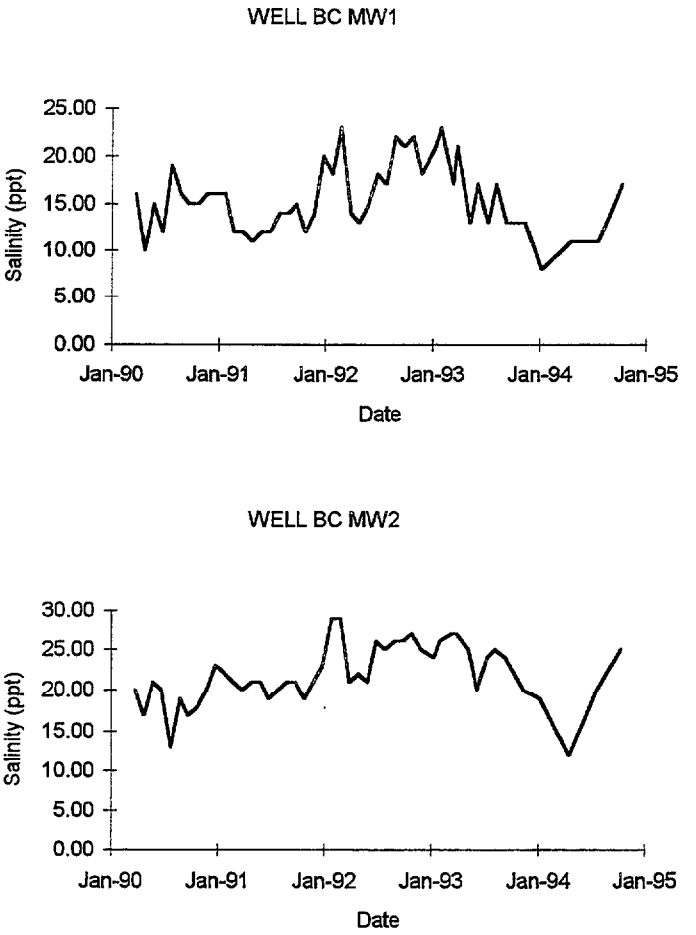


Figure 6-2.
Bayou Choctaw Groundwater Monitoring Well Salinities

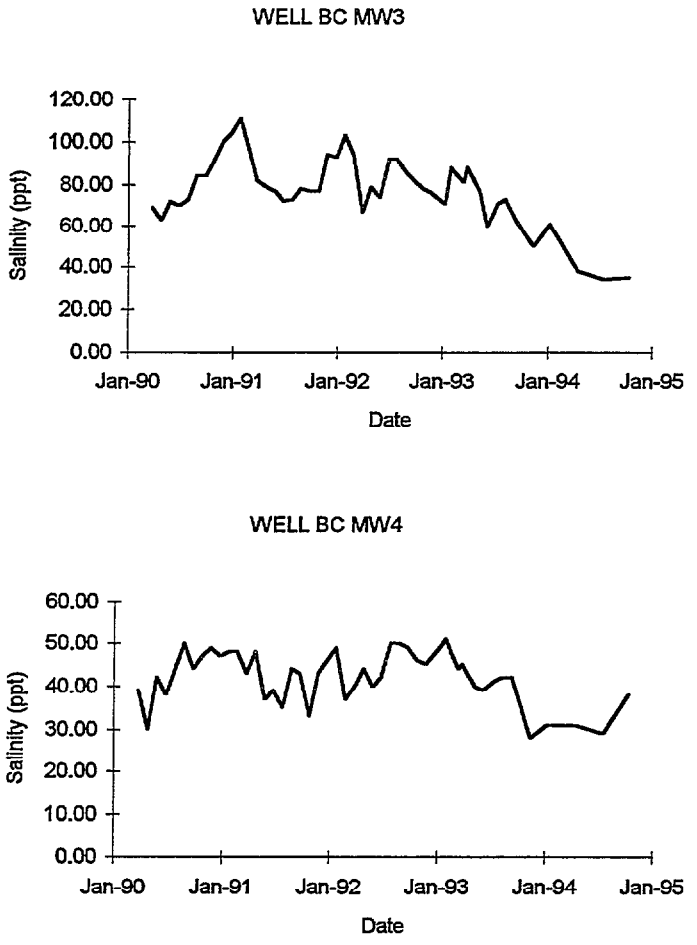


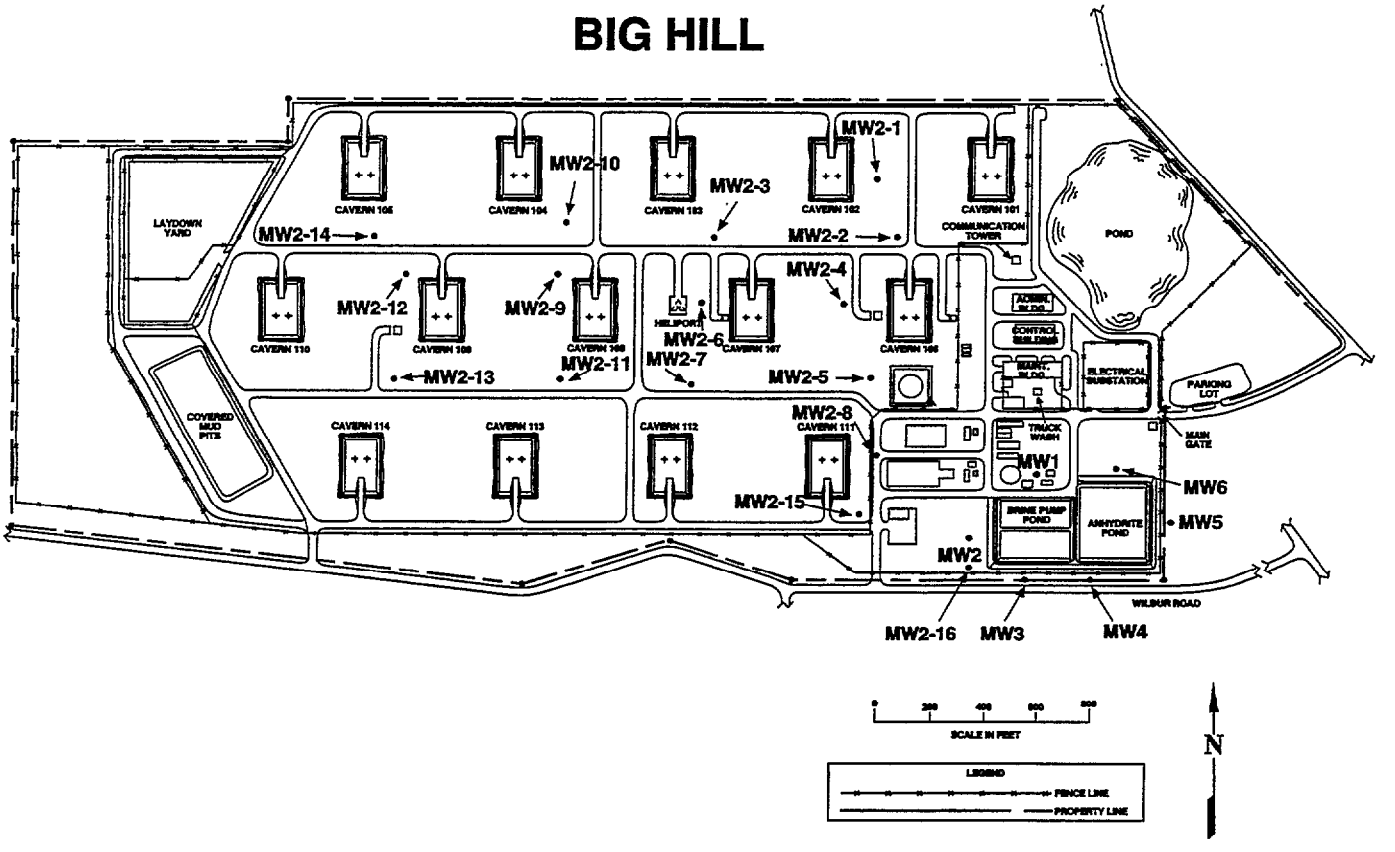
Figure 6-2. (Continued)
Bayou Choctaw Groundwater Monitoring Well Salinities

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 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.

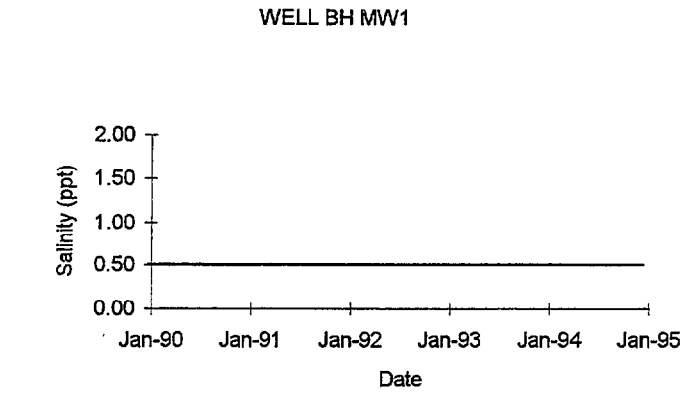
Sampling of six monitoring wells (wells MW1 to MW6) around the brine disposal pond system (Figure 6-3) began in 1987. The system is composed of a three Hypalon-lined ponds, of which two are concrete lined. All three have an underdrain system contained within a slurry wall. Salinity data collected from the six wells for the past five years indicate a consistency among them. Salinity of ground water from all wells remained at or below the detection limit (1.0 ppt) of the salinity meter used (Figure 6-4). All observed values that are below detection limit were evaluated as one-half the BDL for statistical calculations. Observed salinity changes are too low to indicate contamination.

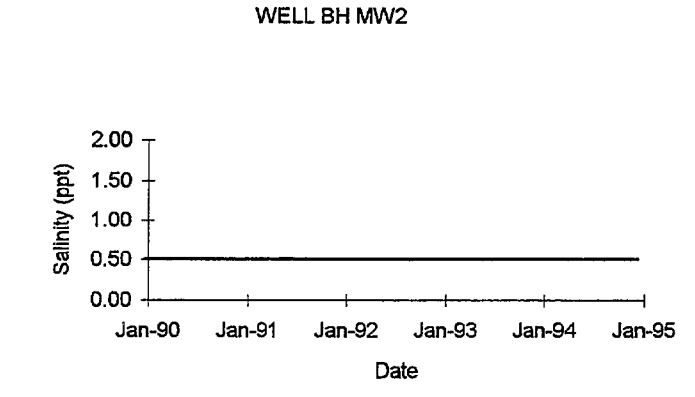
Also located on site are 16 2-inch brine piping leak detection monitoring wells (wells MW2-1 to MW2-16). Unlike those around the brine pond, these smaller wells were installed adjacent to buried brine piping on site to detect brine, should it be released from the piping, and do not intercept an aquifer (Figure 6-3). As a result, five wells were dry in 1994 and the remaining 11 were easily evacuated to dryness during sampling. Salinities at 10 of the 11 wells did not exceed 2.0 ppt. Only ground water from well MW2-15, east of Cavern 111, had elevated salinities of 7.0 to 17.1 ppt which are attributed to past brine piping failure. The maximum observed salinities at this location increased from a 1993 maximum of 14.0 ppt.



3348/FG/ENV/J/B.H. MAP/5-94

Figure 6-3. Big Hill Ground Water Monitoring Wells





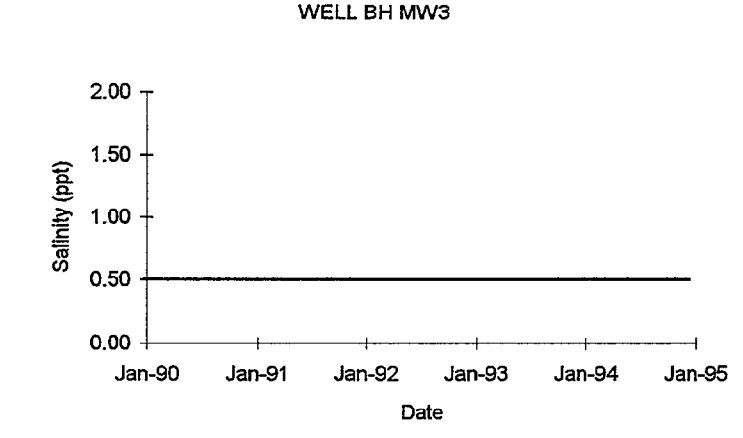
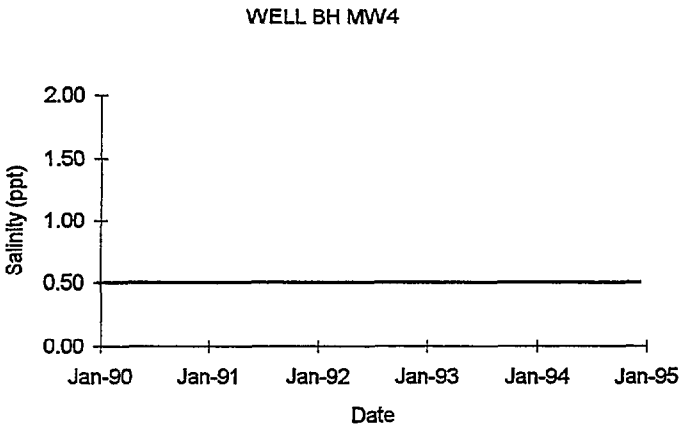
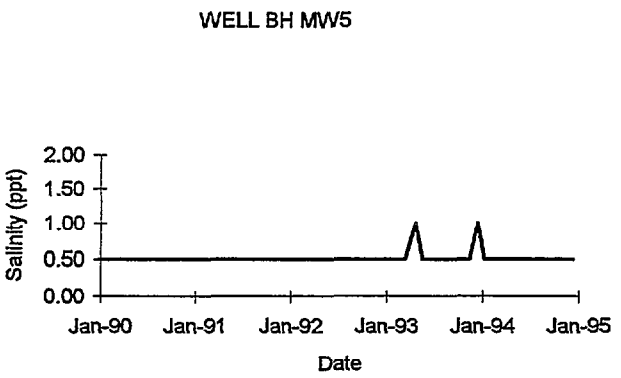


Figure 6-4.
Big Hill Ground Water Monitoring Well Salinities





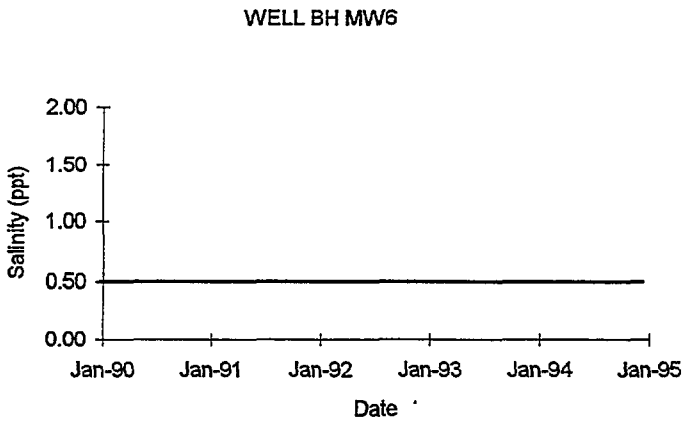


Figure 6-4. (continued)
Big Hill Groundwater Monitoring Well Salinities

6.3 BRYAN MOUND

Site monitoring wells installed in 20 and 50 foot bls zones indicate that no fresh water exists over the salt dome. Monitoring well salinities ranged from 1.0 to 130.0 ppt in 1994. However, the Chicot and Evangeline Aquifers are fresh to slightly saline in the Bryan Mound area, and fresh water for Brazoria County is obtained from the upper portions of the Chicot upgradient of Bryan Mound.

Fifteen monitoring wells were drilled at Bryan Mound in four phases between 1981 and 1990 (Figure 6-5). Sampling began shortly after installation. Wells BP1S, BP2S, and PZ2S are out of service due to casing damage.

A 1991 study determined that site ground water movement in the shallow (20 foot bls) zone was in the northerly direction toward Blue Lake while that of the deep (50 foot bls) zone was in the southeasterly direction toward Mud Lake. Local movement is affected by the domal upthrusting. The aquifers exhibit a very low average linear velocity (ranging from 2.5 to 3.3 ft/yr) due to the clay content of the water bearing strata and very low hydraulic gradients (ranging from 0.001 ft/ft to 0.002 ft/ft). This characteristic reduces the risk of contaminating potable aquifers of the salt dome.

Three areas where ground water salinity exceeds ambient (greater than 20.0 ppt) have been located. The first area stretches from the brine pond eastward to the brine pump pads and to the site of a brine pond demolished in 1989. The second area lies southeast of the security operations center (SOC), and the third lies south of the maintenance building.

Elevated salinities observed at shallow monitor wells PZ1S, MW1S, and BP1S since their installation may be attributed to brine pond activity. A large brine pond with a 36 mil flexible

renovated with new Hypalon and concrete in 1982. Ground water salinity observed in the pond area and to the north and east Hypalon (chlorosulfonated polyethylene) membrane was constructed in 1978. The liner leaked, and the pond was could be the result of previous or continued leakage from the pond or from adjacent buried piping. Salinities of deep complements to wells PZ1S and BP1S (PZ1D and BP1D) are much lower 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.

Salinity of deep zone well MW1D (complement to shallow zone well MW1S) has constantly been over 100 ppt for over three years, is greater than that of any shallow well, and is much greater than any other deep well. This well may be in a brine plume that extends north of the demolished brine pond. The high salinity of the deep well may also indicate upgradient communication of the two zones in that area.

Southeast of the SOC, an anhydrite disposal area used during construction and leaching phases of the site may be the source of brine contamination in the second area where high salinity ground water is found. The contamination is intercepted in the shallow zone by wells MW5S and PZ3S.

A brine contamination source in the third area of elevated salinity, near the maintenance building, has not been identified and probably pre-dates SPR activity. Salinities exceeding ambient levels are observed in both zones at wells MW2S and MW2D.

Brine contamination is not evident at the northwest corner of the site. Shallow zone monitor wells MW3S and MW4S near the southwest corner and west of the brine pond, respectively, and

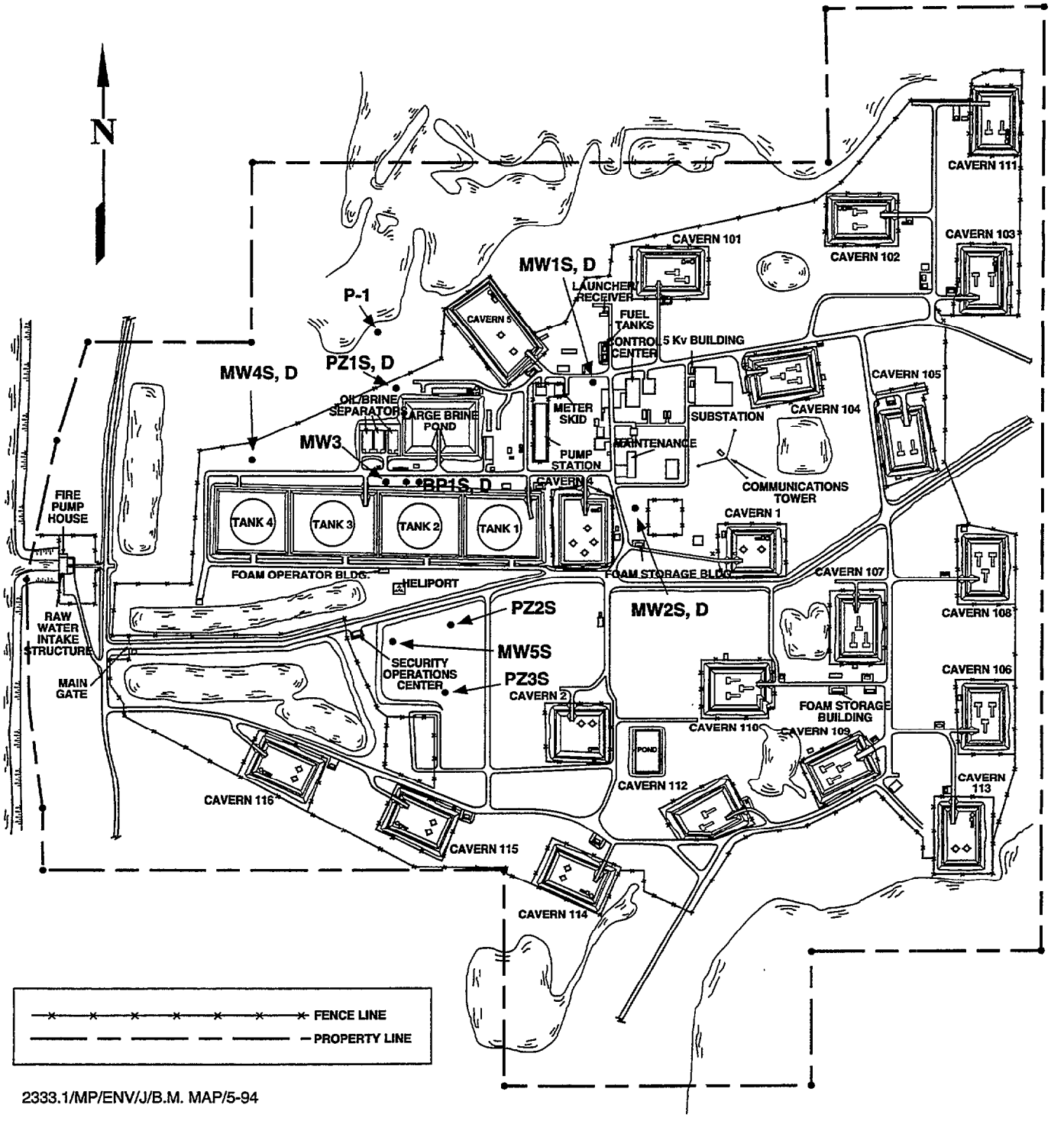


Figure 6-5. Bryan Mound Ground Water Monitoring Wells

Wide salinity fluctuations observed in Figure 6-6 graphs are due to changing sampling methodology. Observed salinity was directly related to the degree of well purging prior to deep zone monitor wells PZ1D, BP1D, and MW4D north and west of the brine pond exhibit lower salinities than wells to the east and south sampling. Consistent purging methodology was instituted in September 1993.

Salinity trends are evident in contaminated and uncontaminated areas. Elevated ground water salinities observed in both zones in the brine pond and pump pad area have remained constant overall, despite fluctuations encountered. High salinities observed in the shallow zone near the SOC and in both zones near the maintenance building appear to be increasing slightly. Salinities observed in uncontaminated deep and shallow zones at the northwest corner of the site increased slightly during the fall in 1994, but additional testing will show if this is a seasonal trend.

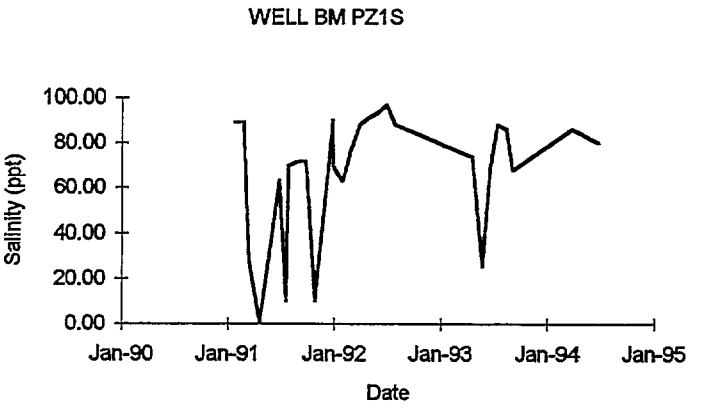
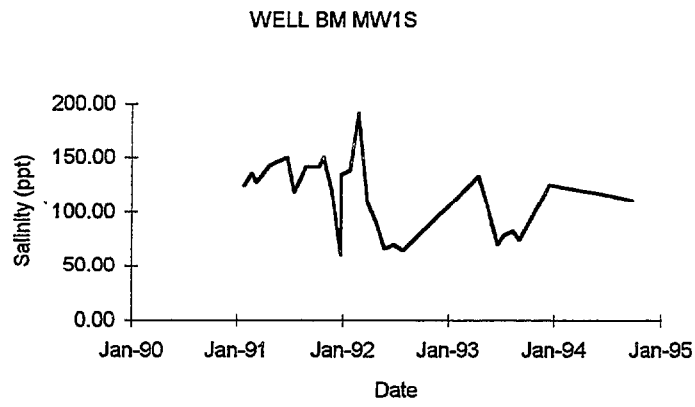
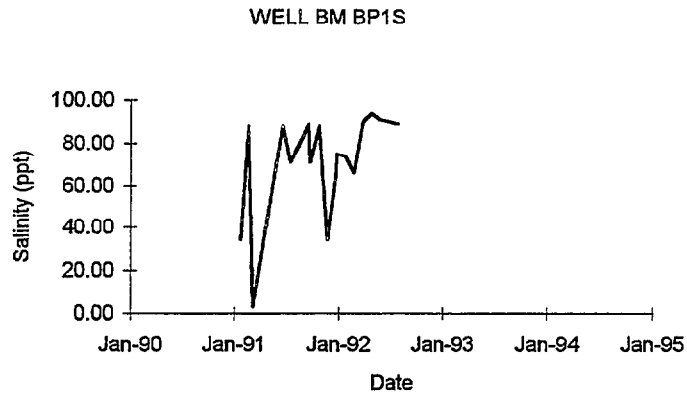


Figure 6-6.
Bryan Mound Groundwater Monitoring Well Salinities





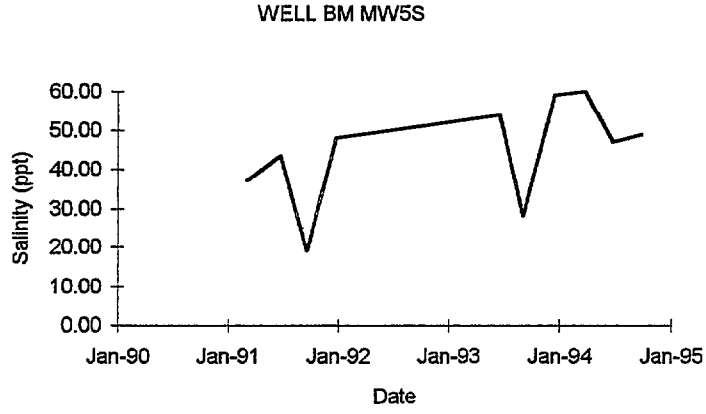
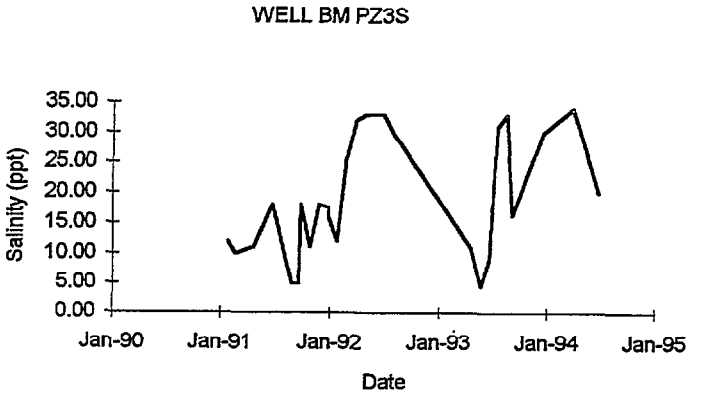
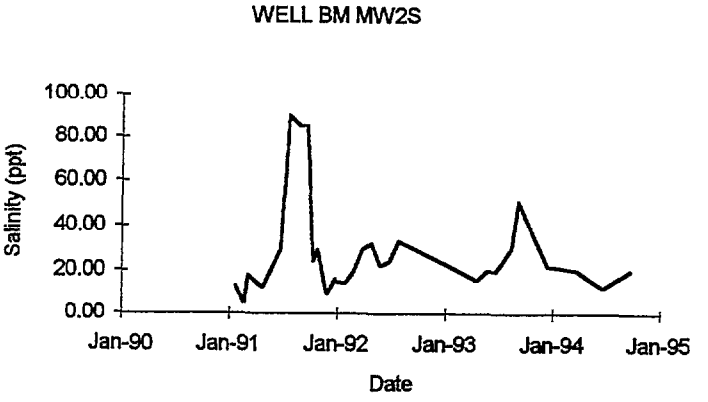


Figure 6-6 (continued).
Bryan Mound Groundwater Monitoring Well Salinities





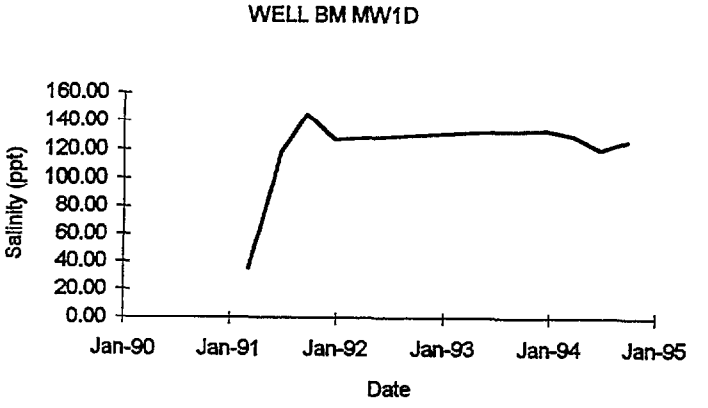
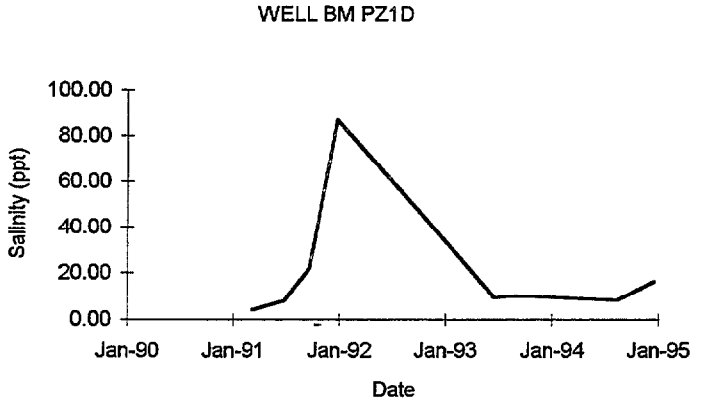
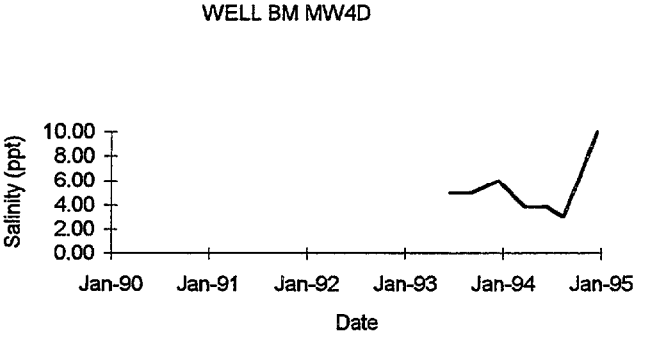


Figure 6-6 (continued).
Bryan Mound Groundwater Monitoring Well Salinities





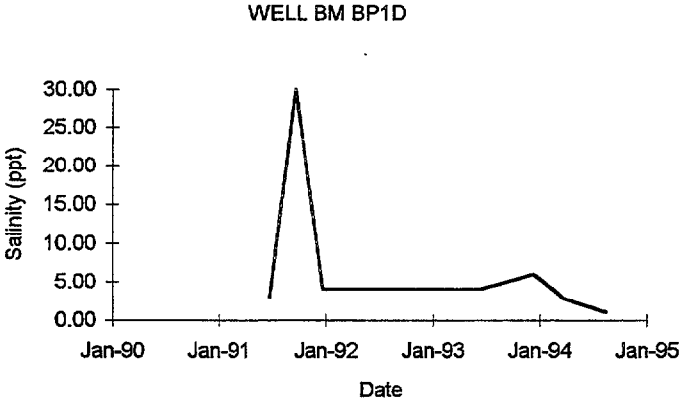
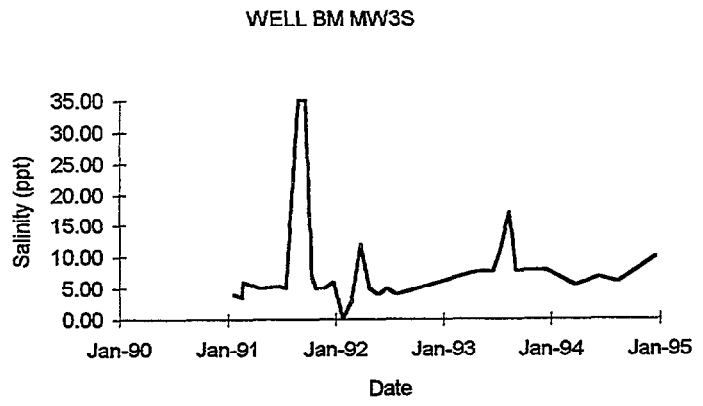
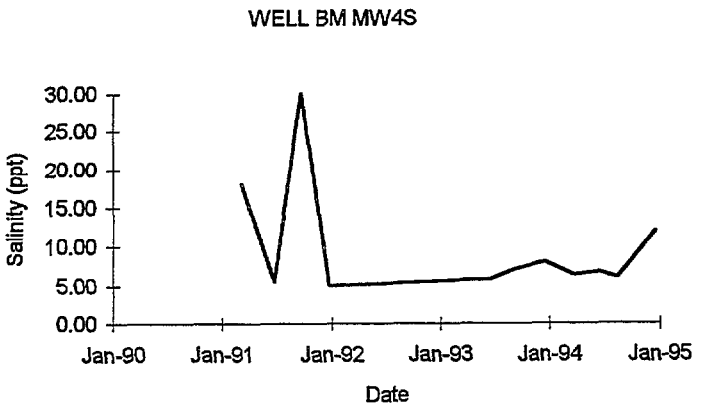


Figure 6-6 (continued).
Bryan Mound Groundwater Monitoring Well Salinities





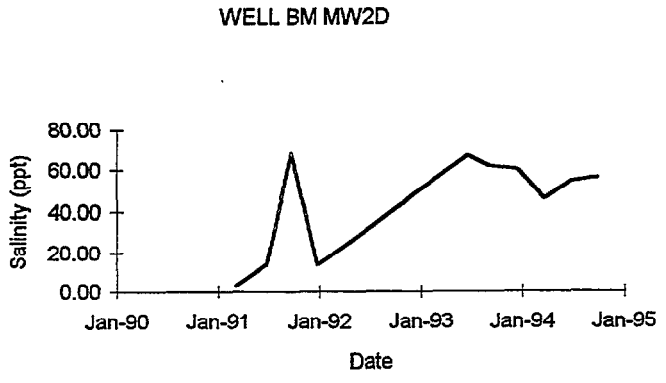


Figure 6-6 (continued).
Bryan Mound Groundwater Monitoring Well Salinities

6.4 ST. JAMES

The Chicot Aquifer is the principal regional 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 Phase I of the ground water contamination survey identified areas of potential contamination that will be verified in 1995.

6.5 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.

A sink hole found two years ago on Morton Property may potentially affect crude oil storage in the underlying mine and has prompted further investigation. The sink hole is located east of the mine's crude oil fill hole and has continued to grow since 1993. Its volume and depth have been monitored closely from the surface, seismic tests were performed to characterize soil from the surface to below the hole at the dome interface, and six monitoring wells were installed around it to monitor ground water piezometric levels. With assistance from Sandia Laboratories, a study is underway to determine the presence and location of communication between the mine and the sink hole. Effort is being made to abate its growth while the mine inventory is relocated to Bayou Choctaw and Big Hill.

Phase I of the contamination survey identified several potentially impacted areas that will be examined in 1995.

6.6 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. 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. Zones contaminated and monitored at West Hackberry are near the surface, the shallow zone at roughly 20 feet bls and the deep zone at roughly 50 feet bls.

A 1991 study identified the brine pond as a source of ground water contamination. The brine pond is one of five adjoining ponds comprising a pond system that contains brine and anhydrite solids pumped from the storage caverns. As an abatement measure, the brine pond was cleaned, and cracks in the walls and floor were grouted to stop leakage. Ground water recovery around the pond was also increased.

Eleven monitoring wells and 15 recovery wells (Figure 6-7) were installed on the West Hackberry site in five phases. All wells are used to monitor or control brine contamination beneath the brine pond system. Salinity data gathered over the past five years at all wells are depicted in Figure 6-8.

Ground water recovery at the brine pond has improved over the past four years. Gaps in the line graphs in Figure 6-8 denote periods when pumps were inoperable or when wells were dry.

Observed recovery well salinities depict a complex picture of ground water contamination beneath the pond system. Salinities are greater in the shallow zone than the deep zone with the

exception of deep zone wells P1D and P4D on west and east sides of the brine pond, respectively, where salinities exceed that of all other wells.

A brine plume extends east-northeastward through the shallow zone from the southwest corner of the brine pond, and its saline ground water is captured by six recovery wells. Wells P1S and P5S intercept the plume on the west side of the pond, wells RW1S and RW2S on the south side, and P3S and P4S on the east side. Wide salinity fluctuations of data graphed were caused by salinity stratification in the wells and oscillating cones of depression. Prior to mid-1993, submersible recovery well pumps ran intermittently and could not develop stable cones of depression and resultant stable salinities. One salinity peak that exceeded 200 ppt in January 1993 in Well P5S was caused by a brief siphoning of brine from the pond into the well.

A decreasing salinity trend is observed at wells P1S, P5S, and RW1S along the west side of the brine pond. A stable to slightly increasing salinity trend is apparent at wells RW2S, P2S, and P3S along the east half of the pond system. With ground water movement to the east, it is expected that wells on the west side of the pond will capture more fresh, uncontaminated ground water from the west as the source of brine contamination decreases. This response may be delayed to the east.

It appears that the elevated deep zone salinities are confined around wells P1D and P4D since no plume has been identified in the deep well network. Salinities of deep zone recovery wells RW1D and RW2D near high salinity P1D, and wells P3D, RW3D, and RW4D north of high salinity P4D remain near ambient (generally less than 3 ppt). Salinity of deep recovery well RW5D south of P4D remains above ambient (17.0 ppt annual average) and may be located at the edge of the contaminated area intercepted by P4D.

Shallow monitoring wells P8, P9, and P11 at caverns 8, 9, and 11, respectively, are located away from the brine pond and intercept ambient to near-ambient ground water. These wells have exhibited little change over the past five years, but wells P8 and P11 have detected localized contamination. Since 1993, salinity at well P8 decreased 0.3 ppt (annual average), and salinity at well P11 decreased 0.6 ppt (annual average). The source of contamination at P8 has not been determined. Temporarily elevated salinities observed at well P11 were caused by a brackish water leak that occurred three years ago from an adjacent fire water system.

Shallow zone monitoring wells P6S, P12S, and P13S, and deep zone monitoring wells P2D, P6D, P12D, P13D, and MW1D are nearer the brine pond than the monitoring wells at the caverns and, with the exception of wells P12S and P13S, also intercept ambient ground water. Well P12S is the only downgradient monitoring well that intercepts the shallow zone brine plume extending eastward from the brine pond. Its salinity is elevated (29.0 ppt annual average in 1994) but has decreased slightly since sampling began in 1992. Over the past three years, salinity at well P13S has increased slightly above ambient, possibly from residual localized contamination from a nearby brineline leak in 1992.

Cones of depression have been sustained in both zones as a result of successful ground water recovery. The differences in shallow and deep zone potentiometric surfaces and the rapid lowering of the piezometric heads during pumping indicate that the two zones are confined.

Continued ground water recovery, sampling, and testing will disclose trends and may determine sources of contamination.

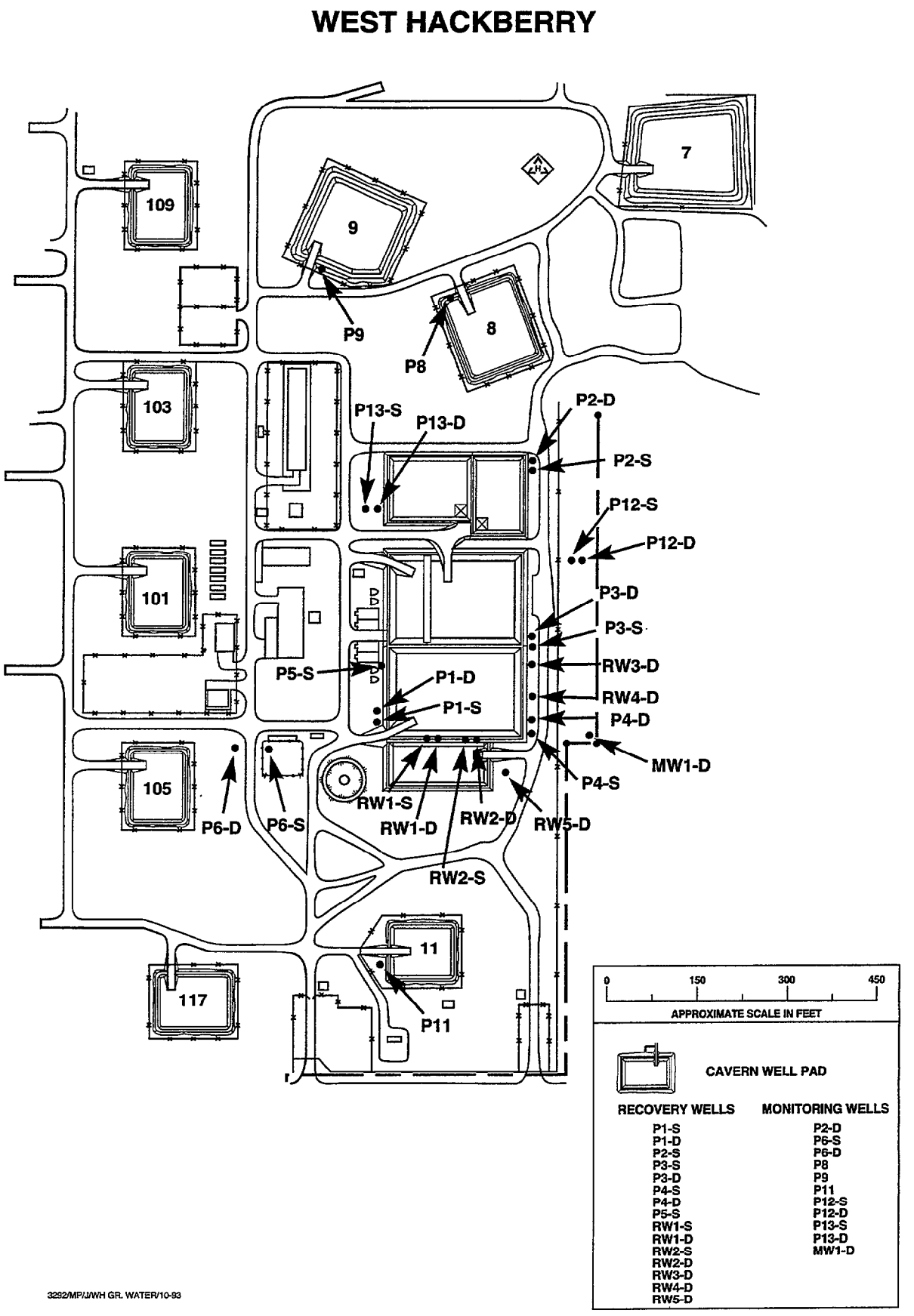
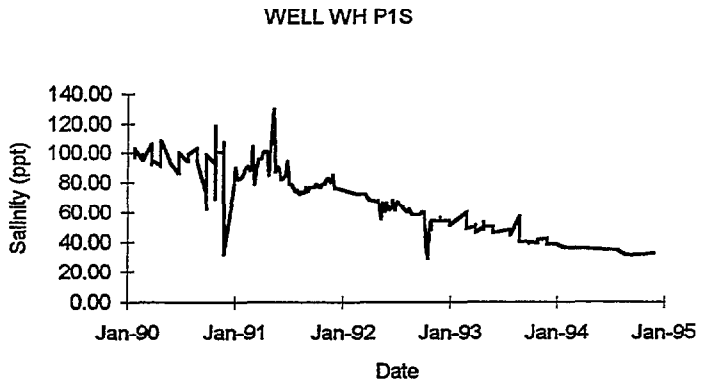
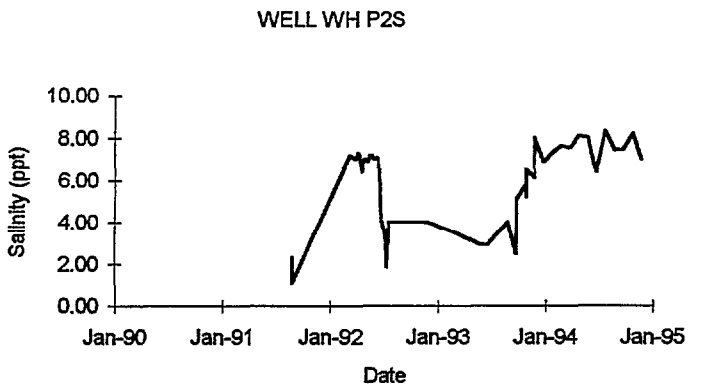


Figure 6-7. West Hackberry Ground Water Monitoring Wells





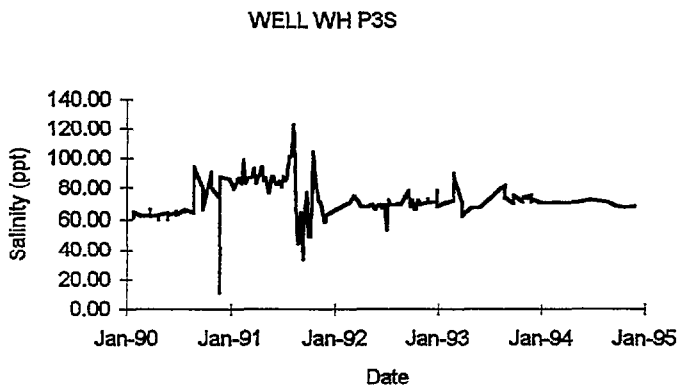


Figure 6-8.

West Hackberry Ground Water Monitoring Well Salinities

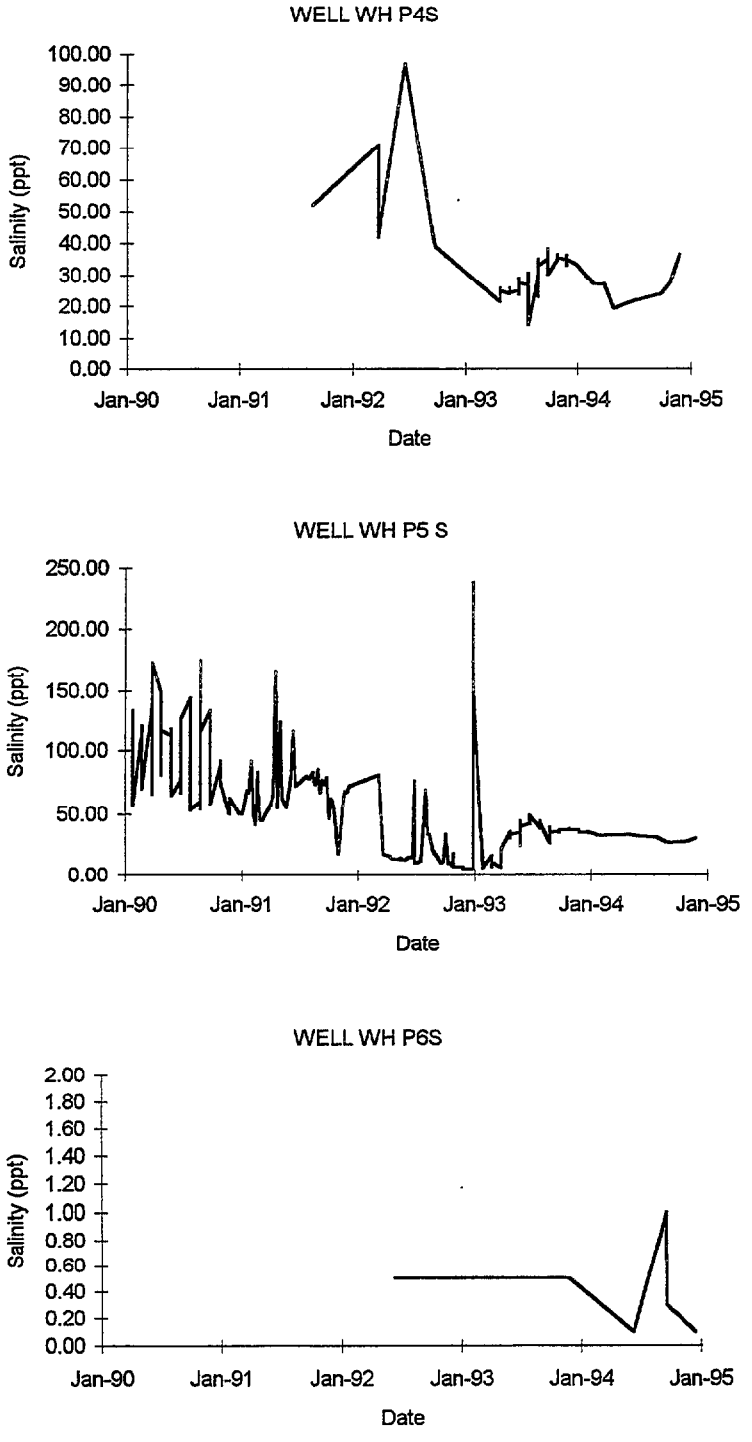
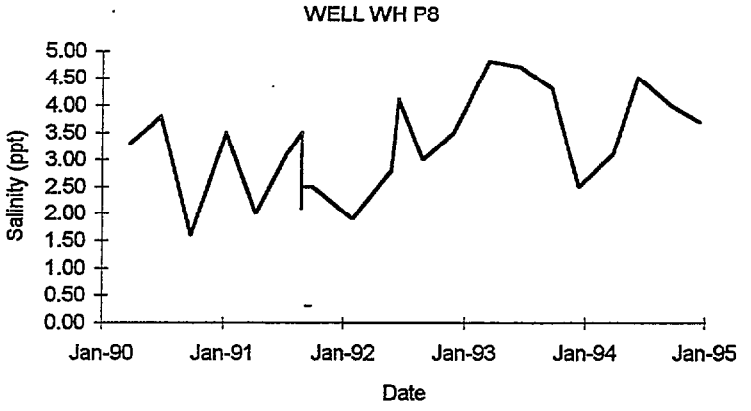
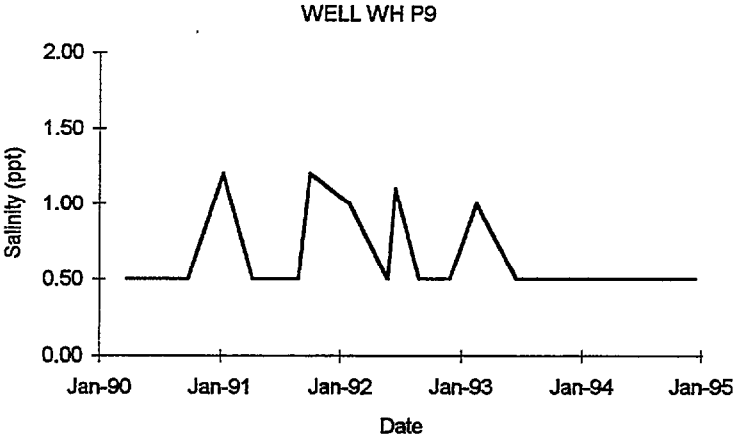


Figure 6-8 (Continued).

West Hackberry Ground Water Well Salinities





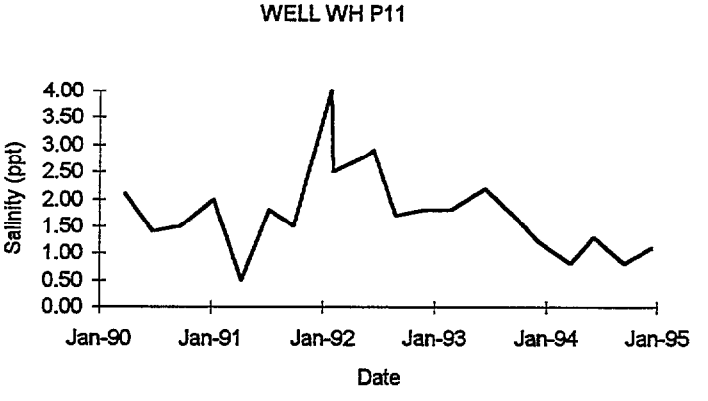
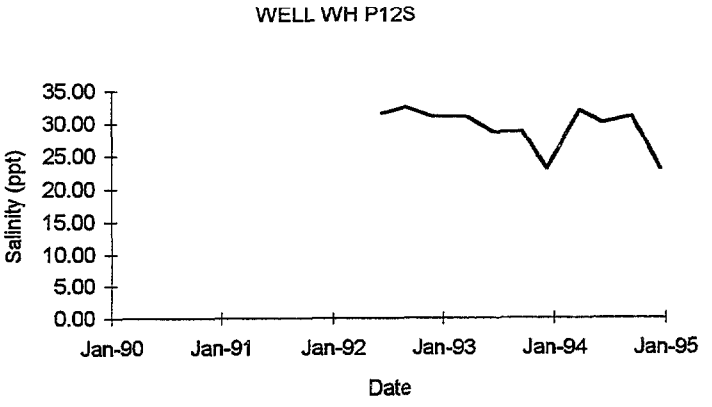
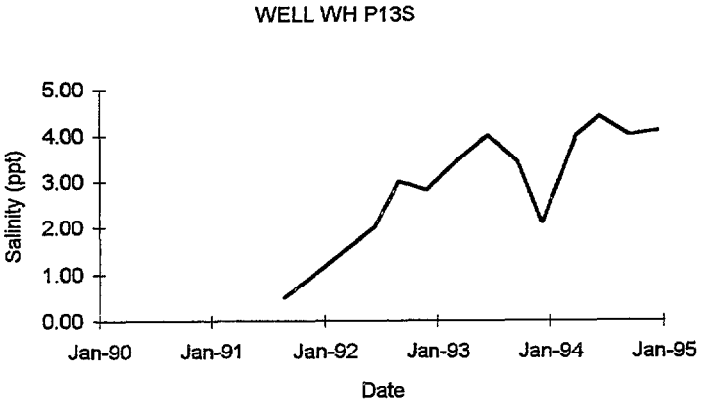


Figure 6-8 (Continued).

West Hackberry Ground Water Monitoring Well Salinities





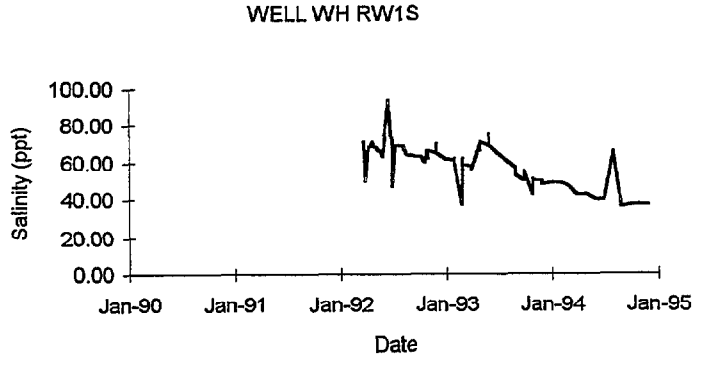
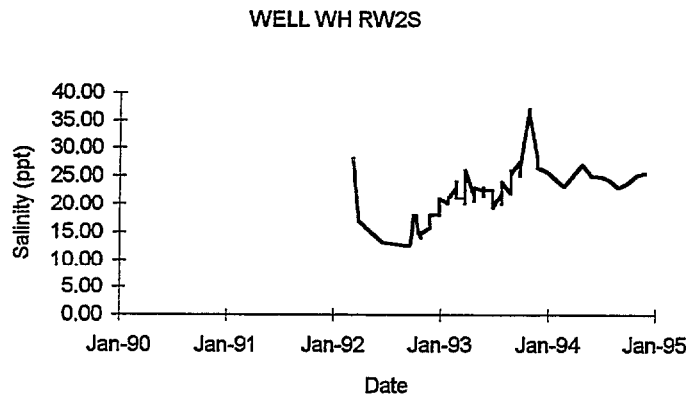
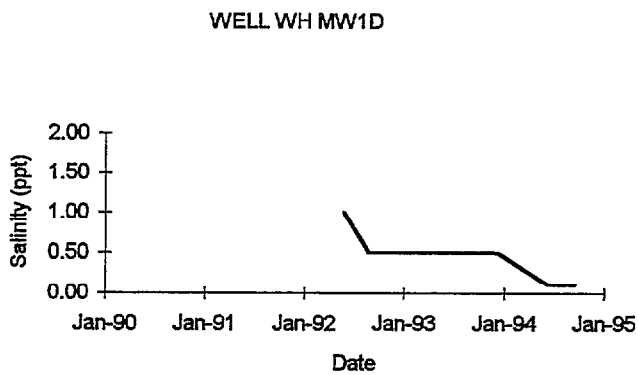


Figure 6-8 (Continued).

West Hackberry Ground Water Monitoring Well Salinities





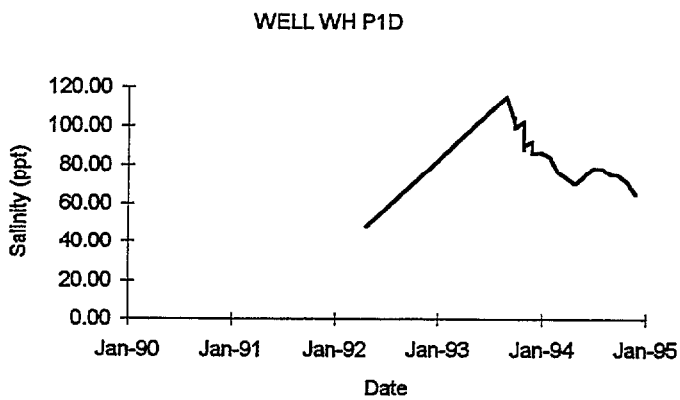
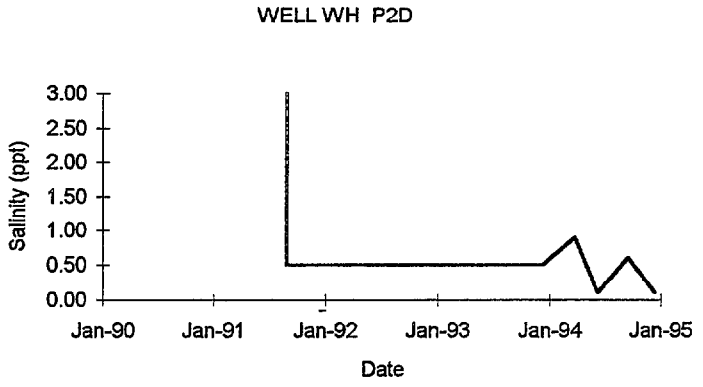
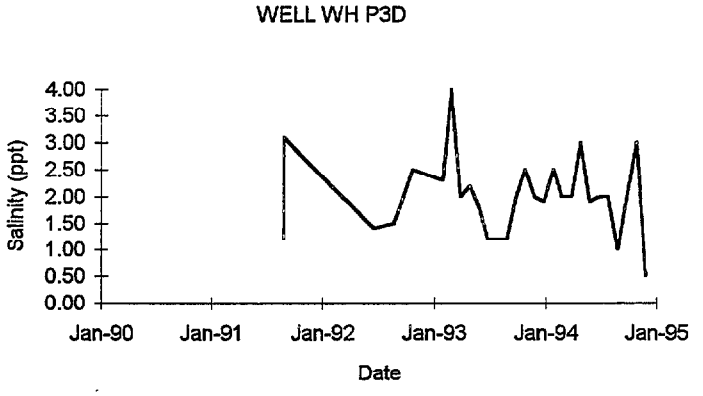


Figure 6-8 (continued).

West Hackberry Ground Water Monitoring Well Salinities





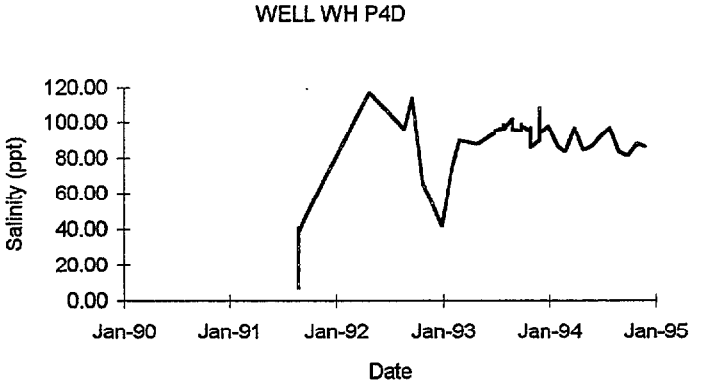
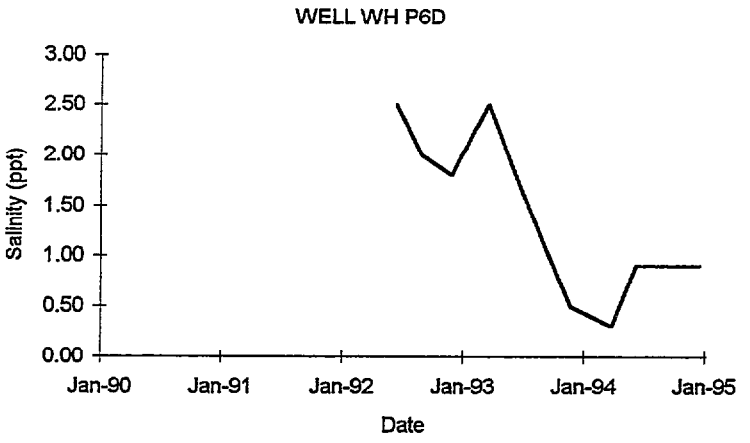
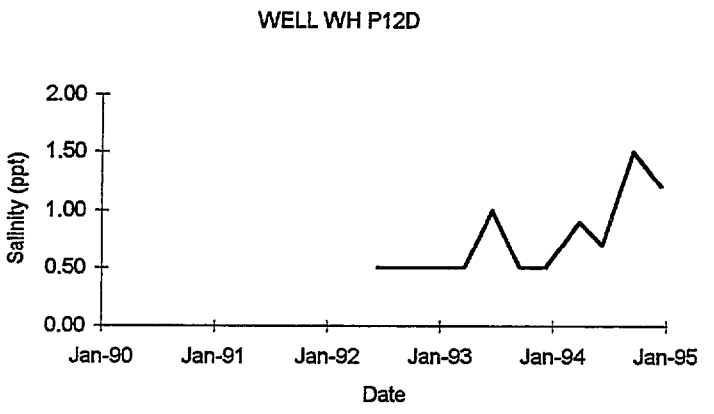


Figure 6-8 (continued).

West Hackberry Ground Water Monitoring Well Salinities





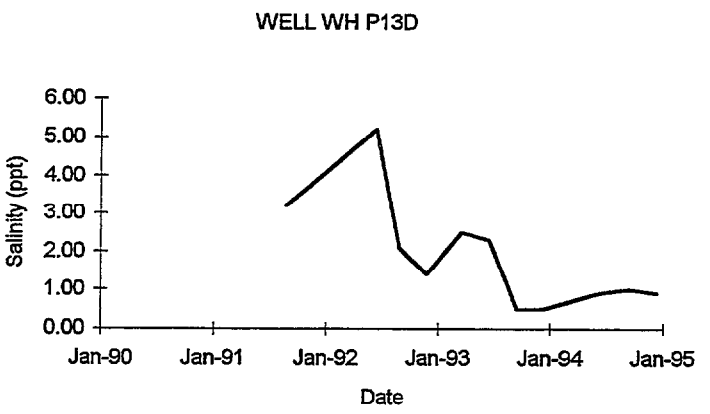
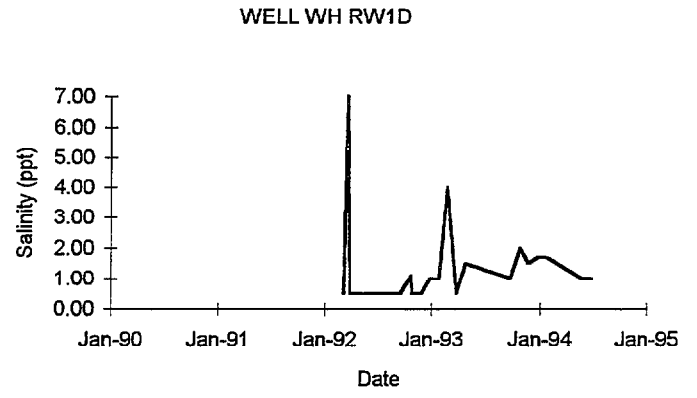
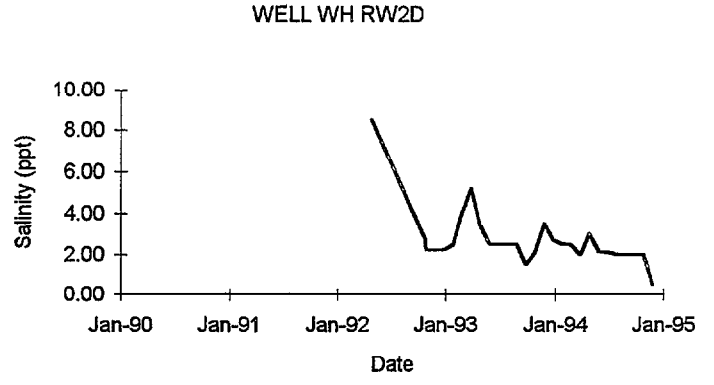


Figure 6-8 (continued).

West Hackberry Ground Water Monitoring Well Salinities





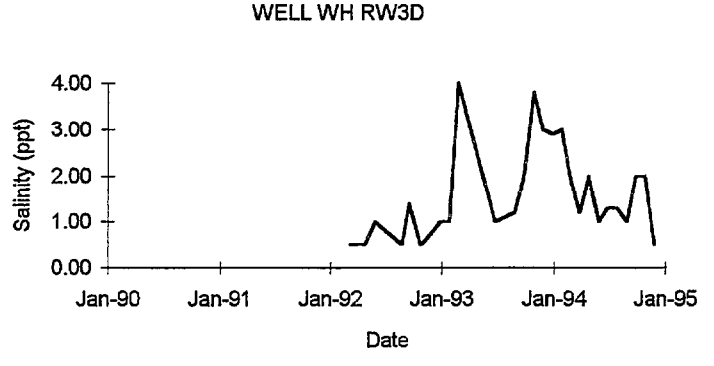
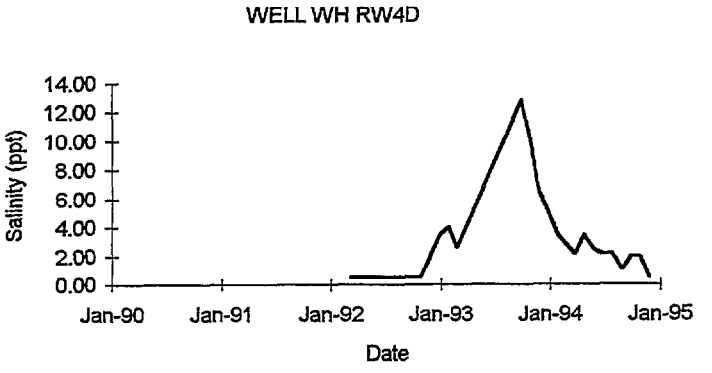


Figure 6-8 (continued).

West Hackberry Ground Water Monitoring Well Salinities



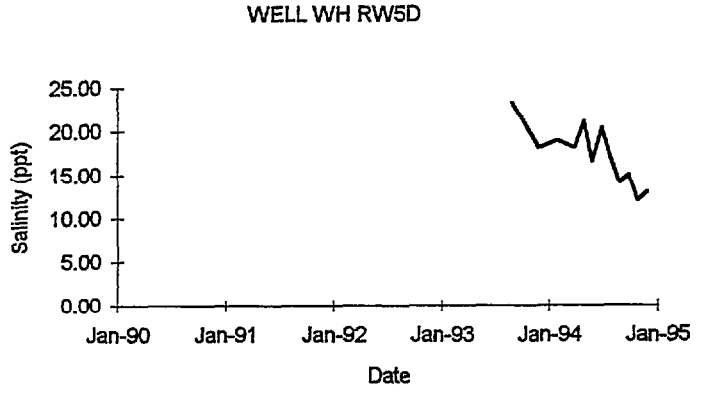


Figure 6-8 (continued).

West Hackberry Ground Water Monitoring Well Salinities

THIS PAGE INTENTIONALLY BLANK

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 Quality Assurance Assessments, Independent Internal Assessments, and audits at select sites by state and Federal environmental agencies.

7.1 INTERNAL ASSESSMENTS

Annual site self-assessments conducted during 1994 by site personnel were examined by NOLA environmental personnel through internal assessments. Internal assessments are conducted to evaluate the accuracy and scope of site self-assessments. Environmental discrepancies that were not captured by site self-assessments were identified as findings in the internal assessments.

Findings fall under Categories I, II, and III. The Category I classification addresses situations that present an immediate danger to the environment and must receive immediate attention. The Category II classification addresses deviation from federal, state, or local regulations, permits, or a major deviation from a DOE Order. These situations do not present a clear and present danger to the environment. The Category III classification addresses minor deviation from a DOE order, policy or procedure, and best management practice.

All 1994 findings from internal assessments fell under categories II and III. Category II findings were primarily administrative in nature and disclosed no significant environmental damage. Category III findings addressed needed improvements as best management practices. Table 7-1 is a tabulation of findings during 1994. Appropriate corrective actions have been scheduled.

Table 7-1. SPR 1994 INTERNAL ASSESSMENT FINDINGS

SITE	CATEGORY I	CATEGORY II	CATEGORY III
Bayou Choctaw	0	2	5
Big Hill	0	1	3
Bryan Mound	0	2	4
St. James	0	0	0
Weeks Island	0	0	1
West Hackberry	0	1	3

7.2 FIELD QUALITY CONTROL

All field environmental monitoring and surveillance activities are performed in accordance with standard procedures which are maintained in the contractor's Laboratory Programs and Procedures Manual and the Environmental Monitoring Plan. The former will be completed in July 1995. These procedures include maintenance of chain-of-custody, collection of quality control (QC) samples, and field documentation.

7.3 EPA DISCHARGE MONITORING REPORT QUALITY ASSURANCE STUDY

The EPA entered the 14th year of its Discharge Monitoring Report Quality Assurance Laboratory Performance Evaluation program (DMR-QA LPE). Through this program EPA ensures verifiable and consistent data generation by providing analytical laboratories of major NPDES dischargers blind samples for analysis of permit parameters. The Big Hill, Bryan Mound, and West Hackberry sites, classified as major dischargers, participated in the study in 1994.

7.4 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 7-2. Several hundred of these quality assurance analyses were performed in addition to the 1994 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 manual quality control chart preparation.

7.5 CONTROL OF SUBCONTRACTOR LABORATORY QUALITY ASSURANCE

The M&O Contractor sub-contracts some of the required analytical work the SPR laboratories perform. The Laboratories Programs and Procedures Manual contains mandatory guidelines by which such contracts must be prepared. In addition, procurement documents are reviewed by the respective laboratory staff and M&O Contractor Quality Assurance, Operations and Maintenance, and Environmental staff. Subcontractor laboratory service vendors are selected from an approved vendors List, and the successful bidder undergoes periodic assessments by the M&O Contractor Quality Assurance and Operations and Maintenance Groups.

Table 7-2. SPR WASTEWATER ANALYTICAL METHODOLOGY

Parameter	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	Micro 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	
	D2579(A)	ASTM	Combustion - IR
	5310 (B)	SM-17	
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
Salinity	D4542-85	ASTM	Refractometric

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

American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Standard Methods for the Examination of Water and Wastewater. 18 ed. Washington, D.C.: American Public Health Association, 1992.

Faust, Samuel D. and Osman M. Aly. Chemistry of Natural Waters. Ann Arbor: Ann Arbor Science Publishers, 1981.

Louisiana Office of Water Resources. "State of Louisiana Water Quality Standards." 1984.

Reid, George K. and Richard D. Wood. Ecology of Inland Waters and Estuaries. Second ed. New York: D. Van Nostrand Company, 1976.

Sandia National Laboratories. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Bryan Mound Salt Dome. SAND80-7111. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Weeks Island Salt Dome. SAND80-1323. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report West Hackberry Salt Dome. SAND80-7131. October 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Bayou Choctaw Salt Dome. SAND80-7140. December 1980; available from National Technical Information Service.

_____. Strategic Petroleum Reserve (SPR) Geological Site Characterization Report Big Hill Salt Dome. SAND81-1045. September 1981; available from National Technical Information Service.

Texas Department of Water Resources. Texas Surface Water Quality Standards. April 1981.

_____. Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana. July, 1994. U.S. Department of Energy.

_____. Finding of No Significant Impact for Environmental Assessment of Oil Degasification at Four Strategic Petroleum Reserve Facilities in Texas and Louisiana. September, 1994. U.S. Department of Energy.

_____. Final Environmental Impact Statement, Strategic Petroleum Reserve, Seaway Group Salt Domes. 3 vols. June 1978; available from National Technical Information Service.

_____. Final Environmental Impact Statement, Strategic Petroleum Reserve, Capline Group Salt Domes. 4 vols. July 1978; available from National Technical Information Service.

_____.
_____Final Environmental Impact Statement, Strategic Petroleum Reserve, Texoma Group Salt Domes. 5 vols. November 1978; available from National Technical Information Service.

_____. Final Supplement to Final Environmental Impact Statement, Strategic Petroleum Reserve, Phase III Development, Texoma and Seaway Group Salt Domes. October 1981; available from National Technical Information Service.

U.S. Environmental Protection Agency. Quality Criteria for Water. July 1976; available from U.S. Government Printing Office.

_____. Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019 September, 1979; Cincinnati, Ohio: Office of Research and Development.

_____. Compilation of Air Pollutant Emission Factors, Supplement No. 12. April 1981; Research Triangle Park, N.C.: Office of Air Quality Planning and Standards.

_____. Methods for Chemical Analysis of Water and Wastes EPA-600/4-79-020. Revised March, 1983; Cincinnati, Ohio: Office of Research and Development.

_____. Air Pollution Engineering Manual. 3rd edition, September, 1985. Method AP-42; Research Triangle Park, N.C.: Office of Air Quality Planning and Standards.

THIS PAGE INTENTIONALLY BLANK

DISTRIBUTION

This report is distributed widely by the Department of Energy's Strategic Petroleum Reserve Project Management Office to local, state, and federal government agencies, the Congress, the public, and the news media.