U.S. DEPARTMENT OF ENERGY

STRATEGIC PETROLEUM RESERVE
PROJECT MANAGEMENT OFFICE
NEW ORLEANS, LOUISIANA

Site Environmental Report
for
Calendar Year 1996

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

Distribution:

SITE ENVIRONMENTAL REPORT FOR 1996 - STRATEGIC PETROLEUM RESERVE

Enclosed for your information is a copy of the Site Environmental Report for Calendar Year 1996 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 1996 environmental monitoring program.

If you have any questions or desire additional information, please contact Dr. Brent Smith of the Project Management Office Environmental, Safety and Health Division at (504) 734-4970.

Sincerely,

William C. Gibson, Jr.
Project Manager

Enclosure

QUESTIONNAIRE/READER COMMENT FORM

The 1997 Strategic Environmental Report, slated for publication in 1998, 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: _____

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Organization (if applicable): _____

Comments:

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(Attach other sheets as needed)
(for originator's use)

Subject Matter Expert (SME): _____ Date: _____

SME's Response: _____

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STRATEGIC PETROLEUM RESERVE

SITE ENVIRONMENTAL REPORT

FOR

CALENDAR YEAR 1996

Document No. ASE5400.52 Rev. AO

Prepared for the U. S. 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

DISCLAIMER

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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	aboveground 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
BMP	best management practices
BOD_5	five day biochemical oxygen demand
CAA	Clean Air Act
CAP	corrective action plan

ABBREVIATIONS AND ACRONYMS (continued)

°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
CMD	Coastal Management Division
CO	carbon monoxide
COD	chemical oxygen demand
COE	United States Army Corps of Engineers
CV	coefficient of variation
CWA	Clean Water Act
CX	categorical 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 Transportation

ABBREVIATIONS AND ACRONYMS (continued)

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
GALCOE	U.S. Army Corps of Engineers, Galveston Division
GLO	General Land Office
ha	hectare
HAP	hazardous air pollutant

ABBREVIATIONS AND ACRONYMS (continued)

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
LPDES	Louisiana Pollutant Discharge Elimination System
LPE	laboratory performance evaluation
LDNR	Louisiana Department of Natural Resources
LDOTD	Louisiana Department of Transportation and Development
LDWF	Louisiana Department of Wildlife and Fisheries
LWDPS	Louisiana Water Discharge Permit System
m^3	cubic meters
m/sec	meters per second

ABBREVIATIONS AND ACRONYMS (continued)

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

ABBREVIATIONS AND ACRONYMS (continued)

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 biphenyl
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
QC	quality control
RCRA	Resource Conservation and Recovery Act
RCT	Railroad Commission of Texas
RPX	recovery pump exercise

ABBREVIATIONS AND ACRONYMS (continued)

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 Terminal
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

ABBREVIATIONS AND ACRONYMS (continued)

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
VWS	verification well study
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 for the U. S. Department of Energy (DOE) Strategic Petroleum Reserve (SPR). The SER, provided annually in accordance with DOE Order 5400.1, serves the public by summarizing monitoring data collected to assess how the SPR impacts the environment. The 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 1996. Two of these highlights include decommissioning of the Weeks Island site, involving the disposition of 11.6 million m^3 (73 million barrels) of crude oil inventory, as well as the degasification of over 4.5 million m^3 (30 million barrels) of crude oil inventory at the Bayou Choctaw and Bryan Mound facilities. The decision to decommission the Weeks Island site is a result of diminishing mine integrity from ground water intrusion. Transfer of Weeks Island oil began in November 1995 with 10.9 million m^3 (68.9 million barrels) transferred by December 31, 1996. Degasifying the crude oil is a major pollution prevention initiative because it will reduce potentially harmful emissions that would occur during oil movements by three or more orders of magnitude. There were only four reportable oil and five reportable brine spills during 1996. Although the total volume of oil moved (received and transferred internally) was approximately 24.9 million m^3 (157.1 million barrels), the total amount of oil spilled in 1996 was only 4.7 m^3 (29.5 barrels). The total volume of brine spilled was 179.7 m^3 (1,130 barrels). The longer term trend for oil and brine spills has declined substantially from 27 in 1990 down to nine in 1996. All of the spills were reported to appropriate agencies and immediately cleaned up, with no long term impacts observed.

The SPR's continuing efforts to improve the quality, cost effectiveness, and integration of environmental operations is consistent with the Code of Environmental Management Principles (CEMP). The SPR is incorporating CEMP's five environmental principles into an Integrated Safety Management System.

The SPR sites were inspected or visited on 13 occasions by outside regulatory agencies (Louisiana Department of Environmental Quality, Railroad Commission of Texas, Texas General Land Office, Texas Department of Health, U. S. Coast Guard, and Texas Natural Resource Conservation Commission) during 1996. All issues and concerns raised were resolved without enforcement action. Fifteen minor noncompliances were self reported under state and federal discharge permits for all SPR sites during 1996, and one Notice of Violation (NOV), received for an oil spill at Bayou Choctaw, was subsequently dismissed by the U. S. Coast Guard. The SPR continues to address ground water contamination from the brine pond and buried piping at West Hackberry with positive results.

The SPR was the focus of a DOE Headquarters' Safety Management Assessment which included Environmental. The DOE team evaluated SPR New Orleans and the Bayou Choctaw site looking into three major areas: line management safety responsibilities and accountability, comprehensive safety management criteria, and competency of SPR personnel. Evaluation results were indicated by color, with red meaning "deficient," yellow "in need of improvement," and green "effective." During their out-briefing, the team reported that they had rated the SPR three greens out of three guiding principles and 10 of 12 criteria.

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 is not a hazardous waste treatment, storage, or disposal (TSD) facility. 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.

During 1995 DOE prepared an Environmental Assessment for leasing the St. James Terminal to private industry as a commercial terminal. The lease was awarded to the Shell Pipe Line Corporation with turnover of the custody of the terminal and its operations on January 31, 1997.

National Pollutant Discharge Elimination System (NPDES) permit renewal applications, found administratively complete by the Environmental Protection Agency (EPA) in late 1993 to early 1994, allow each site to continue to discharge. A renewal NPDES permit was issued for Bryan Mound in 1995, with the applications for the other sites still pending. Further, each SPR site operates in accordance with a Pollution Prevention Plan prepared in accordance with a separately issued general permit for storm water associated with industrial activity.

The SPR met its drill and exercise requirements for 1996 under the Oil Pollution Act of 1990 through the National Preparedness for Response Exercise Program (PREP).

DOE SPRPMO appraisal teams conducted formal annual visits to each site, except Bayou Choctaw, meeting with contractor management staff, reviewing environmental practices and performance indicators, and reviewing findings with management and operations (M&O) contractor staff. Internal M&O contractor environmental self-assessments at the SPR sites during 1996 identified a total of ten Environmental Category II findings (Administrative) and seven Environmental Category III findings (Best Management Practice). No findings indicated environmental degradation occurring.

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.

The SPR was the first government member of the Louisiana Environmental Leadership Pollution Prevention Program and the first DOE facility in the Texas Pollution Prevention Partnership. The vapor pressure management and crude oil degasification pollution prevention integrated planning and design initiative won the 1997 Governor's Award for Outstanding Achievement in Pollution Prevention for the State of Louisiana. The crude oil tank bottom reclamation activities won the 1997 DOE Pollution Prevention award for hazardous waste recycling. Several pollution prevention initiatives are discussed within this report.

The Questionnaire/Reader Comment Form located inside the front cover of this document may be utilized to submit questions or comments to the originator for response.

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1. INTRODUCTION

The purpose of this SER is to present a summary of environmental data gathered at or near SPR sites to characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts.

The creation of the 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.

During 1996, the SPR consisted of five 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). The Weeks Island site is undergoing decommissioning, and its inventory is being transferred to the Big Hill and Bayou Choctaw sites. The St. James Terminal is now under commercial lease as of January 1997. The SPR employed approximately 1,150 government and contractor personnel at these facilities during 1996. Figure 1-1 is a regional map showing the relative location of SPR facilities.

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 Lake Charles refineries (via the Texas 22 pipeline), 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. Section 5, Figures 5-1 through 5-7, provide the site-specific configurations.

Each site's crude oil storage capacity and 1996 year-end inventory is illustrated in Table 1-1.

Table 1-1. Site Storage Capacities/Inventories

Site	Capacity	Inventory (Dec 31, 1996)
BC	11.9 million m^3 (75 mmb)	10.4 million m^3 (66.0 mmb)
BH	25.4 million m^3 (160 mmb)	12.9 million m^3 (81.3 mmb)
BM	35.9 million m^3 (226 mmb)	34.6 million m^3 (217.8 mmb)
SJ	0.3 million m^3 (2 mmb)	102,544 m^3 (644,936 bbl)
WH	34.8 million m^3 (219 mmb)	31.2 million m^3 (196.5 mmb)
WI	11.1 million m^3 (70 mmb)	556,500 m^3 (3.5 mmb)

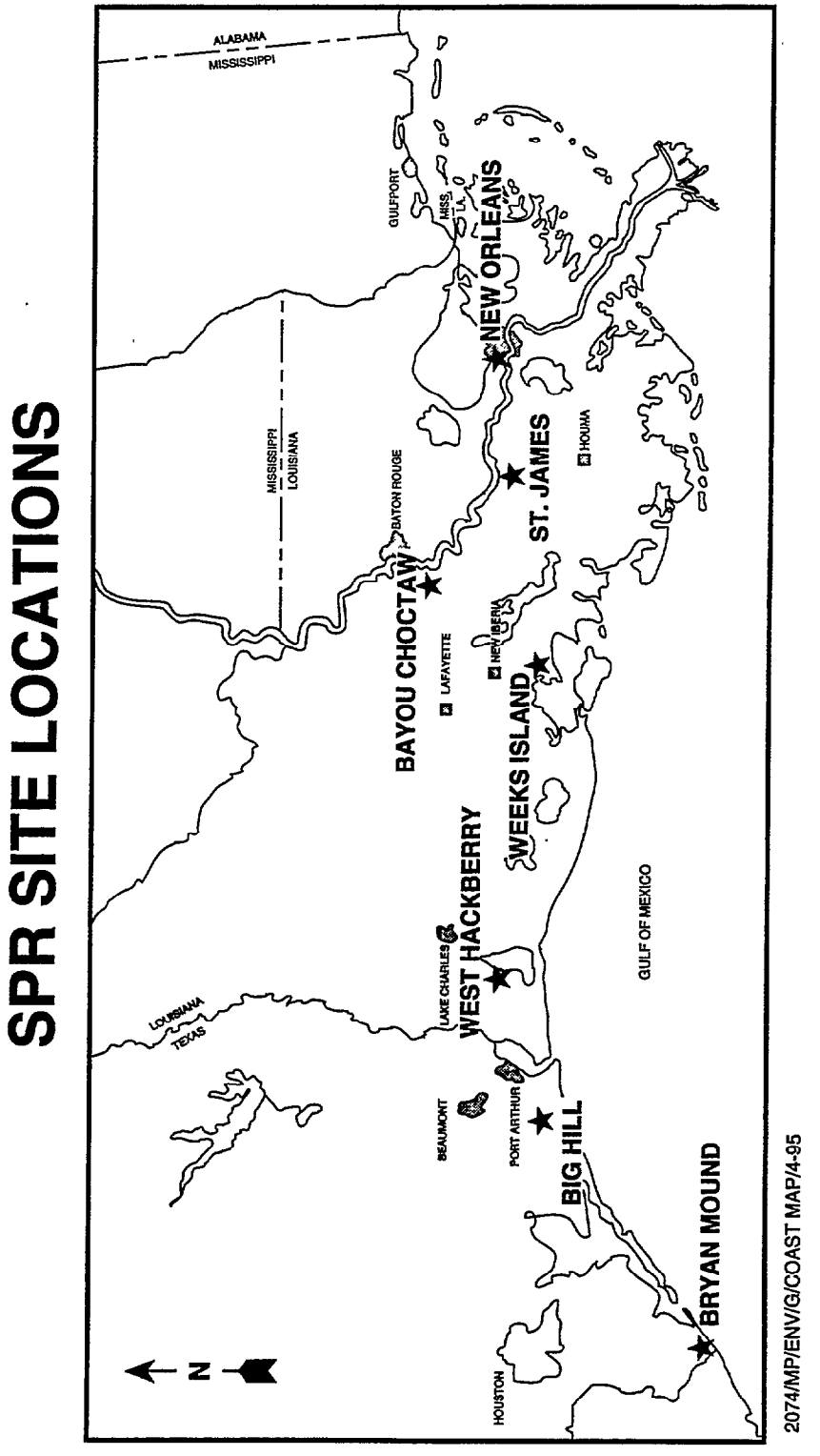

Figure 1-1. SPR Site Locations

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 hectares (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, which is 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 bald cypress, 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.

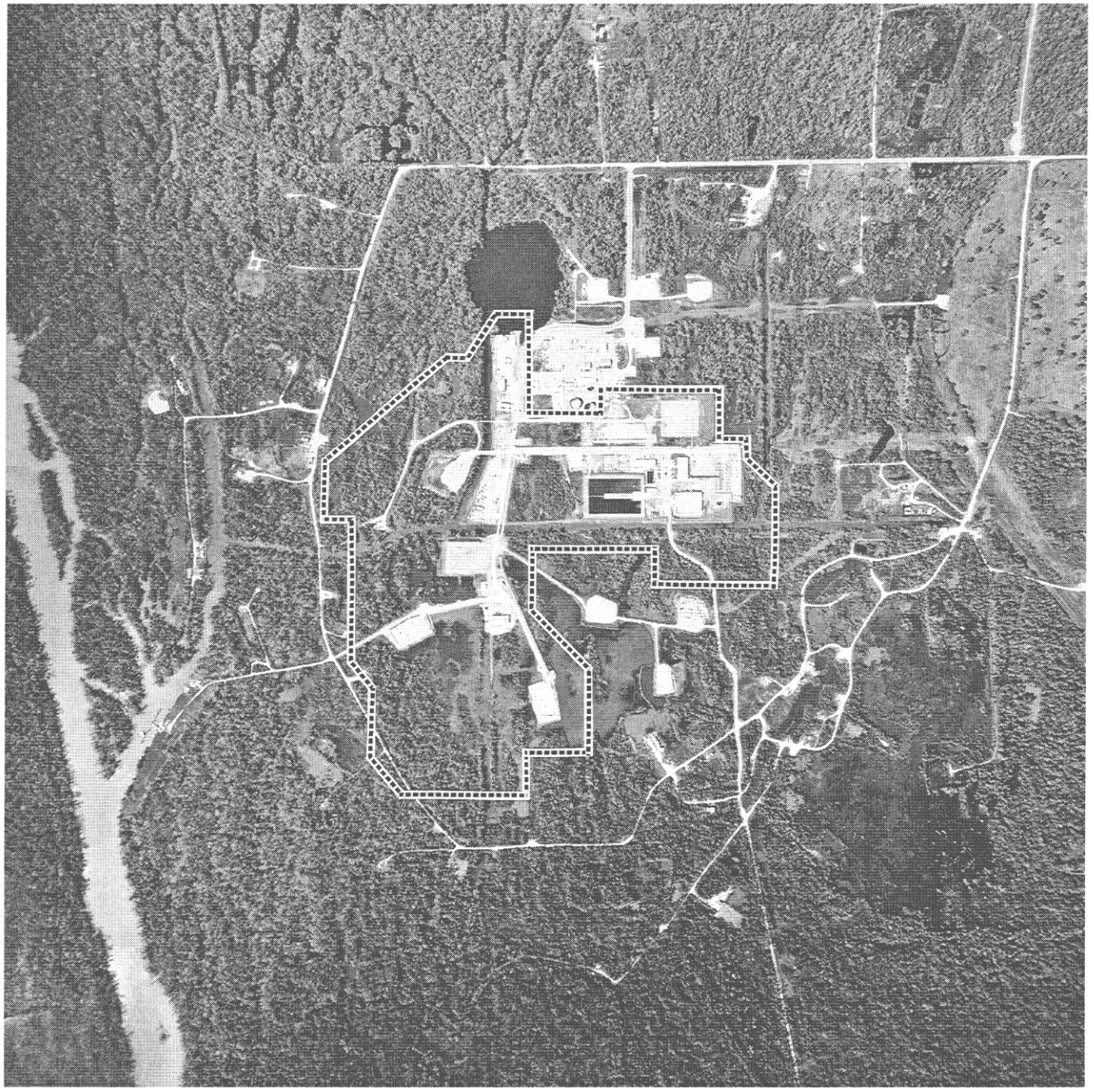

Figure 1-2. Bayou Choctaw SPR Site

Bird species common at Bayou Choctaw are heron, ibis, egret, woodpecker, wood duck, thrush, 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 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 site or along its pipeline right-of-ways. Inhabitants of the bottomland forest and swamp include opossum, squirrel, 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 Locks 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 11.9 million m^3 (75 mmb) of crude oil. The 1996 year-end inventory is 10.4 million m^3 (66.0 mmb). Currently, there are six solution-mined caverns at this storage site. An existing cavern, Number 18, was expanded by solution mining 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 3 km (2 mi) 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. This line was leased to Shell Pipe Line Co. early in 1997.

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 toward 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,

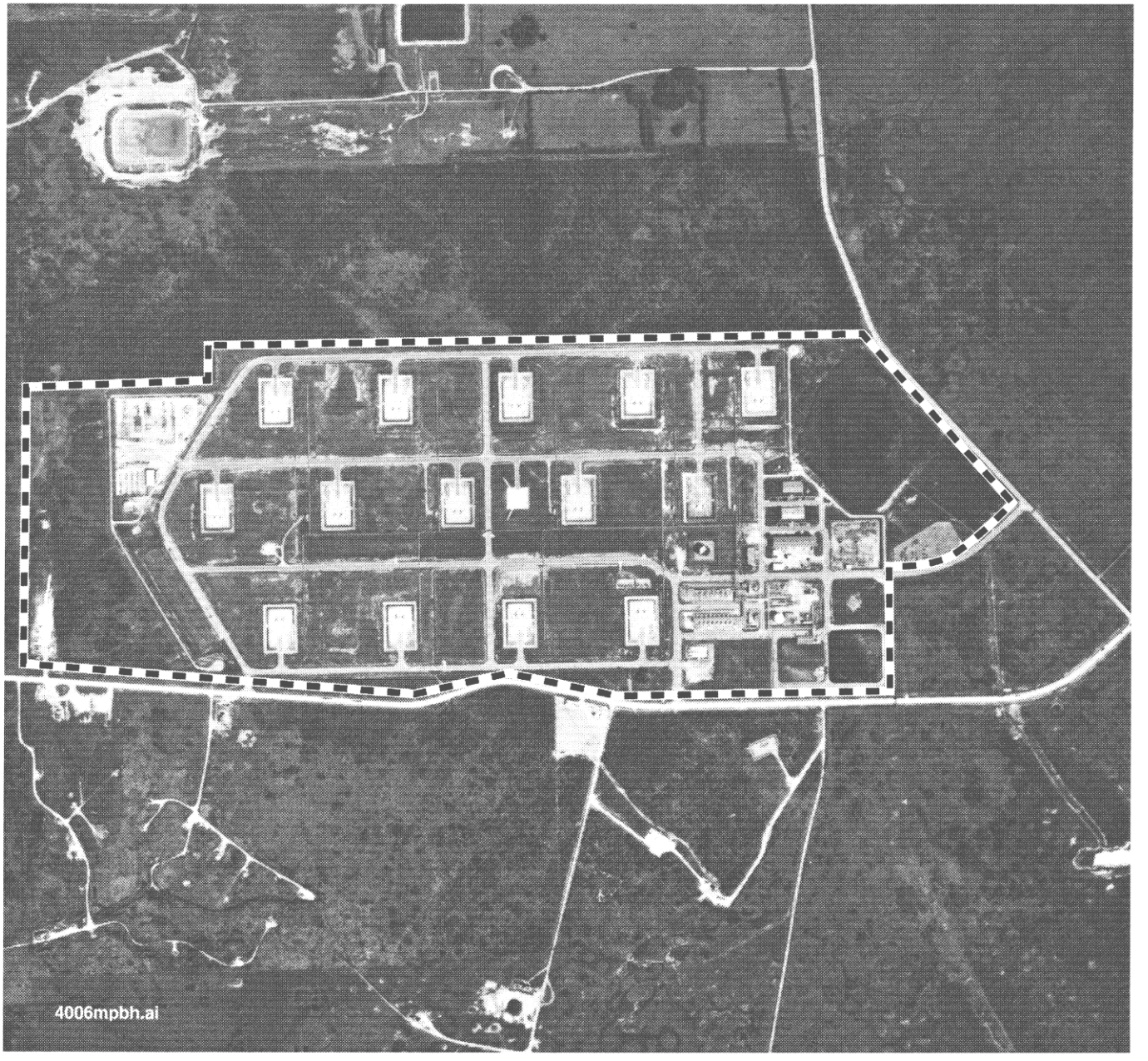

Figure 1-3. Big Hill SPR Site

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 the site. Identified bird concentrations and rookeries are about eight km (five mi) south and west of the 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), formerly Texas Water Commission, Coastal Regional Spill Response Map. The paddlefish, a state regulated species, has been identified in Taylor Bayou in the vicinity of the oil pipeline crossing. Fauna typical in the area include coyote, pocket gopher, rabbit, raccoon, rodents, snakes, turtle, and numerous upland game birds and passerines. The nearby ponds and marsh south of the site provide excellent habitat for the American alligator. The McFaddin National Wildlife Refuge located south of the site provides important habitat for over-wintering waterfowl.

The Big Hill site capacity is 25.4 million m^3 (160 mmb) of crude oil in 14 caverns, but the 1996 year-end inventory is 12.9 million m^3 (81.3

mmb). Appurtenant facilities include a raw water intake structure 8.4 km (5.2 mi) 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 (9.4 mi) onshore and 7.6 km (4.7 mi) offshore in the Gulf of Mexico, and a 39.3 km (24.4 mi) 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 sea water.

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

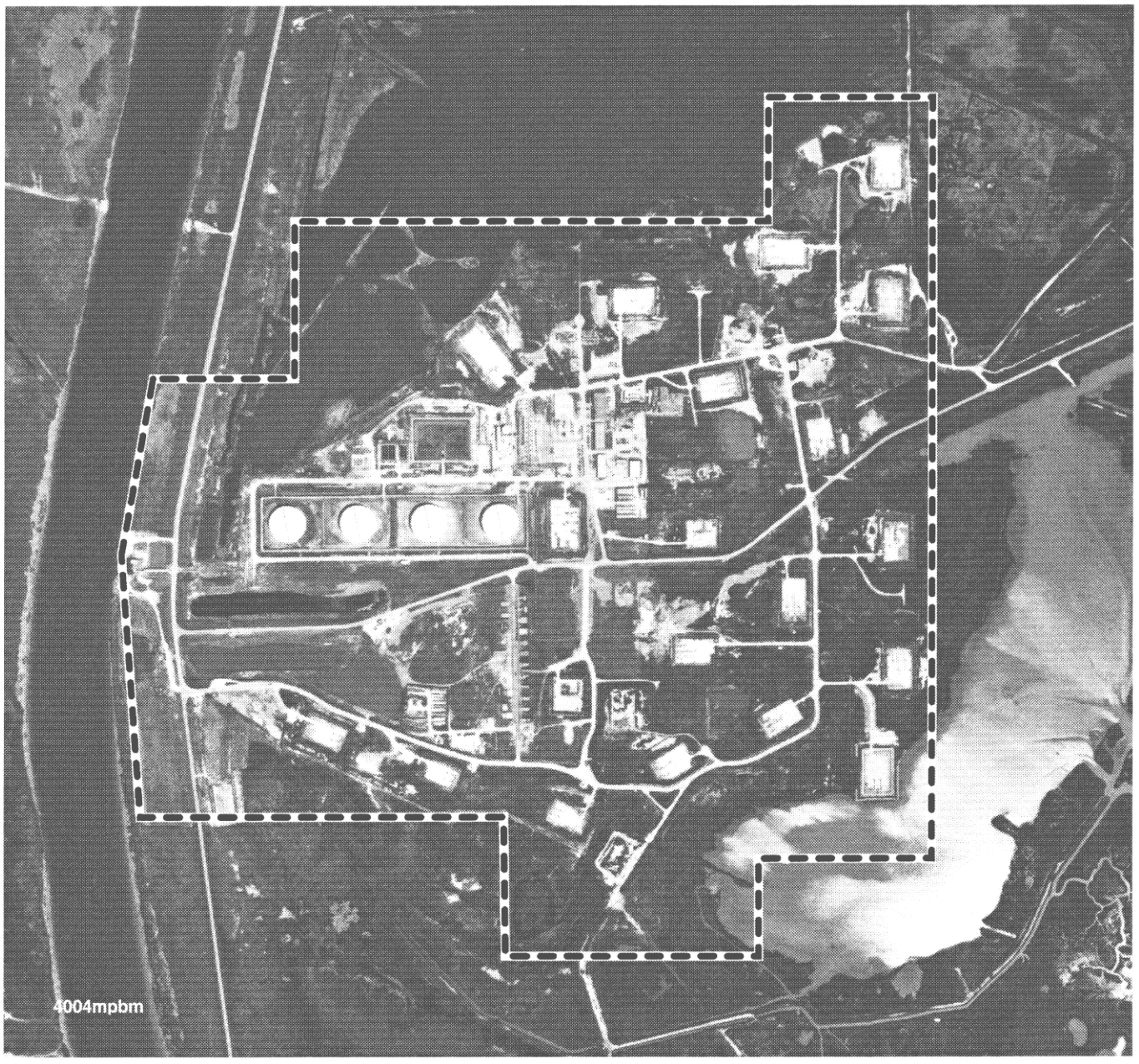

Figure 1-4. Bryan Mound SPR Site

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 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, rattlesnake, turtles, and frogs can be found on and in the area surrounding Bryan Mound. No federally endangered or threatened species are found on the 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, crab, 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. The 1996 year-end inventory is 34.6 million m^3 (217.8 mmb). Appurtenant facilities include a 61 cm (24 in) brine disposal pipeline extending 6.6 km (3.5 nautical mi) offshore into the Gulf of Mexico and 4.5 km (2.8 mi) 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.

1.4 ST. JAMES TERMINAL

During 1995 DOE prepared an Environmental Assessment for leasing St. James to private industry as a commercial terminal. The lease was awarded to the Shell Pipe Line Corporation with turnover of the custody of the terminal and its operations on January 31, 1997.

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 1996 year-end inventory is 102,544 m^3

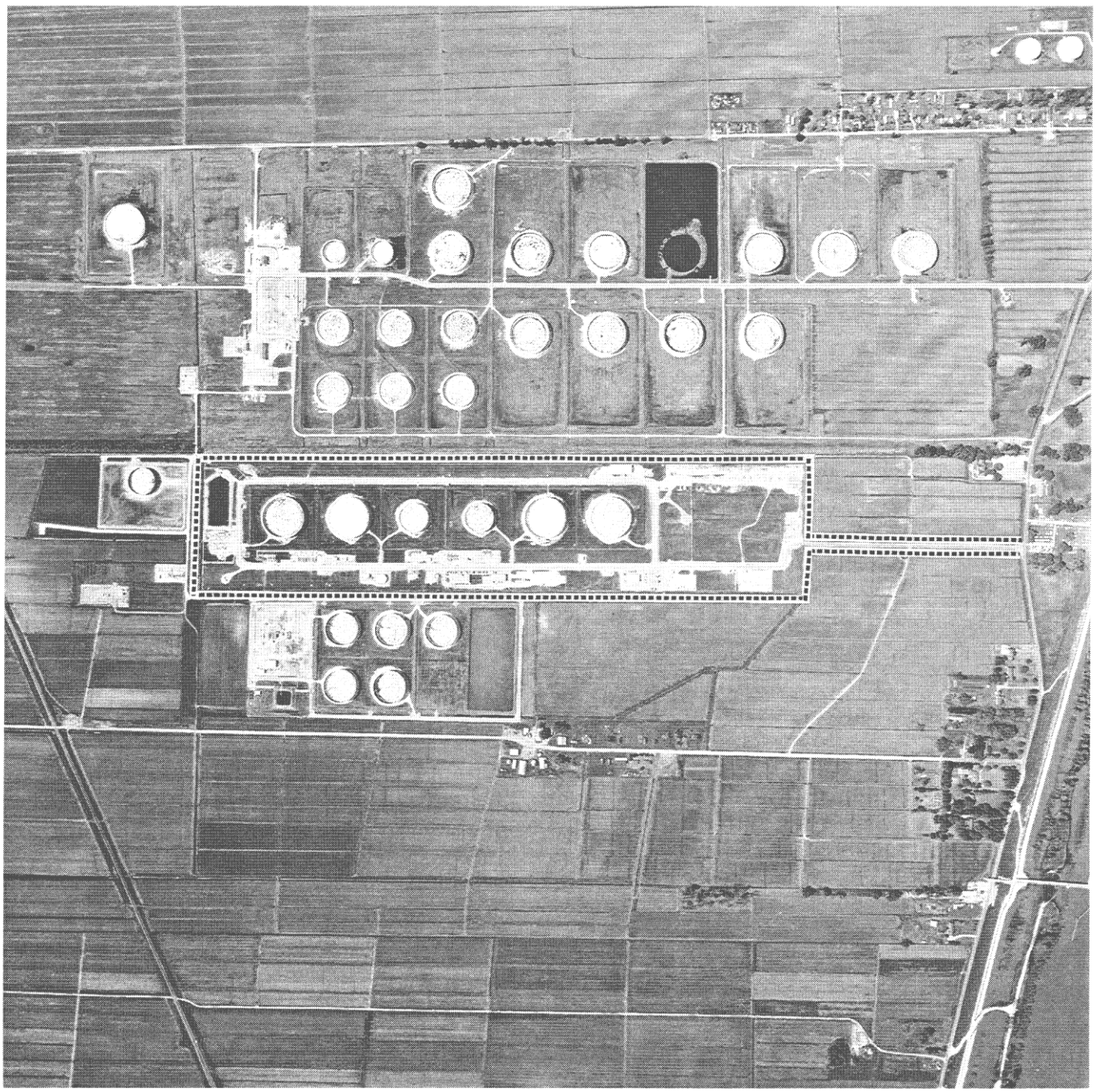

Figure 1-5. St. James SPR Terminal

(644,936 bbl). 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 Weeks Island to St. James pipeline is scheduled to be sold to Louisiana Interstate Gas during 1997, who will be converting the line to a natural gas pipeline. The Bayou Choctaw to St. James pipeline was leased to Shell early in 1997. The site is located on the right descending (west) bank of the Mississippi River, with the two docks central to a point about 158.2 river miles above the Head of Passes. This location is 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 the site; however, a southern bald eagle (endangered) was previously reported flying along the Mississippi River near the docks. Frogs, snakes, turtles, rabbit, raccoon, armadillo, muskrat, opossum, nutria, squirrel, egret, ibis, and heron can be found on the site and in the surrounding areas.

1.5 WEEKS ISLAND

DOE Headquarters announced on December 15, 1994, that the Weeks Island site will be decommissioned. Weeks Island began drawing down oil stocks in November 1995 and transferring them to Big Hill and Bayou Choctaw. Although the oil was, for the most part, removed in 1996, the de-commissioning process is expected to take in excess of three years to complete.

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 1-6, 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 1900s 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

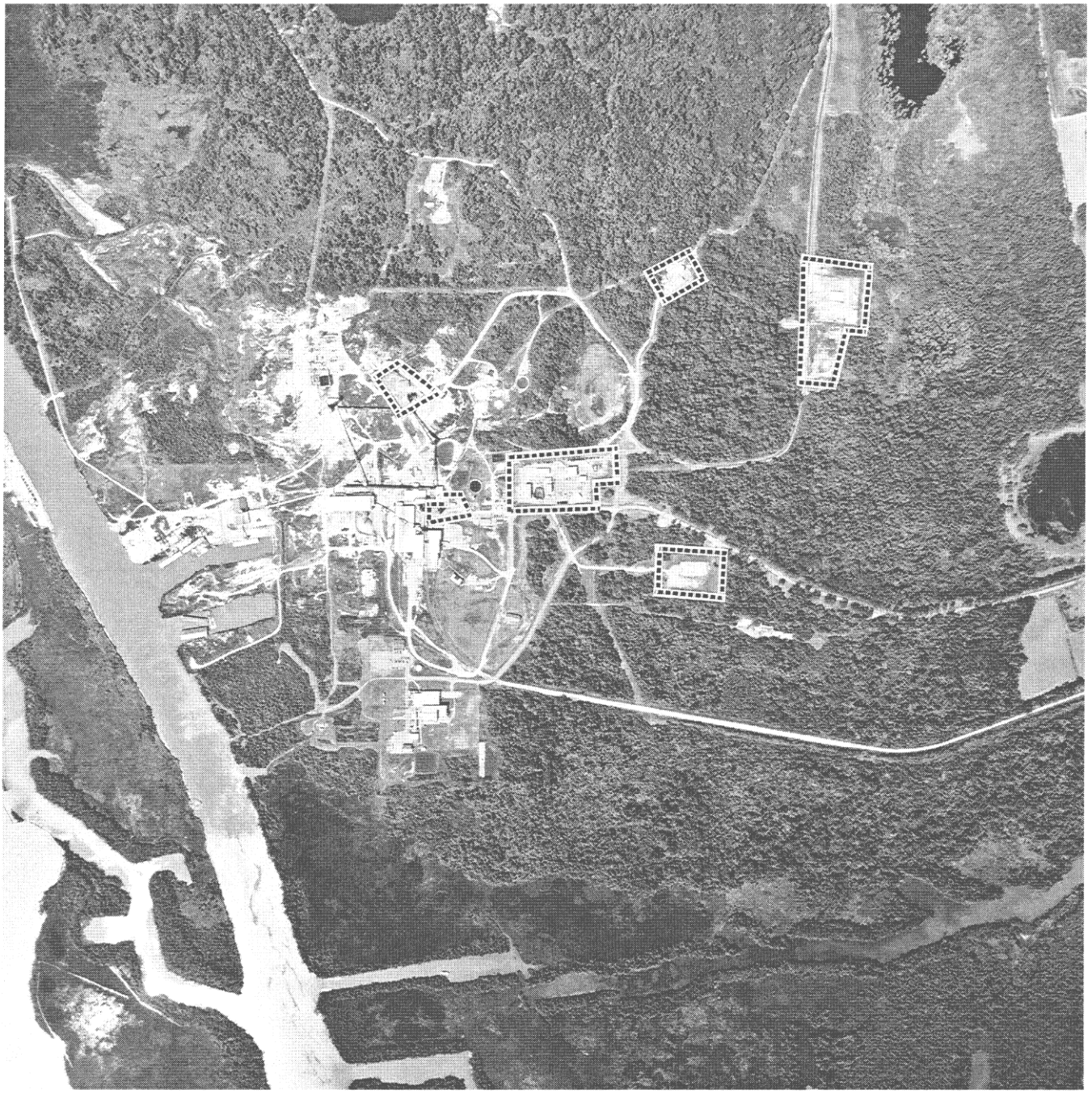

Figure 1-6. Weeks Island SPR Site

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 11.1 million m^3 (70 mmb) of crude oil storage capacity. The 1996 year-end inventory is 556,500 m^3 (3.5 mmb). 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. This line is being sold to an outside operator who is planning to convert it to a natural gas pipeline.

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. Gull, tern, heron, and egret 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, bat, squirrel, swamp rabbit, bobcat, white-tailed deer, and coyote. Weeks Island is the home of one of the densest breeding populations of the Louisiana black bear, which has been listed 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 48.2 km (30 mi) 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 are a breeding area for least terns. The American alligator occurs in the marshes adjacent to the site.

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

1.6 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, 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 1-7). The dome is covered by 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

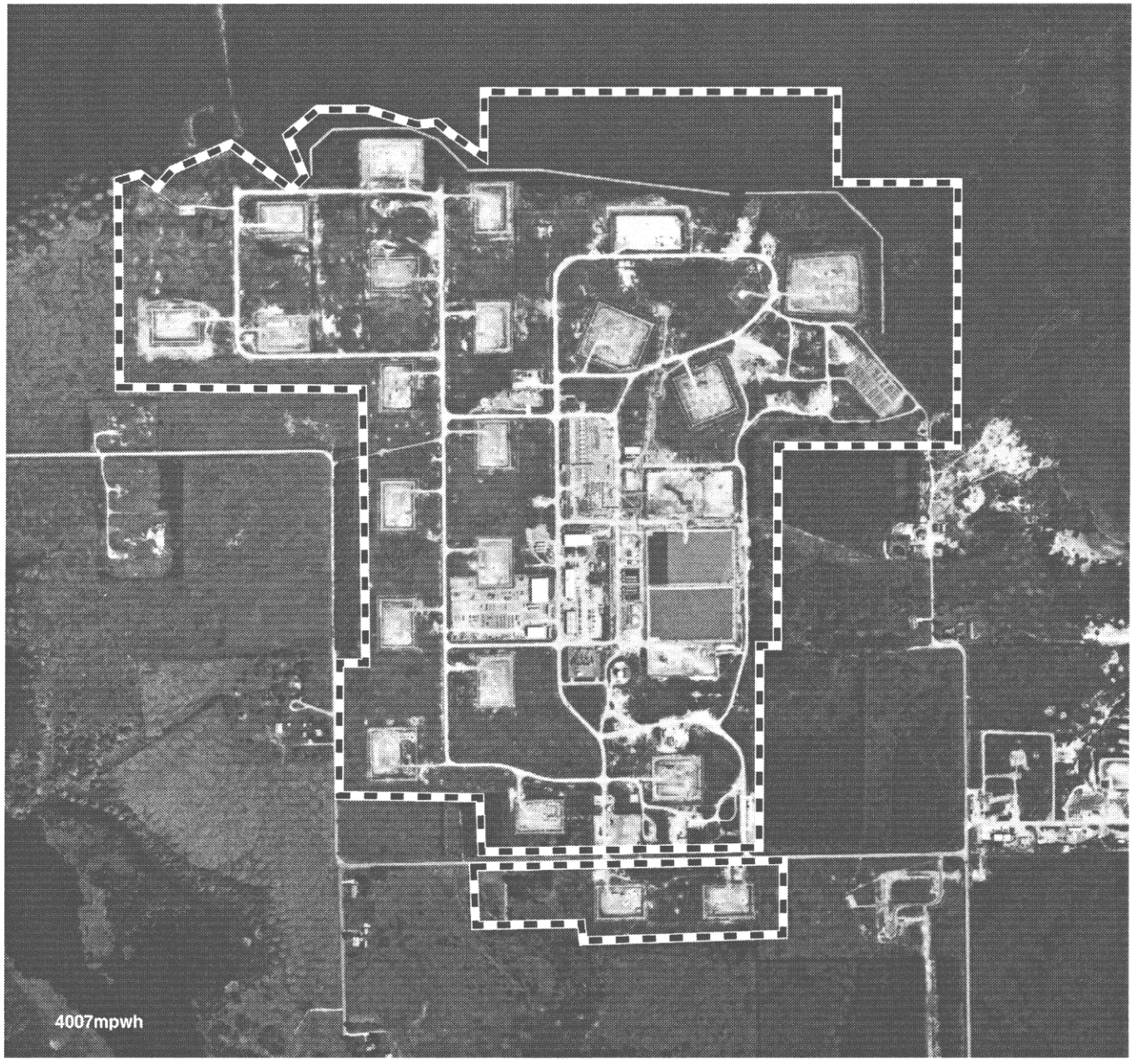

Figure 1-7. West Hackberry SPR Site

(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 the site and in the surrounding area of the West Hackberry site is dominated by Chinese tallow, willow, various oak species, and numerous species of marsh and upland grasses. The marsh lands surrounding West Hackberry and its appurtenant facilities provides excellent habitat for a variety of wetland species. This area is predominantly 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 pelican. These species also inhabit the lands through which the SPR pipelines pass.

Also inhabiting the area surrounding the West Hackberry site are snakes, egret, heron, migratory waterfowl, red-tailed hawk, red fox, raccoon, nutria, opossum, rabbit, and white-tailed deer. Aquatic inhabitants of Black Lake include crab, 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 the site.

The West Hackberry site will store 34.8 million m^3 (219 mmb) of crude oil in 22 solution-mined caverns. The 1996 year-end inventory is 31.2 million m^3 (196.5 mmb). 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 predominantly administrative with nearby warehouse capacity to augment project-wide equipment storage. Office space is rented, not owned, by the Department of Energy.

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2. COMPLIANCE SUMMARY

General

The SPR operates in conformance with standards established by federal and state statutes and regulations, Executive Orders, and Department of Energy (DOE) orders and directives. A list of environmental federal, state, and many of the DOE standards that, in varying degrees, affect the SPR is found in Appendix A.

The DOE Office of Strategic Petroleum Reserve, Fossil Energy, (OSPR FE) has overall responsibility for environmental monitoring, compliance, and protection activities at the SPR. The Project Manager, Strategic Petroleum Reserve Project Management Office (SPRPMO), is responsible for issuing and updating, as required, a General Environmental Statement (Appendix B) that reflects the statement of policy contained in DOE Order 5400.1 and provides broad environmental protection goals.

The SPR has had an Environmental Protection Program since its inception and initial operation. The Deputy Assistant Secretary for the SPR has delegated primary responsibility for implementation of the SPR Environmental Protection Program to the SPRPMO. The SPRPMO has delegated responsibilities for implementation of the program to the current Management & Operating (M&O) contractor, DynMcDermott Petroleum Operations Company (DM); the Architect-Engineering (A&E) contractor, Walk Haydel and Associates, Inc. (WHA); and SPR subcontractors. DM has been under contract to DOE since April 1, 1993.

The SPRPMO Environmental, Safety and Health (ES&H) division is responsible for development and oversight of ES&H programs and provides direction, technical guidance, and independent oversight to its prime contractors and architects and engineers in the implementation of environmental programs and assessment of contractor performance.

It is the SPR's policy and practice to conduct operations in compliance with all applicable environmental requirements with the highest regard for the protection and preservation of the environment. Compliance status in this year's report reflects compliance activities conducted by DOE and DM personnel.

The SPR plans to incorporate the following five broad principles of the Code of Environmental Management Principles (CEMP) into the implementation of an integrated safety management system:

1. management commitment;
2. compliance assurance and pollution prevention;
3. enabling systems;
4. performance and accountability; and
5. measurement and improvement.

This approach to integrating the protection of workers, the public, and the environment is in the first phase of implementation. Additionally, site decommissioning and life extension include environmental management planning based on the principles of ecosystem management and sustainable development.

A summary of the programs and procedures that presently make up the SPR Environmental Protection Program are:

a. inspections, appraisals, assessments, and surveillance which provide regular monitoring to ensure compliance with regulatory and policy requirements;
b. a non-routine reporting program directed toward notification of oil, brine, or hazardous substance spills, or noncompliant effluent emissions, to identify the impact of such spills or emissions on property and the environment, and to comply with regulatory requirements;

c. a routine reporting program directed toward fulfilling self-reporting obligations under water, air, and waste permits and regulations;
d. a permit monitoring program to ensure compliance with all permit requirements and limitations, onsite operations and maintenance activities;
e. an environmental monitoring program to detect any possible influence the SPR might have on surface waters and ground waters on or near SPR sites and to provide a baseline in the event of an environmental upset;
f. a discharge procedures used by each site when releasing liquid from any authorized containment or control system;
g. an environmental training program to ensure that applicable personnel are aware of environmental laws and regulations, trained in oil and hazardous material spill prevention, and safe handling of hazardous waste;
h. a pollution prevention program which focuses on source reduction of wastes, recycling, and proper disposal of all wastes produced on the SPR sites;
i. an underground injection control program mandated by the Safe Drinking Water Act (SDWA) to ensure sound operation of Class II underground wells/caverns for brine disposal or hydrocarbon storage to protect aquifers; and
j. regulatory review program for new environmental requirements.

Regulatory

The principal regulatory agencies responsible for enforcing environmental regulations at SPR facilities 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 facility operations, and oversee compliance with regulations.

Executive Orders (E. O.)

The SPR follows and operates in conformance with numerous Executive Orders applicable to its operation. Two of the major orders include Federal Compliance with Pollution Control Standards (E.O. 12088) and Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements (E. O. 12856).

DOE Orders/Directives

The SPR follows and operates in conformance with numerous DOE Orders applicable to its operation. Two of the major orders include General Environmental Protection Program (5400.1) and National Environmental Policy Act (NEPA) Compliance Program (451.1). The orders establish some of the policies of the SPRPMO.

2.1 COMPLIANCE STATUS (JAN. 1, 1996 THROUGH DEC. 31, 1996)

Fifteen minor noncompliances with state and federal discharge permits for all SPR sites during 1996 were submitted to regulatory agencies under the permit self-reporting provisions. These are discussed further in Section 2.3. The U. S. Coast Guard issued one Notice of Violation for an oil spill at the Bayou Choctaw site. After subsequent evaluation by the Coast Guard, this Notice of Violation was rescinded. 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 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 on site, 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 1996.

The following sections highlight primary 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.

On August 27, 1996, Region VI USEPA granted LDEQ primacy for the NPDES program which includes responsibility for all compliance and enforcement actions relating to the discharge of water in the state of Louisiana. In the interim, both the administratively extended federal permits and the renewed (state) Louisiana Water Discharge Permit System (LWDPS) permits will be valid. The SPR has been informed that a single Louisiana Pollutant Discharge Elimination System (LPDES) permit will be issued by the state as each current LWDPS expires.

Applications for renewal of the NPDES permits were submitted for all sites in 1993 to EPA Region VI and found administratively complete in

1994. Region VI EPA issued a revised NPDES permit for the Bryan Mound site in order to incorporate the new brine disposal line. Region VI EPA has not renewed the other permits giving priority to other non-SPR facilities within the region because these sites are minor dischargers. All of the sites can continue to operate under their existing permits until the new permits are issued because they were found to be administratively complete.

The LDEQ had been unable to process the St. James state permit due to revised priorities. However, due to the lease of the St. James site to Shell Pipe Line early in 1997, the outstanding application was withdrawn as required as part of ownership transferal.

The SPR maintains a Louisiana-wide permit for discharge of hydrostatic test water from LDEQ, saving filing fees and increasing flexibility in support of site construction and maintenance activities.

Each SPR site has an SPCC plan that addresses prevention and containment of oil spills. During 1996, DM revised the SPCC plan for the Big Hill site and reviewed the plans for all the other sites. The Louisiana consolidated hazardous substance onsite provisions were included. All of the SPR spill plans are current in accordance with 40CFR112.

Pollution Prevention Act of 1990 (PPA)

Each SPR site operates in accordance with a Pollution Prevention Plan prepared in accordance with the EPA storm water general permits and similar Louisiana requirements. This multimedia document consolidates these regulatory agency requirements with the more

general DOE Order 5400.1 required Pollution Prevention Plan, and the related Waste Minimization and Solid Waste Management Plans.

Clean Air Act (CAA)

The six SPR sites comply with the applicable provisions of the CAA and State Implementation Plans (SIP). All of the SPR sites are located in attainment areas for all National Ambient Air Quality Standards (NAAQS) pollutants with the exception of ozone. St. James, Weeks Island, and West Hackberry are located in attainment areas for ozone; therefore, they 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. None of the SPR facilities are considered to be major sources during normal operations under PSD, NSR, Title III hazardous air pollutant, or Title V operating permit regulations. All of the facilities operate in accordance with the provisions of the applicable state air permits.

An air permit modification application (addition or deletion of facilities) for West Hackberry submitted to the Louisiana Department of Environmental Quality in June 1995, was approved by LDEQ in March 1996. Also during 1996, an air permit modification application was submitted to LDEQ to install a replacement flare for the existing flare at Weeks Island. This replacement flare is more efficient and will require less fuel gas to burn the mine vent gas which will reduce the emissions from the mine while filling it up with brine during decommissioning of the mine. Approval by LDEQ is expected in 1997.

During 1996, degassing stored crude oil to reduce potential emissions from gassy oil continued. Degassing plants, designed to remove the

methane and ethane from selected crude oil inventories, were installed at Bryan Mound and West Hackberry in 1995 when operations began. During 1996, degassing operations continued at Bryan Mound while at West Hackberry, the plant finished operations and was moved to Bayou Choctaw in April 1996, where it was installed and degassing operations commenced. Degassing operations will continue at Bryan Mound for a total of three years. The degassing plant at Bayou Choctaw finished in September 1996 and was moved to Big Hill where operations commenced at the end of 1996. Since these degassing plants emit regulated pollutants (VOC, NO_x, SO_2, and HAPs) during their operational periods, additional air permits are being obtained prior to constructing and operating these plants at each site. The degassing units for Bryan Mound and Big Hill are being handled under TNRCC Standard Permits for processes that reduce emissions. The degassing units for West Hackberry and Bayou Choctaw were handled under an LDEQ Small Source permit.

There were numerous permit variance requests made to LDEQ during 1996. A permit variance request must be made to LDEQ when there is a likelihood that a change in a process (such as maintenance, upset condition, or other) will increase emissions over the permitted allowables. Associated with the decommissioning of the Weeks Island site, five variance requests totaling 276 tons of VOCs were made for the St. James Terminal in order to sell two million m^3 (12.6 mmb) of crude oil across the docks. The docks were permitted for less than 0.1 tons per year (tpy) in a standby mode. Two other permit variance requests associated with the decommissioning were made for Weeks Island to vent mine gas and operate the existing flare. Another variance request was made for West Hackberry to operate the emergency

generator for an extended period of time due to a planned electrical shutdown at the site.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The SPR has not needed to conduct response activities pursuant to this act. DOE Order 5480.14 required all DOE-owned sites to evaluate compliance with CERCLA. DOE Phase I and 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 and II reports were submitted to EPA Region VI, and all SPR sites are considered as No Further Remedial Action Plan (NFRAP) sites (although follow-on inspection is expected) to reflect the findings in the reports.

During April 1997, the Big Hill site underwent a CERCLA inspection by EPA contractors. The EPA inspectors were impressed with the site's cleanliness and waste minimization program, among other things. It was determined that the site does not have any open CERCLA issues, and the recommendation was made that "no further action be taken."

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. SPR sites do not submit EPCRA 313 (Form R) reports because they are

below the threshold limit that requires reporting. When the SPR exceeds the alternate threshold of one million pounds of benzene, EPCRA 313 reports will be submitted.

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. In Texas, brine pipelines which extend into the Gulf of Mexico are used for brine disposal, as well as ancillary commercial disposal wells. The 1996 Annual Report Form OR-1 was completed and submitted on schedule to the Louisiana Department of Natural Resources.

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. These ponds are scheduled to be replaced with aboveground tanks. The West Hackberry site 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. In 1993, LDNR issued a requirement to continue to monitor the wells for 30 years after closure of the permanent anhydrite disposal pits. This annual requirement is being met by the quarterly monitoring requirement for the brine pond CAP.

Monitoring at West Hackberry during 1996 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. The annual hydraulic evaluation and engineering inspection of the Bryan Mound brine pond was conducted in accordance with pond permit provisions, and the resulting report submitted to the RCT.

A baseline ground water survey was 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 II contamination verification survey was completed in 1996. The results of these studies are detailed in Section 6.7.

A program to develop pre-construction baseline ground water conditions prior to making post-decommissioning comparisons was initiated in 1996. This activity, designed specifically for the Weeks Island decommissioning, will first establish background and then provide long-term ground water monitoring assurance. Background conditions are currently being measured triennially until final skimming and brine backfill is completed in 1999. This activity currently involves four wells, and the program is referred to as Weeks Island Long-Term (WILT) monitoring.

Resource Conservation and Recovery Act (RCRA)

Enforcement responsibility for the hazardous waste program is delegated to both Louisiana and Texas. Non-hazardous SPR wastes associated with underground hydrocarbon storage activities continue to be considered under the corresponding state programs for managing drilling fluids, produced waters, and other wastes associated with the

exploration, development, production or storage of crude oil or natural gas. Other non-hazardous wastes generated at SPR facilities are managed in accordance with state solid waste programs. Hazardous wastes are managed in strict compliance with the delegated state hazardous waste programs. The appropriate waste management strategy is based on the results of waste stream characteristics.

In 1996, the SPR manifested hazardous waste from the Bayou Choctaw, Bryan Mound, St. James, and West Hackberry SPR sites for offsite incineration. The wastes consisted primarily of paint solvent and solids, solvent contaminated oils, and laboratory wastes. The SPR submitted notification forms of regulated waste activity to the EPA for all SPR sites. In 1996, accumulated monthly waste volumes exceeded the Louisiana SQG generator monthly limits once at Bayou Choctaw and once at West Hackberry and the Texas CESQG generator monthly limits once at Bryan Mound. West Hackberry operated as a large quantity generator (LQG) during 1996 as a carryover from large quantities generated in 1995; however, generation levels for 1996 were low enough to permit transition to an SQG in 1997.

During 1996, the SPR M&O Contractor initiated two corporate policies, Appendix B, stressing the SPR's commitment to manage waste and protect the environment.

Toxic Substances Control Act Construction (TSCA)

Friable asbestos construction materials were not found at SPR sites in 1996. The small amount of nonfriable asbestos (less than 1,000 lbs) in use on the SPR is disposed locally as it is taken out of service, in accordance with applicable solid waste regulations. No liquid-filled

electrical equipment or hydraulic equipment used on the SPR has been identified as PCB equipment or PCB contaminated under TSCA.

National Environmental Policy Act (NEPA)

Two hundred and twenty-five design reviews, scopes of work, and purchase requests were submitted for NEPA review action in 1996. None of these projects adversely affected any culturally sensitive resources such as structures of historic, archeological, or architectural significance or any threatened or endangered species or their habitat. Also, no environmentally sensitive areas or wetlands were adversely impacted as a result of these actions. All of these NEPA reviews resulted in categorical exclusions that did not require further action; therefore, no Environmental Assessments (EAs) or Environmental Impact Statements (EISs) were initiated during CY 1996.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

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

The SPR encompasses 748 hectares (1,849 acres) and uses approximately 2,700 kgs (6,000 lbs) of pesticides and herbicides to control weeds, insects, and rodents on the sites annually.

Endangered Species Act (ESA)

The Weeks Island site, along with neighboring facilities on the island, continued to coordinate 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 resident Louisiana black bears.

In a continuing effort to minimize disruption and provide suitable habitat and food supply to the existing wildlife and migratory birds in the Bryan Mound area, mowing of open fields during spring was limited to areas immediately along existing roads. This practice allowed for spring wildflower growth and seed development, and provided nesting areas for Black Ducks and other federally protected birds which nest near Bryan Mound. A bald eagle was observed soaring and engaging an osprey over the Bryan Mound site on several occasions during 1996.

National Historic Preservation Act (NHPA)

No site activities performed in 1996 required coordination with State Historical Preservation Offices. No places on or eligible to the National Register of Historic Places are located on or adjacent to SPR sites.

Oil Pollution Act (OPA) of 1990

SPR emergency programs, planning, and management are guided by OPA 90 regulatory standards for onshore storage facilities, pipelines, and marine terminal facilities. SPR site facility response plans have been developed to meet or exceed the requirement of OPA 90, and have been approved by the cognizant federal regulatory agencies.

The National Preparedness for Response Exercise Program (PREP) has been adopted and incorporated into the SPR Emergency Management exercise program since 1994. SPR sites conduct minor emergency drills or hands-on training each quarter. A staff of professional emergency management exercise personnel from DM New Orleans conduct two equipment deployment exercises at each site annually. In addition, an annual multiple site major emergency exercise is conducted to test overall SPR response readiness. This exercise includes the participation of public regulatory/governmental agencies.

The SPR has adopted the National Interagency Incident Management System (NIIMS), the response management system required by the National Oil and Hazardous Substances Pollution Contingency Plan. SPR site and New Orleans response management personnel have been trained in the Incident Management System, and a "Fly Away Team" of selected New Orleans personnel is available to support extended site emergency operations when needed.

Executive Order (E.O.) 12088 "Federal Compliance with Pollution Control Standards

In accordance with all applicable pollution control standards, the SPR complies with E.O. 12088 by implementing the SPR Pollution Prevention Plan. The plan includes goals for hazardous and non-hazardous waste reduction and for recycling.

Since 1994, the SPR has reduced hazardous waste generation by 75 percent down to two tons in 1996. New Orleans, Weeks Island, and St. James met the 1996 hazardous waste reduction goals. New Orleans, Bryan Mound, and West Hackberry met the 1996 paper

recycling goal. Fourteen pollution prevention cost analyses resulted in saving over $1.5 million. Over 4,000 documents received pollution prevention review. Pollution prevention was integrated into the SPR mission through policies, procedures, performance measures, and standards; updating goals/training; computerizing regulatory tracking; and self-assessment/continual improvement priority planning. The SPR was the first government member of the Louisiana Environmental Leadership Pollution Prevention Program and also the first DOE facility in the Texas Pollution Prevention Partnership. The SPR Louisiana sites have been selected to receive the 1997 Governor's Award for Outstanding Achievement in Pollution Prevention for implementing innovative processing techniques to reduce vapor pressure in stored crude oil and avoid generating 8,200 tons of air emissions during 1996. The SPR was also awarded the 1997 DOE Pollution Prevention award for hazardous waste recycling due to its crude oil tank bottom reclamation activities.

Clean Texas 2000 provides guidelines of an overall reduction of 50 percent or more by the year 2000 in the release of toxics and/or the generation of hazardous pollutants in Texas from 1987 levels. A reduction in the disposal of solid waste in landfills by as much as 60 percent by the year 2000 is also proposed. The SPR sites' specific achievable, measurable waste generation reduction goals satisfy Clean Texas 2000 guidelines.

Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements"

In response to Section 5-501 of E. O. 12856, all SPR sites were listed in the Potential Facilities Listing prepared by DOE on April 13, 1994, for potentially meeting reporting requirements under EPCRA Sections

304 and 311-312 requirements. SPR sites do not submit EPCRA 313 (Form R) reports because they are below the threshold limits that require reporting. When the SPR exceeds the alternate threshold of one million pounds of benzene, EPCRA 313 reports will be submitted. The SPR Pollution Prevention Plan has been implemented since 1993. The SPR has also developed and implemented site-specific emergency response plans. Compliance with E. O. 12856 is indicated in Table 2-1. Tables 2-2 through 2-7 provide a summary of 1996 SARA reporting for each site. Offsite SPR pipelines containing crude oil were reported separately from SPR sites (Table 2-8 and 2-9). There were no extremely hazardous substances in excess of the TPQ in 1996, negating the possibility of reportable releases.

Table 2-1. Compliance with Executive Order 12856

EPCRA 302-303: Planning Notification	Yes [ ]	No [ ]	Not Required [X]
EPCRA 304: EHS Release Notification	Yes [ ]	No [ ]	Not Required [X]
EPCRA 311: Material Safety Data Sheets	Yes [ ]	No [ ]	Not Required [X]
EPCRA 312: Chemical Inventory	Yes [X]	No [ ]	Not Required [ ]
EPCRA 313: TRI Reporting	Yes [ ]	No [ ]	Not Required [X]

Table 2-2. Louisiana SARA Title III Tier Two Summary at Bayou Choctaw

Chemical Name (Category)	* Max Daily Amount (lbs)	Location
Bromotrifluoromethane (Halon 1303)	1,000 - 9,999	Control room in Operations building
Chlorodifluoromethane (R22) or Freon 22	1,000 - 9,999	Degas plant
Crude oil, petroleum flammable and combustible liquid	> 1 billion	Six underground storage caverns in salt dome, site piping, and degas plant.
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Property tank #2, emergency generator fuel tank, and degas plant
Ethylene Glycol	10,000 - 99,999	Degas plant
FC-600 3M Light-water ATC/AFFF	10,000 - 99,999	Foam deluge and fire systems, foam storage building, and degas plant
Gasoline	10,000 - 99,999	Fuel tank
Insecticides, liquid, N.O.S.	1,000 - 9,999	Flammable storage building
Oil, flammable and combustible	10,000 - 99,999	Flammable storage and maintenance buildings, construction laydown
Paint, flammable or combustible	1,000 - 9,999	Flammable storage building
Propane or liquified petroleum gas	1,000 - 9,999	Degas plant
Sodium Chloride	1,000 - 9,999	H20 building
Sodium Hypochlorite	1,000 - 9,999	H20 building
Methyldiethanolamine	1,000 - 9,999	Degas plant

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

Table 2-3. Texas SARA Title III Tier Two Summary at Big Hill

Chemical Name (Category)	* Max Daily Amount (lbs)	Location
Ammonium bisulfite	10,000 - 99,999	Near brine pond
Crude oil, petroleum, flammable and combustible liquid	> 1 billion	Site tanks, piping, and underground storage caverns across the salt dome
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Fuel station, raw water intake structure, fire pump house, emergency generator tank
FC-600 3M Light-water ATC/AFFF	10,000 - 99,999	Fire truck, fire bay, storage north of 111
Gasoline	10,000 - 99,999	Fuel station
Oil, flammable and combustible	10,000 - 99,999	Warehouse, laboratory, raw water intake structure, maintenance laydown yard, and paint shed

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

Table 2-4. Texas SARA Title III Tier Two Summary at Bryan Mound

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liquid	> 1 billion	Site tanks, piping, underground storage caverns across the salt dome, and degas plant
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Fuel station, raw water intake structure, degas plant, and construction dike area
FC-600 3M Light-water ATC/AFFF	10,000 - 99,000	Fixed systems, foam storage, mobile units, and degas plant
Gasoline	10,000 - 99,999	Fuel station, construction dike area, and degas plant
Oil, flammable and combustible	10,000 - 99,999	Degas plant, construction dike area, construction tool shed, OPS pre-stage, property warehouse, guard force trailer #235-T, and I&E storage
Paints, flammable or combustible	10,000 - 99,999	Paint yard, Building 243, and bin outside of tool shed

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

Table 2-5. Louisiana SARA Title III Tier Two Summary at St. James Terminal

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Alkydimethylbenzylammonium Chloride in Methanol and Water	1,000 - 9,999	Pig trap
Bromotrifluoromethane (R-13B1 or H1301)	100 - 999	Control room in Operations building
Crude oil, petroleum flammable and combustible liquid	100,000,000 - 499,999,999	Six oil storage tanks, site piping and sumps
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Fuel station by Maintenance building, Dock #1 fire pumps, emergency generators/southside of fence, and fire pump east of fuel station
FC-600 3M Light-water ATC/AFFF	10,000 - 99,999	Fire truck bay, fire systems on main site and dock, foam trailer
Gasoline	10,000 - 99,999	Fuel station at Maintenance building area
Oil, flammable or combustible	1,000 - 9,999	Flammable storage building
Paint, flammable or combustible	1,000 - 9,999	Flammable storage building
Potassium bicarbonate	1,000 - 9,999	Fire truck bay
Thinners, flammable and combustible	100 - 999	Flammable storage building

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

Table 2-6. Louisiana SARA Title III Tier Two Summary at Weeks Island

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Bromotrifluoromethane (R-13B1 or H-1301)	10,000 - 99,999	Control room in Operations building and mine service shaft
Cement	100 - 999	Property drum storage, flammable storage building
Chlorodifluoromethane (R22) or Freon 22	100 - 999	Property storage warehouse
Crude oil, petroleum, flammable and combustible liquid	$\geq$ 1 billion	Underground storage cavern in salt dome and site piping
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Fuel station in laydown yard, emergency generators, fire water pump
FC-600 3M Lightwater ATC/AFFF	10,000 - 99,999	Fire truck, foam chariot, foam trailer, laydown yard, mainline pump building
Gasoline	10,000 - 99,999	Fuel station in laydown area
Insecticide, liquid N.O.S.	1,000 - 9,999	Laydown yard, flammable storage building, and warehouse
Oil, flammable and combustible	1,000 - 9,999	Laydown yard, flammable storage building, drum storage, maintenance building, and warehouse
Paint, flammable or combustible	1,000 - 9,999	Flammable storage building
Potassium bicarbonate	1,000 - 9,999	Fire truck, all area
Propane or liquefied petroleum gas	10,000 - 99,999	Fill site road., main site
Thinners, flammable or combustible	1,000 - 9,999	Flammable storage building

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

Table 2-7. Louisiana SARA Title III Tier Two Summary at West Hackberry

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Alkydimethylbenzylammonium Chloride in Methanol and Water	10,000 - 99,999	Sun Oil Terminal and high pressure pad
Antifreeze compound	100 - 999	D-Warehouse
Bromotrifluoromethane (R-13B1 or H-1301)	1,000 - 9,999	Building 301
Compressed gas (except helium, neon, argon, krypton, xenon)	1,000 - 9,999	Property yard, Lake Charles meter station tank area, LSW laydown, and building 301
Crude oil, petroleum, flammable and combustible liquid	> 1 billion	Underground storage caverns in salt dome, site piping, tankage, and E-Warehouse
Diesel fuel #2 (clear amber liquid)	10,000 - 99,999	Site fuel station and workover rig yard, and LSW laydown
FC-600 3M Lightwater ATC/AFFF	10,000 - 99,999	Foam storage and site fire systems
Gasoline	10,000 - 99,999	Fuel station and pipeline shed, and maintenance laydown yard
Insecticides, liquid N.O.S.	100 - 999	Flammable storage shed, pipeline shed, and D-Warehouse
Oil, flammable and combustible	10,000 - 99,999	Workover rig yard, OCB 5KV substation, high pressure pump, LSW flammable storage, pipeline shed, and D-Warehouse
Paint, flammable or combustible	1,000 - 9,999	Site flammable storage, warehouses, paint blast area, workover yard, LSW flammable storage
Potassium bicarbonate	1,000 - 9,999	Building 303, LSW Tool Trailer
Propane or liquefied petroleum gas	1,000 - 9,999	Lake Charles meter station
Silica, crystalline-quartz	1,000 - 9,999	Paint laydown
Thinners, flammable or combustible	1,000 - 9,999	LSW flammable storage, site flammable storage, fuel station cabinet, laboratory, workover yard

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

Table 2-8. Louisiana SARA Title III Tier Two Summary in Offsite Pipelines

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liquid	1,000,000 - 9,999,999	Off-site pipeline in Ascension Parish, LA
Crude oil, petroleum, flammable and combustible liquid	50,000,000 - 99,999,999	Off-site pipelines in Assumption Parish, LA
Crude oil, petroleum, flammable and combustible liquid	50,000,000 - 99,999,999	Off-site pipelines in Calcasieu Parish, LA
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Off-site pipelines in Cameron Parish, LA
Crude oil, petroleum, flammable and combustible liquid	1,000,000 - 9,999,999	Off-site pipeline in Iberia Parish, LA
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Off-site pipeline in Iberville Parish, LA
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Off-site pipeline in St. Martin Parish, LA
Crude oil, petroleum., flammable and combustible liquid	50,000,000 - 99,999,999	Off-site pipeline in St. Mary Parish, LA
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Off-site pipelines in St. James Parish, LA

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

Table 2-9. Texas SARA Title III Tier Two Summary in Offsite Pipelines

Chemical Name (Category)	*Max Daily Amount (lbs)	Location
Crude oil, petroleum, flammable and combustible liquid	50,000,000 - 99,999,999	Off-site pipelines in Brazoria County, TX
Crude oil, petroleum, flammable and combustible liquid	10,000,000 - 49,999,999	Off-site pipeline in Galveston County, TX
Crude oil, petroleum, flammable and combustible liquid	50,000,000 - 99,999,999	Off-site pipeline in Jefferson County, TX (Big Hill)
Crude oil, petroleum, flammable and combustible liquid	1,000,000 - 9,999,999	Off-site pipeline in Jefferson County, TX (W. Hackberry)
Crude oil, petroleum, flammable or combustible liquid	10,000,000 - 49,999,999	Off-site pipeline in Orange County, TX

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

DOE Orders/Directives

Phase I of the expanded baseline ground water surveillance field work, conducted in accordance with the SPR Groundwater Program Plan, was conducted in 1993 at all SPR sites. Phase II was completed in 1996 and included installation of 28 ground water observation wells; 21 of which were maintained to monitor salinity and water levels where indicated by the Phase II verification.

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 to other terminals. One of the problems was volatile organic compounds (VOC) emissions at storage tanks and docking facilities at both SPR and private terminals. Methane gas (non-regulated) that migrated from the salt dome into stored crude oil, strips and releases to the atmosphere regulated pollutants (VOC) in the oil when pressure on the oil is reduced. The best option was to blend crude oil that had methane gas removed from it with other untreated oil during drawdown in order to minimize the impact to air quality. SPR procured, installed, and began operating equipment to separate and collect the gas. Operations were started at Bryan Mound and West Hackberry in 1995. Due to the amount of gas in the oil at Bryan Mound, operations will continue for about two more years. Operations were completed at West Hackberry in 1996, and equipment from that site was moved to Bayou Choctaw and then Big Hill, in turn, to process crude oil at those sites. Degas operations will be completed at Big Hill in 1997. Site air quality permits were required for the above mentioned operations.

Weeks Island Sinkholes

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 a concurrent increase in brine inflow into the mine was detected. A significant leached zone or crevasse in the salt below the sinkhole was located and downward flow of partially saturated brine and sediments was monitored. 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. Saturated brine was introduced into the sinkhole chimney to slow the growth of the pathway, and subsequently the rate of inflow into the mine. A ground freeze plug was successfully established under the sink hole and above the crevasse to isolate this feature from the surrounding aquifer and facilitate a safe drawdown of oil during 1996.

A second sinkhole, identified in 1995, was filled with sand and monitored for activity. This sinkhole is currently inactive.

On December 15, 1994, DOE HQ announced the decision to decommission Weeks Island because these sinkholes may be linked to the integrity of the mine. The plan to draw down and decommission Weeks Island commenced in 1995 with removal of oil beginning in late 1995. The majority of the oil was removed in 1996 and will be completed in 1998 through skimming operations. The mine will be filled with saturated brine while removing the oil.

Tiger Team Assessments

The DOE Tiger Team visited the SPR during 1992, assessing all environmental programs in accordance with established protocol. A Corrective Action Plan (CAP) was prepared for 84 findings and approved by headquarters.

In June 1994, the SPR reevaluated the remaining Tiger Team findings and CAPs and consolidated the corrective actions to more efficiently correct the findings. As of December 1996, all environmental CAPs are closed.

DOE Headquarters Assessment

During 1996, the DOE Office of Self Assessment conducted an evaluation of the SPR Safety Management Systems, which included the SPR Environmental Program. The three guiding principles to be confirmed by the assessment were:

1. line managers are responsible and accountable for safety;
2. comprehensive requirements exist, are executed, and are appropriate; and
3. competence is commensurate with responsibilities.

Evaluation results were indicated by color with red meaning "deficient," yellow "in need of improvement," and green "effective." The assessment resulted in three "greens" indicating effective performance in all emphasis areas. Two sub-categories, Requirements Implementation and Assessment Programs, were noted for future improvement. Corrective Actions Plans have been submitted to make the recommended enhancements, and corrective action is underway. Only one other DOE facility ranked as high.

DOE On-Site Appraisal

DOE SPRPMO appraisal teams conducted formal annual visits to each site, except Bayou Choctaw, meeting with contractor management staff, reviewing environmental practices and performance indicators, and reviewing findings with M&O contractor staff. Of the 11 environmental issues identified during 1996, all were resolved within approximately 45 days, and none were associated with significant environmental impact.

M&O Contractor Self-Assessment

The annual self-assessment was conducted by all site and New Orleans environmental groups in accordance with the self-assessment plan for 1996. Self-assessments are reviewed annually for adequacy through the DM Internal Assessment program. Internal assessment findings are tracked to completion in the Consolidated Corrective Action Plan (PMO) and the Action Tracking System (contractor).

The 1996 Environmental internal assessment findings fell under categories II and III. Category II findings were primarily administrative in nature and disclosed no environmental impact. Category III findings were minor deviations from environmental policies and regulations. Table 2-10 is a tabulation of 1996 findings by site. Appropriate corrective actions have been scheduled.

Table 2-10. 1996 M&O Contractor Internal Assessment Environmental Findings

Site	Category I	Category II	Category III
Bayou Choctaw	0	3	0
Big Hill	0	1	1
Bryan Mound	0	2	0
St. James	0	0	0
New Orleans	0	0	6
Weeks Island	0	1	0
West Hackberry	0	3	0

Regulatory Inspections

The LDEQ performed inspections of Bayou Choctaw, Big Hill, Bryan Mound, St. James, and West Hackberry in 1996. The Bayou Choctaw inspections were by the Louisiana Department of Environmental Quality (LDEQ) and the U.S Coast Guard (USCG) in regard to a site oil spill; the Big Hill inspections were by the Railroad Commission of Texas (RCT) regarding oil storage regulations and the Texas General Land Office regarding oil pipeline spill risks; the Bryan Mound inspections were by the Texas Natural Resource Conservation Commission regarding the air quality program and closed landfill, the Texas Department of Health regarding the potable water system, and the Railroad Commission of Texas regarding oil storage regulations; the Saint James inspection was by the Louisiana Department of Environmental Quality for air quality; and the West Hackberry inspection was by the Louisiana Department of Environmental Quality for ground water. All issues raised in conjunction with these inspections were satisfactorily resolved while the inspector was on site or as a follow-up action. A notice of violation issued by the Coast Guard in response to a Bayou Choctaw oil spill was dismissed

following provision of supplemental information and follow-up inspections.

The Texas General Land Office (GLO) accepted the Facility Response Plans (FRP) as replacements for the Big Hill and Bryan Mound Discharge Prevention and Response Plans (DPRP) negating the need to re-certify the DPRPs in 1996.

Non-Routine Releases

In 1996, the six SPR sites reported four oil spills and five brine spills in quantities of one barrel (42 gallons) or greater or as required by regulation.

The total volume of oil spilled in 1996 was 4.7 m^3 (30 bbls), and the total volume of brine spilled was 179.7 m^3 (1,130 bbls). Oil spills are reported to the National Response Center (NRC) if they cause a film or sheen on navigable waters. During 1996, one of the spill events occurred when approximately one barrel of crude oil was released into a natural drainage on the Bayou Choctaw site. The drainageway carried approximately ½ barrel of the oil to a shallow swamp area causing an oil slick. This incident was immediately reported to the NRC. For further spill incident information, see Sections 5.4.1 and 5.4.2.

During CY 1996, the SPR moved (received and transferred internally) 24.9 million m^3 (157.112 mmb) of oil. The primary reason for this large volume of fluid movement is the decommissioning of Weeks Island, the sale of 2.2 million m^3 (13.6 mmb), and degassing of crude oil.

State agencies require notification if an oil spill equals or exceeds one barrel (LA) or five barrels (TX) or if the potential for impact is recognized by making required NRC notifications. Brine spills are reported if they equal or exceed one barrel (LA) or 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 28 in 1990 to 13, 14, 12, 10, and 5 in 1991 through 1995, respectively.

2.3 SUMMARY OF PERMITS (JAN. 1, 1996 THROUGH DEC. 31, 1996)

General

Permits currently in effect during 1996 include six NPDES permits, ten CAA permits (four are for the degassing plants), 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. These permits are presented in tabular form in Section 3, Tables 3-2 through 3-7.

Permit Compliance

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 continued to be performed at the Big Hill and Bryan Mound sites as required by the permits. Annual

VOC monitoring at Bayou Choctaw and West Hackberry commenced in 1996 in order to comply with the permits. Monitoring was not required at the St. James and Weeks Island facilities. The Emissions Inventory Questionnaire (EIQ) for Bryan Mound continued to be submitted annually 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 on the site and can be compared to the permitted allowable limits. The other sites do not require EIQ submission because their permitted VOC emissions are below the regulatory limit of 10 tons per year of VOC for the ozone nonattainment areas or they are below 50 tons per year for ozone attainment areas.

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

National Pollution Discharge Elimination System (NPDES)

Routine compliance reports, monthly and quarterly NPDES Discharge Monitoring Reports (DMRs), were submitted to the appropriate agencies. A number of minor modifications were made to discharge permits during 1996 in order to accommodate degas operations, align sampling and analysis requirements between state and federal discharge permits, facilitate minor discharge changes in accordance with operational adjustments, and minimize costs for sampling and analysis. A general permit to discharge hydrostatic test water from all sites in the state of Louisiana, including offsite pipelines, was extended via written renewal during CY 1996.

Noncompliances

Fifteen National Pollutant Discharge Elimination System (NPDES) permit noncompliances occurred out of a total of 8,464 permit related analyses performed in 1996. One (7 percent) of the permit noncompliances experienced on the project was due to a reporting error. Three (20 percent) were due to sampling, sample handling, or sampling related phenomena. Eleven samples were outside of the permit parameter limits accounting for 73 percent. The fifteen noncompliances produced an overall project-wide 99.8 percent compliance rate for 1996. All noncompliances were of short duration and immediately resolved, causing no observable adverse environmental impact. Summary information of NPDES exceedances and noncompliances is contained in Section 5.3, Tables 5-8, 5-10, 5-13, and 5-15.

Notice of Violation (NOV)

During 1996, the SPR continued to maintained a status of low risk to the environment. NOVs have declined significantly from 10 (all administrative) in 1990 to none in 1996. Although an NOV was issued by the U. S. Coast Guard for a Bayou Choctaw oil spill of less than one barrel into a navigable waterway during 1996, supplemental information and follow-up inspections resulted in the Coast Guard dismissing this NOV.

3. ENVIRONMENTAL PROGRAM INFORMATION

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 1996 are discussed in sections 5 and 6.

3.1 ASSOCIATED PLANS AND PROCEDURES

Associated plans that support the SPR environmental program include site-specific Spill Facility Response Plans with spill reporting procedures; the site-specific Spill Prevention, Control, and Countermeasures Plans (SPCC) for Bayou Choctaw, Big Hill, Bryan Mound, New Orleans, and West Hackberry; the Ground Water Protection Management Program (GWPMP) document; and the Environmental Monitoring Plan (EMP). The GWPMP document and the EMP were revised during 1996 and are scheduled for publication in early 1997. The Environmental Protection Implementation Program Plan was reviewed during 1996 by DM and DOE in accordance with DOE Order 5400.1.

Associated procedures that support the SPR environmental program are located in the new DM Environmental Instructions Manual that was published in 1996.

These procedures identify requirements, responsible personnel, deadlines, and governing standards. Each site has developed instructions that implement the environmental program specific to their facility.

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 reports to the appropriate regulatory agencies occur 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), Louisiana Pollutant Discharge Elimination System (LPDES) after August 27, 1996; and through the Railroad Commission of Texas (RCT) by the Texas Pollutant Discharge Elimination System (TPDES) Program. Depending upon 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. State permits received during 1993 and 1994 reduce the frequency of testing and reporting for all SPR water discharge sources.

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 monitoring reports
		Railroad Commission of Texas (RCT)	Water Discharge Permit	Quarterly monitoring reports
Clean Water Act	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.
Clean Water Act	Dredging, maintenance, and any construction in wetlands for structures.(Section 404 & 10)	U.S. Army 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
Coastal Zone Management Act	Wetlands Construction within state coastal management zones	Louisiana Dept. of Natural Resources (LDNR), General Land Office (GLO)	Federal project consistency determinations	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
Oil Pollution Act of 1990 (amendment of FWPCA)		U.S. Dept. of Transportation	Pipeline Response Plan	None
Oil Spill Prevention and Response Act of 1991	Oil Spill Response in Texas Coastal Zone	GLO	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	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
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	Monthly Tank Emissions
Resource Conservation and Recovery Act	Hazardous 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
	Non-hazardous 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-hazardous 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 the 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 Minimization. Plan, Waste Management Plan, Storm water 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 tiered 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 Storage	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
DOE Order 5400.1	Environmental Planning (5400.1)	DOE	Environmental Protection and Implementation Plan	Annual revision
	Environmental Planning (5400.1)	DOE	Ground Water Protection Management Program Plan	Annual review (revision every 3 years)
	Environmental Planning (5400.1)	DOE	Environmental Monitoring Plan	Annual review (revision every 3 years)
	Environmental Planning (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
	Budget/Planning	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.

The SPR holds a general permit to discharge hydrostatic test water in the state of Louisiana. This permit applies to all Louisiana SPR facilities, including offsite pipelines, and coverage was extended via written renewal during CY 1996.

On August 27, 1996, Region VI EPA granted LDEQ primacy for the NPDES program in Louisiana which includes responsibility for all compliance and enforcement actions relating to the discharge of water in the state of Louisiana. In the interim, both the administratively extended federal permits and the renewed (state) LWDPS permits will be valid. The SPR has been informed that a single LPDES permit will be issued by the state as each current LWDPS expires.

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. The site operated under a current LWDPS permit issued in March, 1994. The NPDES renewal application, forwarded to Region VI EPA in November 1993, and accepted as administratively complete on January 3, 1994, was not acted upon in 1996. Both discharge permits for the Bayou Choctaw site were affected by Louisiana receiving primacy as described in the section introduction. A Nationwide Permit (NWP) authorization to perform maintenance on the road to the brine disposal wells and another authorizing construction of a line of security fence curbing and

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	
7777-00212-02	LDEQ	Air	10/26/95	9/96	(3a)
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 (Bull Bay)3	COE	Constr. & Maintain	1/30/79	-	(7)
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.
(3a) Small source permit for degassing plant. Modified on 8/9/96.
(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. Major maintenance performed in 1996.
(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.

ramp maintenance were received in September and November, 1996, respectively, from the New Orleans District of the U. S. Army Corps of Engineers (NODCOE). A maintenance notification was also made to NODCOE for offsite pipeline work in March 1996. This action included a casing extension under State Highway 75 and the addition of a new cathodic protection anode bed. Additional fencing was added to the maintenance notification of November in a December letter request/response.

Both of the Bayou Choctaw discharge permits had minor modifications made to accommodate the additional temporary storm water outfall from the degassing unit. In addition, notifications were made to both LDEQ and Region VI EPA concerning the proposal to recycle water at the RWIS during start-up and for routine monthly pump preventive maintenance activities.

An application to amend the air quality permit for the facility operations was submitted to LDEQ in December 1995. This amendment was submitted to revise the permit to include new minor sources, increase the emissions of other sources, and change the status of other sources to insignificant sources. All of these changes only increased site VOC emissions by 10 percent but still remains less than 10 tpy. Approval of these changes is expected in 1997.

The degassing plant that was installed and became operational during 1996 was permitted as a small source in 1995. Due to the requirement to degas additional crude oil as a result of decommissioning Weeks Island, a permit modification application was submitted to LDEQ in 1996 to include an additional nine mmb of Weeks Island crude oil. The

degassing of oil at Bayou Choctaw was completed during 1996, and the degas air quality permit was closed.

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 surface waters for the leaching, site utility, and fire protection systems. Because the site has completed the leaching process and because a fee is assessed based on water set aside (not actual use), the SPR completed the administrative process of relinquishing a portion of its unneeded water right in 1996. The new permit still requires a yearly report of water quantities used. In 1996, the site appropriated 1.356 million m^3(1091.79 acre-feet) of water from the Intracoastal Waterway exclusive of water for fire protection. This represents only 3.64 percent of the new revised total allowable withdrawal for a year.

The NPDES renewal application, forwarded to Region VI EPA in November 1993 and accepted as administratively complete on December 22, 1993, was not acted upon in 1996. Big Hill applied for a reduction in the TNRCC water appropriations permit from 117,291 acre feet to 30,000 acre feet in 1995 in order to realign Big Hill water rights from leaching needs to standby and drawdown needs. As described earlier, this action was completed in April 1996.

A couple of minor modifications to both the state and federal discharge permits were requested and acted upon in 1996. The mobile degassing unit's storm water outfall was added to both permits prior to commencing operations at Big Hill in November 1996. Both agencies were notified of the proposal to recycle raw water at startup and for monthly routine preventive maintenance exercises at the RWIS in the Intracoastal Canal. Both agencies respectfully declined to grant

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 (01,02,03,04)	COE	Constr. & Maintain	01/11/84	-	(3)
P-7	F&WS	Constr. Operate	07/31/86 07/31/86	07/31/88 06/30/36	(4) (5)
9256	TNRCC	Air	05/17/83	5/16/98	(6)
32432	TNRCC	Air	06/12/96	Open	(6a)
02937 & 02939	RCT	Operate	11/28/83	Open	(7)
P000226A & P000226B	RCT	Operate/ Maintain	09/19/84	Open	(8)
0048295 0048320	RCT	Operate	05/09/83 06/23/83	Open Open	(9)
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. Modified in 1996 for new integrity test method.
(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.
(6a) Standard Permit for degassing plant.
(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. Modified in 1996 to reduce water set aside down to 30,000 ac/ft per year.

anything but a temporary waiver to investigate offshore impacts of the low pH brines encountered from a limited suite of three caverns.

The pH measurements reported as noncompliances in accordance with the state and federal discharge permits was never less than a 5.6 s.u.

against the lower effluent limit(s) of 6.0 s.u.. The low pH measurements for the noncompliant brine discharges occurred on four separate days in February. As a result, the SPR decided to mix slightly higher pH raw water with the intermittent low pH brines in the onsite brine pond, sufficiently buffering the low pH prior to discharge. This approach appears satisfactory to avoid future noncompliant discharges of brines .

Maintenance notifications made to the U. S. Army Corps of Engineers Galveston District (GALCOE) included painting and sandblasting work performed at the RWIS during 1996 and under-road casing extension work beneath SPUR 93 in Jefferson County. In a separate COE permitting action, instrumentation protected by a net guard and the permanent addition of a sea bottom anchor were added to the permit for the brineline and offshore diffuser section. As a result of the new equipment, Region VI EPA was notified of the procedural change associated with the routine brine line integrity tests performed for the NPDES permit.

An application to modify the facility's air quality operating permit was initiated in 1996 and will be submitted to the TNRCC in 1997. This application reflects the addition of small sources and addition of existing sources that were not identified in the original permit.

The degassing plant was installed and became operational during 1996. It was permitted as a standard permit in 1996. Due to the requirement to degas additional crude oil as a result of decommissioning Weeks Island, a permit modification application was submitted to TNRCC in early 1997 to include an additional 24.8 million barrels of Weeks Island

crude oil. Approval was received by the TNRCC in 1997 to degas the additional crude oil.

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 1996, the site used a total of 3.46 million m^3 (2808 acre-feet) of water from the Brazos River Diversion Channel. A total of 148.21 million m^3 (120,149 acre-feet) of water has been appropriated to date for site activities which represents 35.04 percent of the total volume permitted.

Maintenance dredging was performed in 1996 under COE permit 12347 (as amended in 1995). The COE permit for construction and maintenance of the offshore diffuser was modified to accommodate the new dedicated and enclosed instrumentation for performing the modified integrity test procedure. In addition, Region VI EPA was notified of the change to a more cost-effective and accurate brine line integrity test procedure for the NPDES permit. The commissioning hydrostatic test report for this brineline was also forwarded to that agency in 1996.

Bryan Mound continued to report under the modified state TPDES permit UHS-004 reflecting monthly storm water. Metals testing was deleted from the storm water outfalls after one year of data produced

Table 3-4. Active Permits at Bryan Mound

PERMIT NUMBER	ISSUING AGENCY	PERMIT TYPE	EFFECTIVE DATE	EXPIRATION DATE	COMMENTS
TX0074012	EPA	NPDES	09/01/95	08/31/00	(1)
TXR00B609	EPA	NPDES*	12/31/92	12/31/97	(2)
SWGCO-RP-12347(01)	COE	Dredging	04/24/95	12/31/06	(3)
3-67-782 (Docket#)	RCT	Injection	08/21/78	Open	(4)
3-70-377 (Docket#)	RCT	Injection	12/18/78	Open	(4)
P001447	RCT	Operate	10/30/84	Open	(5)
P001448	RCT	Operate	10/30/84	Closed	(6)
3681A	TNRCC	Water	7/20/81	Open	(7)
UHS-004	RCT	Water Disch	10/01/93	09/30/98	(8)
6176B	TNRCC	Air	01/11/95	Open	(9)
28076	TNRCC	Air	03/03/95	03/03/99	(10)
82-8475	TDH&PT	Constr.	01/01/83	Open	(11)
SWGCO-RP-11666	COE	Constr. & Maint.	10/15/77	-	(12)
SWGCO-RP-12112	COE	Constr. & Maint.	07/25/77	-	(13)
SWGCO-RP-12062(03)	COE	Constr. & Maint.	10/10/78	-	(14)
SWGCO-RP-14114(01)	COE	Constr. & Maint.	05/18/85	-	(15)
SWGCO-RP-16177	COE	Constr. & Maint.	09/07/82	-	(16)
04994	RCT	Operate	*06/95	-	(17)

(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 12/31/06. (SWGCO-RP 12347 authorized constr. of RWIS). Extension/renewal authorizes spoil area addition.
(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 received January 11, 1995
(10) Standard Permit for degassing plant
(11) Corresponds with SWGCO-RP-16177.
(12) for 30-inch crude oil pipeline to 3 miles SW from Freeport
(13) for 30-inch crude oil pipeline to 2 miles S from Freeport
(14) for 36-inch brine disposal pipeline & diffuser
Revision/amendment (01) deleted special condition (a) requiring maximized deep well injection; (02) approved construction of 24 inch replacement pipeline and diffuser in January 12, 1993. (03) added the offshore additions the new integrity test method.
(15) general permit for pipeline crossings by directional drilling in navigable waters
(16) place an 8-inch water line (PVC, potable)
(17) Pipeline distribution system registration to operate crude oil lines.
* Permit issuance in process.

no indication of such a contamination problem. Both the state and federal discharge permits were modified to include a new outfall location for the degas unit which remained and operated onsite during 1996.

Bryan Mound also received a modification to an existing COE permit, 13435(01), to allow a minor fill and construction in the wetland areas along the northern site boundary in early 1996.

Region VI EPA was notified and RCT acted upon the request to reroute the onsite sewage treatment plant (STP) discharge to an onsite [closed] pond providing tertiary treatment (oxidation) in lieu of the state's chlorination requirements. EPA elected not to modify the recently revised (1995) permit; therefore, residual chlorine is maintained and reported as required to that agency.

Bryan Mound continued to operate under the 1995 revised TNRCC air emission permit. This permit recognizes the standby status of the site and the concept that a presidentially-ordered drawdown and refill would be treated as a variance from the permitted emission limitations.

The degassing plant at Bryan Mound also continued to be operated under the standard permit issued in 1995. Operation of this plant is expected to continue until early 1998.

3.3.4 St. James

Table 3-5 lists the active permits at St. James Terminal. The NPDES renewal application, forwarded to Region VI EPA in November 1993, and accepted as administratively complete on January 3, 1994, was not

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.

acted upon in 1996. EPA has taken no further action on this renewal application and as DOE moves toward lease or sale of this site, the permit will be appropriately addressed.

The outstanding LWDPS renewal application of 1990 was updated and revised at the request of LDEQ in June 1994. This application has been accepted as complete and in the interim, until a new permit is issued, conditions of the old permit remain in force. Primacy was received by LDEQ for the NPDES program in August of 1996 affecting this permit and outstanding application as with the other Louisiana SPR sites.

St. James received five variances to its air quality permit during 1996, to allow an additional 276 tons of VOC emissions associated with loading of 2.0 million m^3 (12.6 mmb) of crude oil to tankers. This

crude oil was moved across the St. James docks while decommissioning the Weeks Island site.

3.3.5 Weeks Island

The active permits for Weeks Island are listed in Table 3-6. Several subcontracted projects implemented as part of the Weeks Island decommissioning have required permitting activity during 1996.

Freeze Wall Inc. continued to report as required on permits obtained for its separately permitted water discharges during 1996. The freeze wall plug constructed during 1995 over a crevasse in the salt that corresponds with the sink hole, grew and was maintained throughout 1996. By freezing the ground water via refrigeration wells, this plug provides a means of protecting against a sudden inflow of ground water into the Weeks Island mine through the crevasse as the oil is being removed from the mine. The final volume of directly pumpable oil from the mine storage was transported via pipeline to the Big Hill site in mid-November, 1996. Portions of the crude oil inventory had also been relocated earlier in the year to the Bayou Choctaw oil storage site.

In a separate but related permit action, SOFREGAZ, Inc. obtained a COE permit and a Coastal Management Division (CMD) coastal use permit for the construction of a RWIS, pipelines, and a drilling platform/pumping station, in order to provide DOE with brine for backfilling the mine. The brine was purchased under a negotiated contract which included the private permitting of the necessary structures on the Intracoastal Waterway within a portion of a Morton Inc. barge slip and on other portions of the Morton owned lands. The

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)
1260-00065-01	LDEQ	Air	09/08/92	Open	(4)
SDS-8	LDNR	Injection	02/16/79	Open	(5)
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.

brine results from an underground salt solutioning process similar to SPR cavern production. This approach was the most economical and lowest risk manner of obtaining the quantities of brine needed to successfully backfill the two converted mine storage chambers after the oil in storage has been removed.

The NPDES renewal application, forwarded to Region VI EPA in November 1993, and accepted as administratively complete on December 22, 1993, was not acted upon in 1996.

During 1996, an application to modify the site operating air permit to include a new thermal destruction unit source replacing the existing flare, was submitted to LDEQ. This replacement flare is more efficient and will require less fuel gas to burn the mine vent gas which will

reduce the emissions from the mine while filling it up with brine during decommissioning of the mine. Approval by LDEQ is expected in 1997.

Two permit variances were requested in 1996 for exceeding the allowable permit limits at Weeks Island. One variance was to vent mine gas (10 percent VOCs, 90 percent inert gas) in order to perform maintenance on one of the pumps. The other variance was to use the existing flare to combust the mine gas while partially filling up the mine with brine.

3.3.6 West Hackberry

Active permits for West Hackberry are listed in Table 3-7.

Permit amendments and/or permitting actions for West Hackberry projects in 1996 include the permits from the COE, CMD, and a Water Quality certification for modifications to the onsite boat ramp and boat slip. Also permitted in 1996 was placement of fill for erosion control on the two adjacent sides of the RWIS. This activity also required a COE permit modification, a CMD consistency determination, and a Water Quality certification form LDEQ. A maintenance notification was made to the GALCOE for repairs needed to an underground portion of the West Hackberry 42-inch diameter crude oil line occurring in wetlands near the Neches River in Jefferson County, Texas. A letter request was made to LDEQ in Baton Rouge, Louisiana, to add the two new outfalls associated with the discharge of retained storm water from required secondary containments around the

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)
0560-00019-01	LDEQ	Air	03/06/96	Open	(12)
7777-00212-00	LDEQ	Air	3/20/95	3/96	(13)
SWGCO-RP-12342	COE	Constr. & Maint.	3/28/78	-	(14)
LMNOD-SP (Cameron Parish Wetlands) 152		Constr. & Maint.	3/16/78	-	(15)
LMNOD-SP (Cameron Parish Wetlands)276		Constr. & Maint.	2/11/80	-	(16)

(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) Small Source Permit for degassing plant
(14) For 42" crude oil pipeline crossings of waters & waterways
(15) For brine disposal wells, well pads, and brine disposal pipelines, (12", 20", & 24")
(16) For well pads, levees, and access roads (Wells 110, 111, 112, 113, 114, & 115)

new slop oil system completed in 1996. These outfalls had not been successfully added by the close of CY 1996 and an interim "work around" transporting this water to an adjacent discharge point has been implemented until permit actions are completed by the state.

The NPDES renewal application, forwarded to Region VI EPA in November 1993, and accepted as administratively complete on January 3, 1994, was not acted upon in 1996. Primacy for the NPDES program to LDEQ in 1996 has affected this and all other Louisiana SPR sites in a similar fashion.

The site operating air permit was modified in 1996 to include new minor sources (such as slop tanks), delete other sources (such as the surge and slop tanks), and reflect the different operational mode of stand-by.

During 1996, the degassing of oil at West Hackberry was completed and the degas plant was moved to Bayou Choctaw. This degas air quality permit was closed during 1996.

3.4 WASTE MINIMIZATION PROGRAM

The waste minimization program reduces the generation of all wastes including hazardous and non-hazardous sanitary wastes. The most significant waste minimization accomplishments during 1996 were:

a) vapor pressure management and crude oil degassing;
b) crude oil tank bottoms reclamation;
c) low flow ground water sampling;
d) software documentation recycling;

e) Environmental Advisory Committee Public Outreach and Partnership;

f) implementation of DM Corporate Environmental Policy (see Appendix B); and

g) implementation of DM Corporate Waste Management Policy (see Appendix B).

The SPR generated only RCRA hazardous and sanitary (non-hazardous municipal and non-hazardous oil field) wastes during 1996. The SPR sent 1.88 metric tons (4,162 lbs.) of hazardous waste off site for incineration during 1996.

The SPR sent 753.49 metric tons (1,661,172 lbs.) of sanitary waste off site for disposal during 1996. Paper, used oil burned for energy, antifreeze, scrap metals, and laser printer cartridges were reclaimed or recycled off site. The SPR collected 48.8 metric tons (107,600 lbs.) of paper and 2.2 metric tons (4,864 lbs.) of cardboard for reclamation off site. The SPR generated 10.26 metric tons (22,638 lbs.) of used oil burned for energy during 1996.

The DM Environmental department staff distributed Pollution Prevention caps to those employees who completed Pollution Prevention Opportunity Assessments and plans to distribute certificates on Earth Day 1997 to New Orleans, West Hackberry, Bryan Mound, Weeks Island, St. James, and Big Hill sites in recognition of accomplishing their waste generation reduction and recycling goals. The SPR Pollution Prevention Interdepartmental Team, including a DOE representative, conducted SPR-wide monthly conference calls to discuss pollution prevention topics, thus increasing its scope of activity.

Pollution prevention information appeared in an SPR-wide publication via E-Mail and handouts.

3.5 POLLUTION PREVENTION

Major pollution prevention initiatives in 1996 were the oil degasification at two other sites, New Orleans computer paper recycling, St. James tank bottoms recycling, and low flow ground water sampling activity, as follows:

- Start of degassing SPR stored oil at Bayou Choctaw and Big Hill. The degassing process essentially retains all of the original crude oil components while primarily using stripped methane and ethane to fuel the degas plant, minimizing generation of waste byproducts. The pollution prevention aspects of this process thus far are avoidance of generating nearly 8,200 tons of air emissions (VOCs, HAPs, and H_2S) when the oil inventory currently stored in these two facilities is moved to atmospheric pressure conditions; reuse of the degassing equipment at multiple locations; recycling and reuse of chemicals within the process and between facility locations; use of an otherwise waste methane stream as a fuel source; and reuse of 17,450 tons of foundation material remaining after the degas plants were removed. Another 42,337 tons of emissions are expected to be avoided when degas operations at the Texas sites is completed. See Section 2.2 for additional details.

- At the SPR 33,700 lbs of out-of-date, registered computer manuals were to be "destroyed" as part of a software licensing agreement. Rather than shredding and landfilling or burning, the manuals were reclaimed, thus eliminating the waste stream and saving over $8,000 for waste treatment and disposal. Space in the SPR

warehouse and in the community landfill was conserved, fire and safety hazards were avoided, and a small business was supported. This process can be applied throughout the United States.

- By recovering crude oil and minimizing the use of cleanser, the SPR reduced the volume of the St. James tank bottoms to approximately 2,000 barrels. Crude oil mixed with diesel that could not be sent to another SPR storage facility was sent to a petroleum refinery, sediments were used in road construction, and waxes were processed for cosmetics and fireplace logs. Not only was the waste stream eliminated but air emissions and worker confined space exposure time were reduced. This process can be applied to crude oil tank cleaning throughout the oil and gas industry and to SPR site decommissioning.

- A new groundwater sampling method was implemented on the SPR. The method has been acknowledged by EPA and industry. The method employs a very low pumping rate to obtain representative groundwater samples. The SPR implementation utilizes dedicated sampling devices thereby enhancing both labor and time saving aspects. An original outlay of $13,000 produced an overall savings of $28,520; or better than a 2 to 1 return. The technique was evaluated in a statistical experiment designed to fairly evaluate incompatibilities with the historic database. Both the method and the design of the statistical evaluation have potential complex-wide applicability.

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

3.6 TRAINING

Site Environmental and Emergency Response Team (ERT) personnel have received training in environmental plans and procedures. Site management personnel are knowledgeable of environmental procedures, spill reporting procedures, the group-specific Spill Contingency Plans, the site-specific Spill Prevention Control and Countermeasures (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.

All site personnel and unescorted site visitors receive compliance awareness training via "The Active Force of Protection" videotape. SPCC and Hazardous Waste Handling training is mandatory and provided to site personnel annually.

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4. ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

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

4.1 SEALED SOURCES

A total of 2 nuclear density gauges located on the metering skid at the West Hackberry site. The gauges are used for monitoring fluid density changes (oil versus brine) in pipelines. Each gauge unit contains between 2000 and 4000 millicuries (mCi) of cesium 137. Gauge wipe tests are performed every three years as required by the general license. All of the gauges for the Bryan Mound pipelines and the majority of the gauges for the West Hackberry pipelines were removed in 1996 during the Life Extension project. The two remaining gauges at West Hackberry will be removed as part of life extension projects in FY '97. 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 Louisiana and Texas regulations. No additional monitoring is required due to the negative results of this 1991 NORM survey.

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5. ENVIRONMENTAL NON-RADIOLOGICAL PROGRAM INFORMATION

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

Effective environmental 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 sites are either hazardous in nature or have an impact on the ambient air quality. The non-hazardous pollutants that have an impact on air quality are non-methane/non-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, pump seals, storage tanks, tankers, and brine ponds. These emissions do not occur from functional pressured systems such as the storage caverns. All of the sites are equipped with emergency generators that emit less than one tpy of NO_x, SO_2, CO, and PM_{10} during periodic equipment maintenance.

Oil stored at Bayou Choctaw, Big Hill, Bryan Mound, Weeks Island, and West Hackberry has become entrained with methane and ethane

from the salt domes, which is released when the oil is depressured, stripping the valuable higher weight VOCs from the crude oil. In order to reduce the resultant pollution, a project to strip excess methane and ethane, while retaining higher weight VOCs, was started at Bryan Mound and West Hackberry in 1995 and proceeded to Bayou Choctaw and Big Hill in 1996. Weeks Island crude oil was degassed at Bayou Choctaw and Big Hill.

There are two types of air monitoring required at the SPR sites. They are VOC fugitive emission testing and tank seal inspections.

The two Texas facility permits (Big Hill and Bryan Mound) require screening all piping components and pump seals for VOC leaks. This is done quarterly at both sites with an organic vapor analyzer (OVA). Currently, there are only two sites in Louisiana that require this type of screening: Bayou Choctaw and West Hackberry. This is done annually at both sites with an organic vapor analyzer (OVA). In order to use more accurate calculation factors, these components need to be screened for effectiveness in minimizing VOC releases. In 1996, the project to recount and tag all piping components at Bryan Mound, Big Hill, Bayou Choctaw, and West Hackberry that require fugitive monitoring was completed. This project was performed to improve the recordkeeping and reporting of fugitive emissions required by the regulatory agencies.

If a site in a nonattainment area for ozone emits more than nine metric tons (10 tons) VOC per year, it must submit annual Emission Inventory Questionnaires (EIQ). These EIQs reflect the amount of pollutants emitted from the site using industry acceptable calculations during a calendar year. Currently, the only site required to submit an EIQ in

1996 is Bryan Mound because it is over the threshold of nine metric tpy (10 tpy).

The second type of monitoring is seal inspection of the internal and external floating roof tanks. St. James and Big Hill have external floating roof tanks that required inspection of the primary (every five years) and secondary (once a year with the exception of Big Hill which requires semi-annual) seals. Bryan Mound requires seal inspections every year because it only has a mechanical shoe seal in its internal floating roof tanks. 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 site were calculated using method AP-42 (EPA, 1985) to be less than nine metric tpy (10 tpy); therefore, it does not require an EIQ. The site is a "minor source" because it emits less than 25 tpy. Even though minor sources are exempt from emissions monitoring requirements, the piping components require annual monitoring in order to use smaller emission factors that keep the site as a minor source. All of the applicable piping components were identified, tagged, and monitored in 1996 to verify their leak rates. There were no major configuration changes which would have resulted in additional air emissions during 1996.

5.1.2 Big Hill

The Big Hill site, located in a moderate nonattainment area for ozone, operated in accordance with applicable air quality regulatory requirements and all conditions of the air quality permit during 1996.

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 out of compliance during 1996. The secondary seals were temporarily repaired until they can be completely replaced in early 1997. An EIQ is not required at Big Hill because total VOC emissions are less than nine metric tpy (10 tpy) which is the regulatory limit for having to submit an EIQ. All of the applicable piping components were identified, tagged, and monitored during 1996. No other form of monitoring is required at Big Hill.

5.1.3 Bryan Mound

The Bryan Mound site, located in a severe nonattainment area for ozone, operated in accordance with all air quality regulatory requirements throughout 1996. The air permit requires that calculations of the VOC emissions from the four internal floating roof tanks be prepared monthly and maintained on the site. 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 site is permitted to emit over nine metric tpy (10 tpy) of VOC emissions under its general permit, it must submit an annual EIQ. The Bryan Mound site degas plant operated for most of 1996. The degas plant exceeded its permit limits for SO2 by 4.8 metric tpy (5.3 tpy) during 1996 due to mechanical difficulties resulting from extreme cold weather. State air regulations allow for permit exceedances for either upset conditions or maintenance.

5.1.4 St. James Terminal

St. James Terminal, located in an attainment area for ozone, operated in accordance with all air quality permit and regulatory requirements during 1996. The permitted emissions during stand-by are 27.2 metric tpy (30 tpy) of VOC with allowance to exceed 90.72 metric tpy (100 tpy) through a variance during drawdown. Five variances were requested during 1996 in order to sell 12.6 mmb of crude oil from Weeks Island across the docks into tankers. The total calculated VOC emissions from this loading operation was estimated at 276 tons for 1996. 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 1996.

5.1.5 Weeks Island

Weeks Island is one of three 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 (10.04 tpy) of nitrous oxides. With the exception of approved variances, the site operated within these permitted limits. Weeks Island began drawdown of crude oil in late 1995 and continued through 1996; however, this activity did not substantially alter emissions. Air quality monitoring was neither required nor conducted during 1996. Variances were requested to vent part of the mine gas in order to perform maintenance on a pump and also to use the existing flare at the site to destroy the mine gas while filling the mine with brine. An application to modify the site operating permit was submitted to LDEQ during 1996 in order to replace the existing flare with a more efficient flare. To use the existing flare to combust the mine gas would have required more fuel gas to maintain combustion within the regulatory limits.

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 1996. The 1996 permit modifications increased the allowable VOC emissions from the site to about 36 metric tpy (40 tpy) during stand-by mode. This was due to additional sources identified at the site such as the use of frac tanks 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. The piping components were screened for leaks during 1996 to maintain a minor VOC source designation. During 1996, the West Hackberry degas plant was moved to Bayou Choctaw for degassing that site's crude oil.

5.2 SURFACE WATER QUALITY MONITORING

During 1996, 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 or Weeks Island because of the low potential to impact surface waters at these two sites. Table 5-1 identifies frequency of specific parameters measured at each SPR site for both DMR and surface water quality.

Table 5-1. Physicochemical Parameters

Physicochemical 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		001	001 6-9 11 101-117 HPP SOT			001 002 A-F	001 002 004 A-G TX-003 & other storm water	TX-001 TX-002* TX-003 001 002* 003 004 005 A-J		01A 01B 002	002 A-F 001 004 Veh. Rinse TX-22	SJ002, 003
Salinity					001 HPP			A-F	A-G 001 TX-003 & other storm water	A-J TX-003 003 004 005			A-F	
Temperature					001			A-F	A-G 001				A-F	
Total Dissolved Solids					001	001				001			A-F	
Total Suspended Solids					001	001 002		001 002	004	002* 001		01B 002 003	002, A-F Veh. Rinse	SJ002, 003
Dissolved Oxygen		*** 001			001			A-F	A-G	A-J		A-F		
BOD5								001 002	004	TX-002* 002*		01B 002	002	SJ002, 003
COD									004	TX-002*				
Oil & Grease	15,17-20, 101, HPP, SWD1 SWD2 SWD3	001 003	TX-001	001	001 101-117 HPP				TX-003 & other storm water	001 TX-003 003 004 005		01A	004 Veh. Rinse TX-22	A-G BM A-J
TOC		003		001	6-9,11 101-117 HPP, SOT			A-F	A-G	A-J TX-003 003 004 005		E	A-C, E-F, 004 Veh. Rinse	WH TX-22 BC 15,17-20, 101, HPP, SWD1thru 3
Fecal Coliform												01B, 002	002	
Residual Cl										002*				
Flow	001, 002 15,17-20, 101, HPP, SWD1 SWD2 SWD3	001	TX-001, TX-002*** 001	001	001 HPP***	002 004***	003 004 005			002*	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

Data and statistics are presented in tabular form by site in Tables 5-2 through Table 5-5. 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 used to quickly identify data sets with a high incidence of variation. Values approaching or exceeding 100 percent indicate that one standard deviation from the stated mean encompasses zero. Such occurrences invalidate the data from a statistical utility standpoint. This method draws attention to highly variable data sets for further evaluation. 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.

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 (SAL), temperature, dissolved oxygen (DO), oil and grease (O&G), and total organic carbon (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 7.1 to 7.5 s.u. This indicates that natural waters are generally neutral. Fluctuations observed are attributed to environmental and seasonal factors such as variations in rainfall, temperature, and aquatic system flushing.

BAYOU CHOCTAW

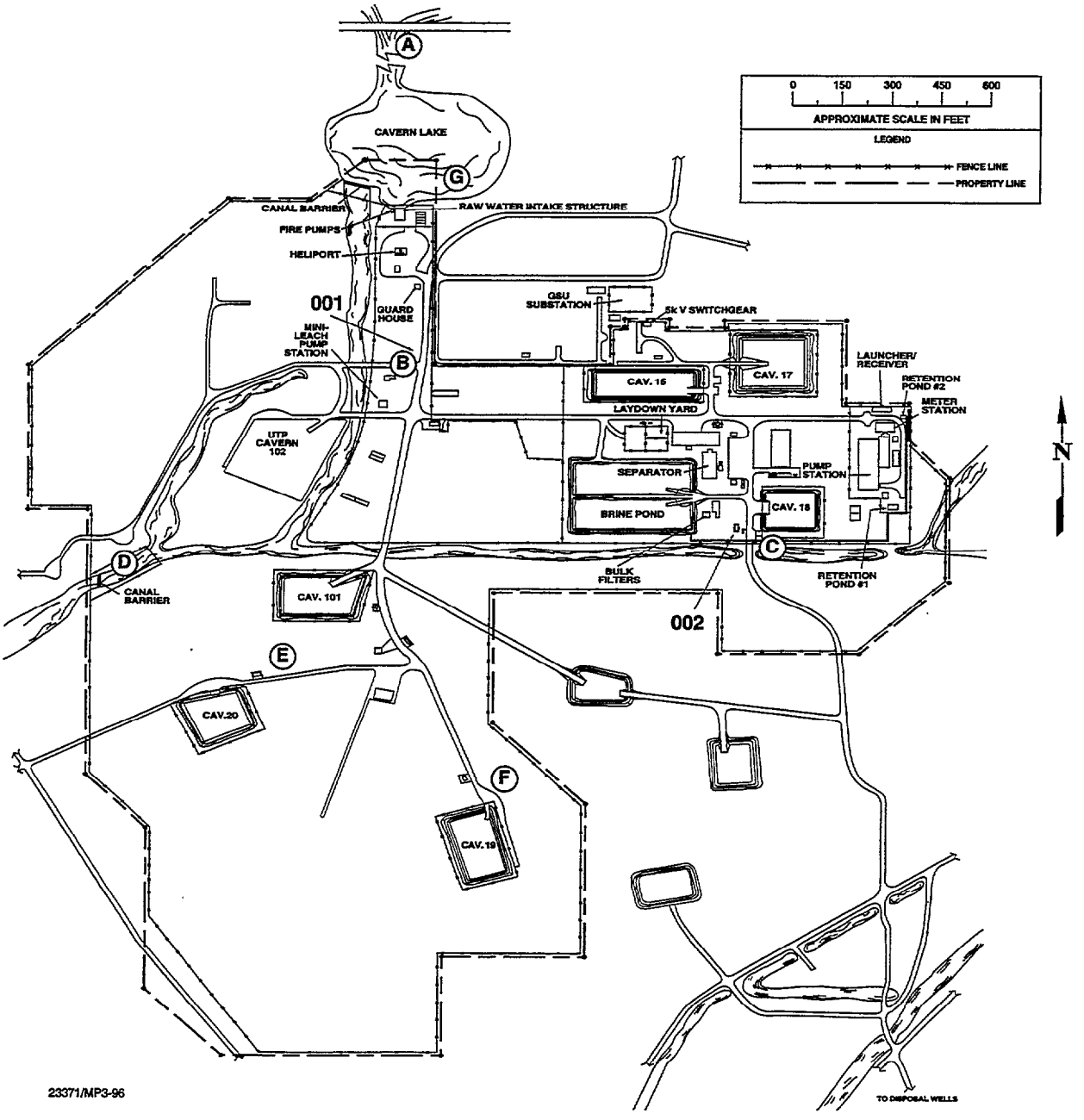


Figure 5-1
(Sheet 1 of 2) Bayou Choctaw Environmental Monitoring Stations

Federal 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 Ditch running under the road to warehouse on West side of the road in area of heat exchangers.

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. 1996 Data Summary for Bayou Choctaw Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Dissolved Oxygen (mg/l)	Total Organic Carbon (mg/l)
A							
	Sample Size	12	12	12	4	12	12
	Number of BDL			12	4		
	Maximum	8.7	30.4	0.5	2.5	8.1	13.3
	Minimum	6.8	9.2	0.5	2.5	0.6	4.5
	Mean	NV	21.0	0.5	2.5	4.4	8.1
	Median	7.4	23.1	0.5	2.5	4.2	8.1
	Standard Deviation	NV	7.7	0.0	0.0	2.3	3.3
	Coefficient of Variation	NV	36.5	0.0	0.0	53.6	40.1
B							
	Sample Size	12	12	12	4	12	12
	Number of BDL			2	4		
	Maximum	8.5	30.9	4.8	2.5	13.4	12.9
	Minimum	7.2	8.4	0.5	2.5	1.1	2.4
	Mean	NV	21.0	2.4	2.5	7.8	6.0
	Median	7.5	22.4	3.0	2.5	7.3	5.6
	Standard Deviation	NV	7.0	1.5	0.0	4.0	3.5
	Coefficient of Variation	NV	33.1	62.5	0.0	51.0	58.0
C							
	Sample Size	12	12	12	4	12	12
	Number of BDL			8	4		
	Maximum	7.5	29.8	6.0	2.5	7.0	14.4
	Minimum	6.8	8.1	0.5	2.5	0.6	5.9
	Mean	NV	20.3	1.1	2.5	4.3	9.9
	Median	7.3	22.1	0.5	2.5	4.4	10.1
	Standard Deviation	NV	7.6	1.6	0.0	2.2	2.9
	Coefficient of Variation	NV	37.3	139.4	0.0	51.1	29.3
D							
	Sample Size	12	12	12	4	12	12
	Number of BDL			12	4	1	
	Maximum	8.1	30.2	0.5	2.5	7.0	13.3
	Minimum	6.8	7.8	0.5	2.5	0.2	4.8
	Mean	NV	21.1	0.5	2.5	3.5	8.4
	Median	7.3	22.6	0.5	2.5	3.9	8.9
	Standard Deviation	NV	7.6	0.0	0.0	2.0	2.6
	Coefficient of Variation	NV	35.7	0.0	0.0	57.6	30.7
E							
	Sample Size	12	12	12	4	12	12
	Number of BDL			7	4		
	Maximum	7.9	30.8	3.0	2.5	7.4	14.7
	Minimum	7.0	7.1	0.5	2.5	0.6	2.7
	Mean	NV	20.8	1.0	2.5	3.5	9.3
	Median	7.4	22.2	0.5	2.5	3.5	9.4
	Standard Deviation	NV	8.4	0.8	0.0	2.4	3.9
	Coefficient of Variation	NV	40.2	77.8	0.0	67.3	42.2

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table 5-2 (Continued).
1996 Data Summary for Bayou Choctaw Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Dissolved Oxygen (mg/l)	Total Organic Carbon (mg/l)
F							
	Sample Size	7	7	7	3	7	7
	Number of BDL			5	3		
	Maximum	7.3	24.4	2.0	2.5	5.8	14.8
	Minimum	6.7	8.3	0.5	2.5	0.7	6.8
	Mean	NV	15.8	0.8	2.5	2.9	10.0
	Median	7.1	16.5	0.5	2.5	2.5	10.2
	Standard Deviation	NV	6.4	0.6	0.0	1.9	2.9
	Coefficient of Variation	NV	40.3	72.2	0.0	63.9	29.4
G							
	Sample Size	12	12	12	4	12	12
	Number of BDL			12	4	1	
	Maximum	8.8	30.5	0.5	2.5	10.8	13.3
	Minimum	6.9	9.4	0.5	2.5	0.2	4.9
	Mean	NV	21.4	0.5	2.5	5.1	7.9
	Median	7.4	24.2	0.5	2.5	5.3	7.1
	Standard Deviation	NV	7.7	0.0	0.0	3.0	2.5
	Coefficient of Variation	NV	35.8	0.0	0.0	58.3	32.3

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

5.2.1.2 Salinity (SAL)

In 1996, average annual salinities remained 1.0 ppt or less at all stations except B and C which averaged 2.4 and 1.1 ppt, respectively. Similar to last year, several spikes were observed at these stations that could possibly be due to off-site sources (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 7.1° C in late winter to 30.9° 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 (O&G)

Oil and grease levels were below detectable levels (<5 mg/l) at all stations throughout 1996. 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)

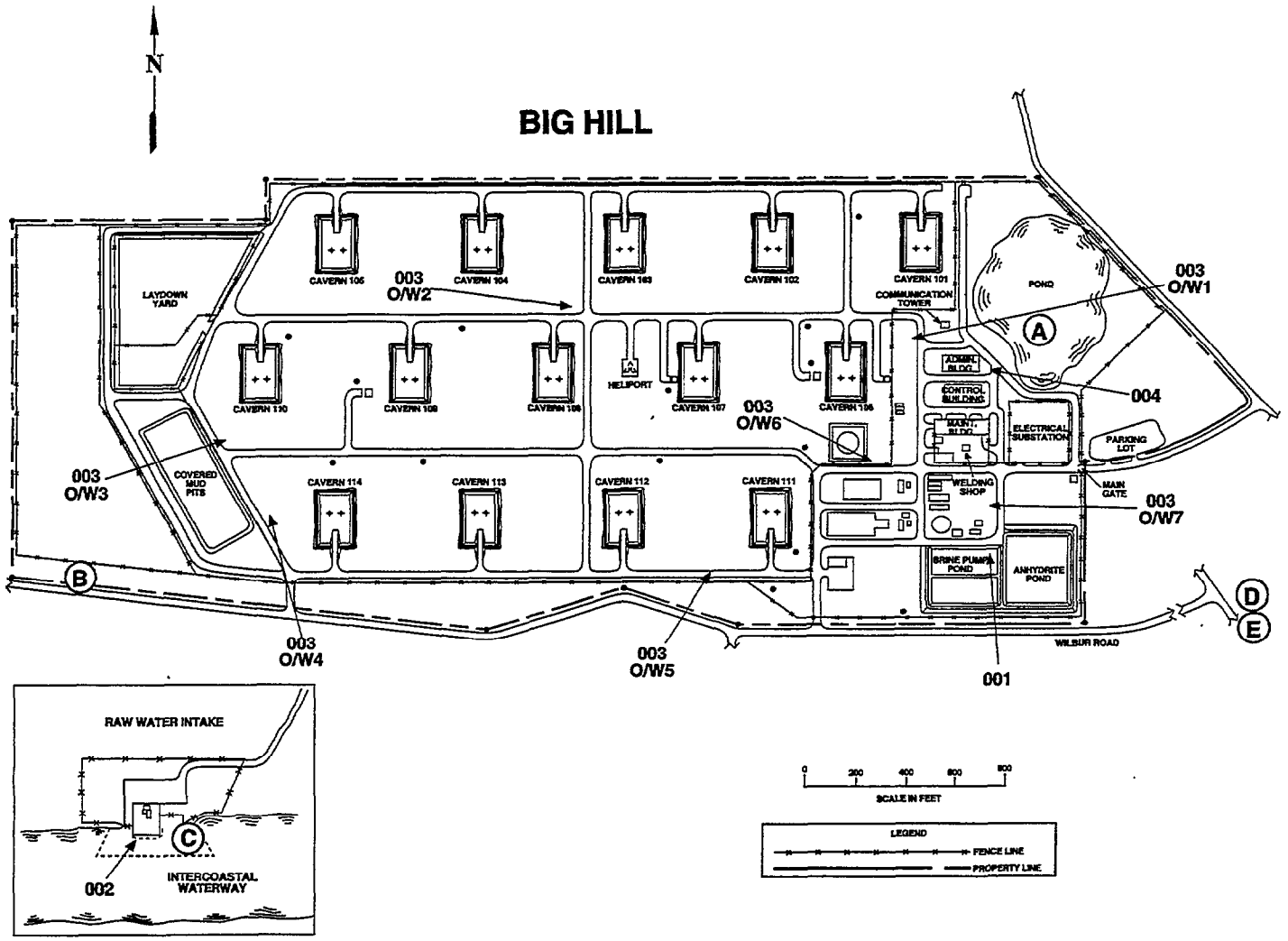
Average annual TOC concentrations ranged from 6.0 to 10.0 mg/l. High TOC readings correlate with high organic loading which is usually found in stagnant or sluggish water bodies of limited volume, such as an evaporating pool of water. This range of TOC is indicative of biologically stable surface waters.

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 pH.

b. Except for one excursion at station C, observed salinities remained generally low and within the historical range. Those



2071/BHMP/4-96

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

Table 5-3. 1996 Data Summary for Big Hill Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Dissolved Oxygen (mg/l)	Total Organic Carbon (mg/l)
Gator Hole							
	Sample Size	12	12	12	11	8	12
	Number of BDL			2	11	1	
	Maximum	8.0	30.0	12.2	2.5	13.2	27.0
	Minimum	6.1	9.0	0.5	2.5	0.1	9.6
	Mean	NV	21.7	5.0	2.5	4.5	16.4
	Median	7.1	23.5	3.8	2.5	3.7	14.9
	Standard Deviation	NV	6.7	4.1	0.0	4.2	6.1
	Coefficient of Variation	NV	30.7	81.7	0.0	94.0	37.2
Pipkin Reservoir							
	Sample Size	12	12	12	11	8	12
	Number of BDL			11	11		
	Maximum	7.3	30.0	1.4	2.5	3.0	22.2
	Minimum	6.5	12.0	0.5	2.5	0.7	4.9
	Mean	NV	21.2	0.6	2.5	1.9	16.7
	Median	6.8	23.5	0.5	2.5	2.0	18.2
	Standard Deviation	NV	6.7	0.3	0.0	0.9	5.1
	Coefficient of Variation	NV	31.8	45.2	0.0	44.3	30.6
RWIS							
	Sample Size	13	13	13	12	8	13
	Number of BDL				11		
	Maximum	8.0	32.0	20.0	2.5	8.8	10.5
	Minimum	6.4	13.0	3.2	2.5	4.8	0.5
	Mean	NV	22.2	11.4	2.5	7.0	6.3
	Median	7.7	23.0	11.2	2.5	7.1	6.0
	Standard Deviation	NV	6.6	5.2	0.0	1.5	2.8
	Coefficient of Variation	NV	29.6	45.8	0.0	22.0	45.4
STP Pond							
	Sample Size	12	12	12	11	8	12
	Number of BDL			12	11		
	Maximum	8.6	32.0	0.5	2.5	9.1	35.2
	Minimum	6.0	12.0	0.5	2.5	1.0	4.6
	Mean	NV	22.4	0.5	2.5	4.0	14.8
	Median	6.7	25.0	0.5	2.5	3.4	11.5
	Standard Deviation	NV	6.0	0.0	0.0	3.2	9.6
	Coefficient of Variation	NV	26.7	0.0	0.0	81.1	65.1
Wilber Ditch							
	Sample Size	12	12	12	11	8	12
	Number of BDL			2	11	1	
	Maximum	7.7	33.0	10.0	2.5	9.9	26.2
	Minimum	6.4	9.0	0.5	2.5	0.3	6.7
	Mean	NV	22.2	3.1	2.5	5.2	14.1
	Median	7.2	23.5	1.6	2.5	5.1	13.9
	Standard Deviation	NV	7.0	3.1	0.0	3.9	5.6
	Coefficient of Variation	NV	31.5	100.4	0.0	75.0	40.0

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

other station. A single monthly measurement of 8.6 s.u. observed at the STP Pond produced the overall highest value this year. However, this value was for the single month and no site activity was associated with the temporary anomaly. Brackish water occasionally found at the Wilber Road Ditch and Gator Hole stations also had slightly elevated pH.

5.2.2.2 Salinity (SAL)

Annual average salinities were generally low, ranging from fresh on the site throughout the year to a maximum of 20.0 ppt at the RWIS during early spring . It was observed that the further south the station location, the slightly higher the salinity and its variability due to seasonal effects, tides, and weather. The fresh water environment evident at the STP pond (Station A) and the Pipkin Reservoir (D) transitioned to brackish at the Gator Hole (E) and the ICW (C). Marsh changes from fresh to intermediate regime were evident. The Gator Hole and the ICW stations which are located in a tidally affected brackish water environment are more subject to variations in salinity.

Salinity observed in the Wilber Road ditch (B) that flows along the south side of the site were greater than that on the site. Possible sources include oil field and agricultural activities in the area. The coefficient of variation for salinity readings taken over the year was much higher at the Wilber Road ditch and the Gator Hole than other stations which confirm that salinity is highly variable at these tidally affected locations.

5.2.2.3 Oil and Grease (O&G)

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

5.2.2.4 Temperature

Temperatures observed in 1996 ranged from 9.0°C to 33.0°C and exhibited the characteristics expected from seasonal meteorological changes. Observed temperatures fell below 20°C during the months of January, February, March, November, 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 lowest variability was at the RWIS where the greater flow and depth of the ICW provided a more constant dissolved oxygen level. The most variable station was the Gator Hole (E) possibly due to seasonal flushing episodes.

5.2.2.6 Total Organic Carbon (TOC)

Average annual TOC concentrations ranged from 6.3 to 16.7 mg/l. The higher TOC levels observed are indicative of potential biological decomposition events.

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 the 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 non-SPR, industrial, or agricultural activities.

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

d. Temperature variations followed seasonal meteorological changes.

e. Dissolved oxygen and total organic carbon fluctuations were within typical ranges indicative of seasonal and meteorological influences.

5.2.3 Bryan Mound

Surface waters surrounding the Bryan Mound site were monitored during 1996. Blue Lake was sampled at seven stations and Mud Lake was sampled at three stations during the months of April and June.

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 Mud lake, serves as a control.

Parameters monitored in the Bryan Mound surface waters include pH, temperature, salinity (SAL), oil and grease (O&G), and total organic carbon (TOC) (Table 5-4). Summary statistic tables were prepared for each of the stations and although only two samples were taken during

BRYAN MOUND

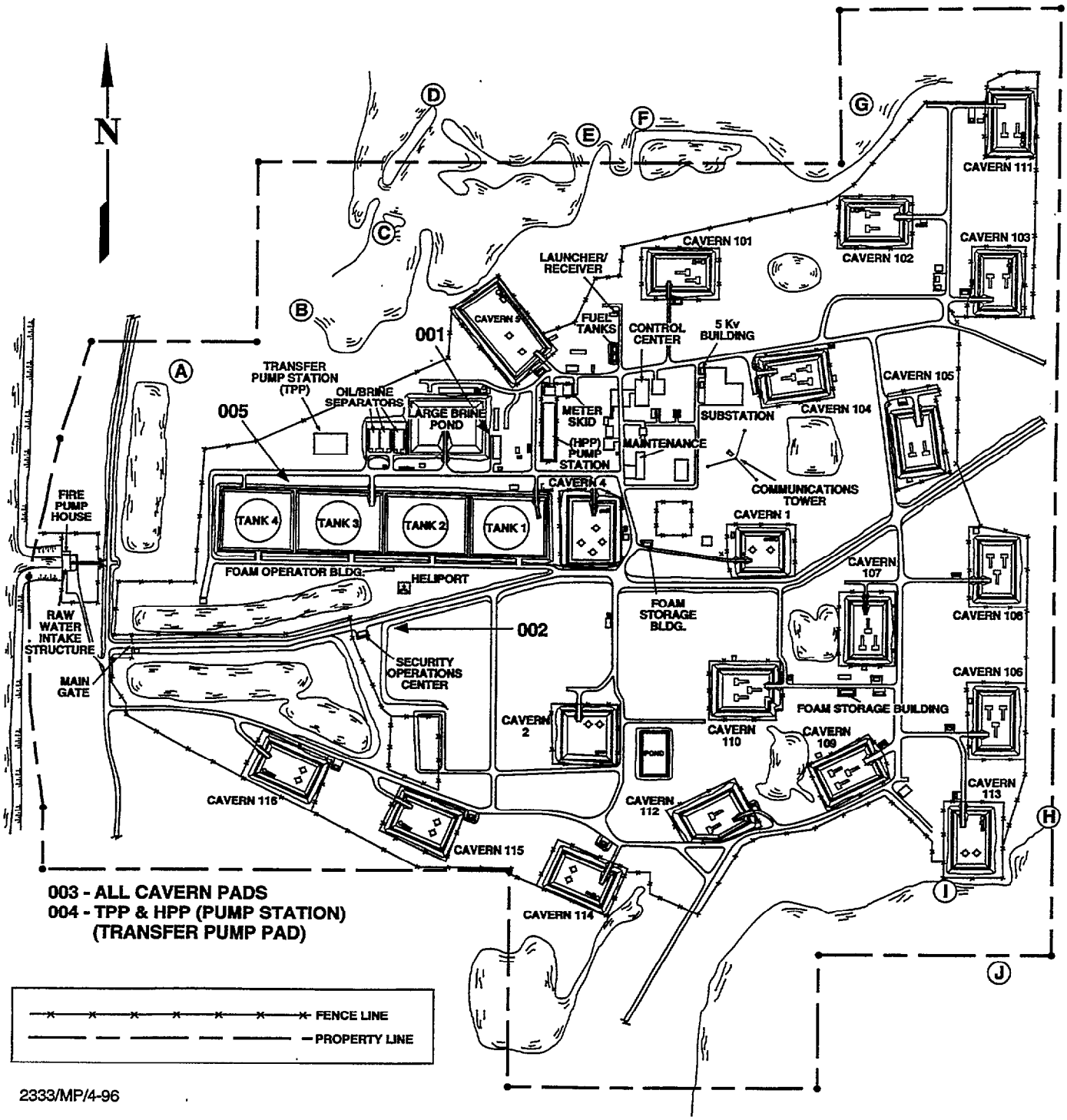


Figure 5-3
(Sheet 1 of 2) Bryan Mound Environmental Monitoring Stations

Federal 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. 1996 Data Summary for Bryan Mound Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Total Organic Carbon (mg/l)
A						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.5	28.0	7.5	2.5	14.2
	Minimum	8.3	21.0	6.0	2.5	13.8
	Mean	NV	24.5	6.8	2.5	14.0
	Median	8.4	24.5	6.8	2.5	14.0
	Standard Deviation	NV	4.9	1.1	0.0	0.3
	Coefficient of Variation	NV	20.2	15.7	0.0	2.0
B						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.4	28.0	7.5	2.5	15.4
	Minimum	8.3	21.0	5.8	2.5	11.8
	Mean	NV	24.5	6.7	2.5	13.6
	Median	8.4	24.5	6.7	2.5	13.6
	Standard Deviation	NV	4.9	1.2	0.0	2.5
	Coefficient of Variation	NV	20.2	18.1	0.0	18.7
C						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.5	28.0	7.5	2.5	14.2
	Minimum	8.3	21.0	5.8	2.5	10.6
	Mean	NV	24.5	6.7	2.5	12.4
	Median	8.4	24.5	6.7	2.5	12.4
	Standard Deviation	NV	4.9	1.2	0.0	2.5
	Coefficient of Variation	NV	20.2	18.1	0.0	20.5
D						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.3	28.0	7.5	2.5	14.5
	Minimum	8.3	21.0	5.7	2.5	11.9
	Mean	NV	24.5	6.6	2.5	13.2
	Median	8.3	24.5	6.6	2.5	13.2
	Standard Deviation	NV	4.9	1.3	0.0	1.8
	Coefficient of Variation	NV	20.2	19.3	0.0	13.9
E						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.2	28.0	7.5	2.5	14.0
	Minimum	8.2	21.0	5.7	2.5	11.8
	Mean	NV	24.5	6.6	2.5	12.9
	Median	8.2	24.5	6.6	2.5	12.9
	Standard Deviation	NV	4.9	1.3	0.0	1.6
	Coefficient of Variation	NV	20.2	19.3	0.0	12.1

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table 5-4 (Continued).
1996 Data Summary for Bryan Mound Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Total Organic Carbon (mg/l)
F						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.2	28.0	7.5	2.5	14.0
	Minimum	8.2	21.0	5.6	2.5	11.4
	Mean	NV	24.5	6.6	2.5	12.7
	Median	8.2	24.5	6.6	2.5	12.7
	Standard Deviation	NV	4.9	1.3	0.0	1.8
	Coefficient of Variation	NV	20.2	20.5	0.0	14.5
G						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.3	28.0	7.5	2.5	14.2
	Minimum	8.1	21.0	5.7	2.5	11.4
	Mean	NV	24.5	6.6	2.5	12.8
	Median	8.2	24.5	6.6	2.5	12.8
	Standard Deviation	NV	4.9	1.3	0.0	2.0
	Coefficient of Variation	NV	20.2	19.3	0.0	15.5
H						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.4	28.0	26.6	2.5	4.0
	Minimum	8.0	26.0	26.2	2.5	3.4
	Mean	NV	27.0	26.4	2.5	3.7
	Median	8.2	27.0	26.4	2.5	3.7
	Standard Deviation	NV	1.4	0.3	0.0	0.4
	Coefficient of Variation	NV	5.2	1.1	0.0	11.5
I						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.5	28.0	26.6	2.5	4.3
	Minimum	8.0	25.0	26.2	2.5	3.2
	Mean	NV	26.5	26.4	2.5	3.8
	Median	8.3	26.5	26.4	2.5	3.8
	Standard Deviation	NV	2.1	0.3	0.0	0.8
	Coefficient of Variation	NV	8.0	1.1	0.0	20.7
J						
	Sample Size	2	2	2	2	2
	Number of BDL				2	
	Maximum	8.8	28.0	26.7	2.5	9.4
	Minimum	8.0	26.0	26.6	2.5	5.1
	Mean	NV	27.0	26.7	2.5	7.3
	Median	8.4	27.0	26.7	2.5	7.3
	Standard Deviation	NV	1.4	0.1	0.0	3.0
	Coefficient of Variation	NV	5.2	0.3	0.0	41.9

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

the year, summary statistics were compiled to aid with the review, as appropriate.

5.2.3.1 Hydrogen Ion Activity (pH)

In 1996 the pH of Blue Lake and Mud Lake was 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.

The pH fluctuations in these Bryan Mound surface waters were quite small and considered within the normal range of variability.

5.2.3.2 Salinity (SAL)

Observed salinity fluctuations ranged from 5.6 to 7.5 ppt in Blue Lake and 26.2 to 26.7 ppt in Mud Lake. Salinity fluctuations are attributed to meteorological and tidal conditions rather than site operations, since salinity 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 1996 ranged from 21°C to 28°C and exhibited the characteristics expected from seasonal meteorological changes.

5.2.3.4 Total Organic Carbon (TOC)

In 1996 observed average TOC in Blue Lake ranged from 10.6 to 15.4 mg/l for the two months tested. Observed TOC in Mud Lake was lower (range: 3.2 to 9.4 mg/l) than Blue Lake. Higher TOC measured in Blue

Lake is attributed to primary productivity and low flushing. 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 for the period tested and slightly basic in Blue Lake and Mud Lake, typical of brackish waters.

b. Temperature and salinity fluctuations observed during the period tested are attributed to meteorological and tidal conditions rather than site operations.

c. Higher TOC levels observed in Blue Lake are attributed to higher primary productivity and low flushing of this surface water body.

5.2.4 St. James Terminal

St. James Terminal is located in a low-lying agricultural area beyond the right descending (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 right descending (west) bank of the Mississippi River. They are curbed with all runoff pumped to the storm water treatment system and retention pond. The site retention pond, which also collects storm water runoff from the six crude oil storage tank containment areas, is discharged intermittently through outfall 001 (Figure 5-4) into the Mississippi River. Two

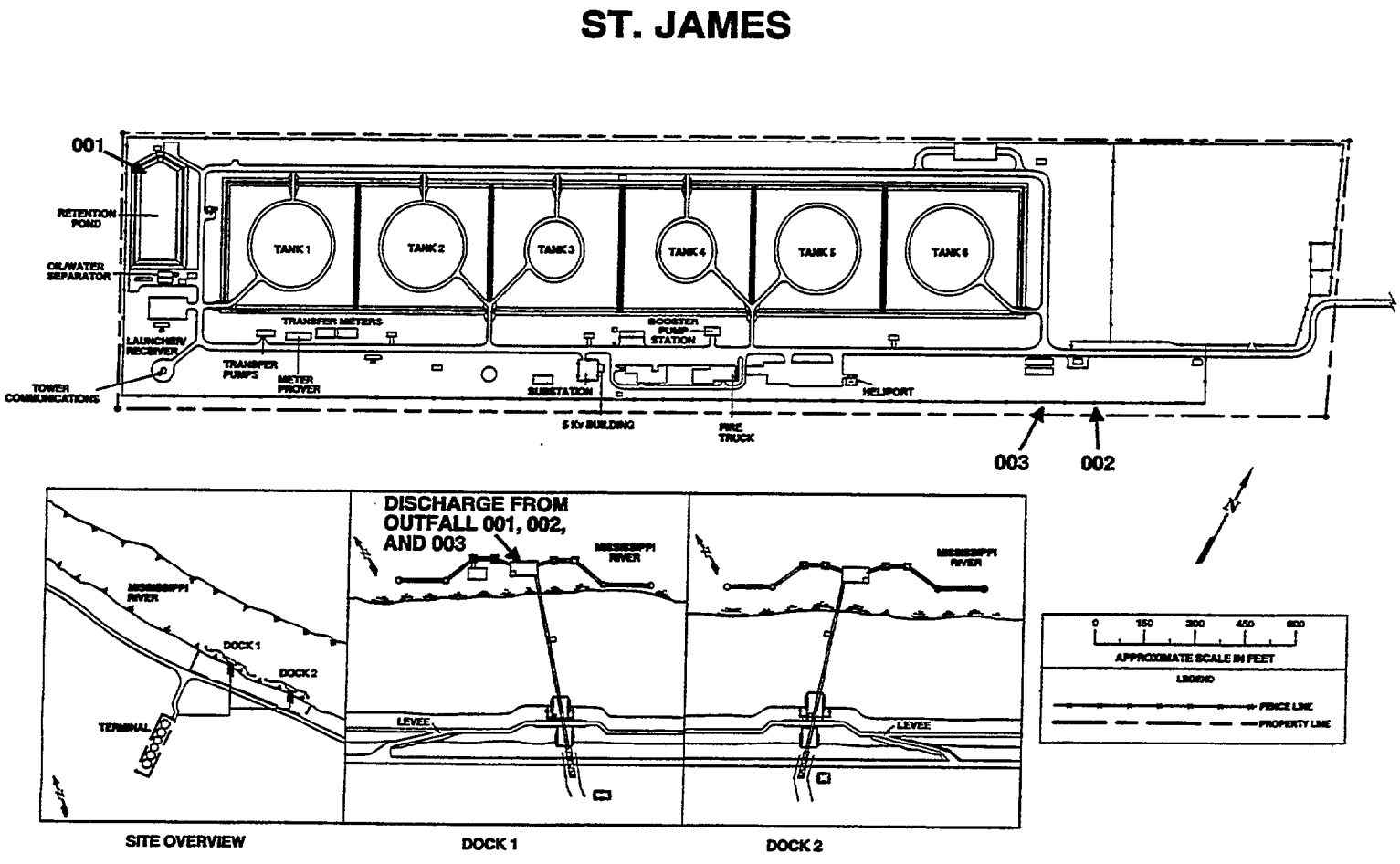


Figure 5-4
(Sheet 1 of 2). St. James Terminal Environmental Monitoring Stations

Federal 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

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.

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.

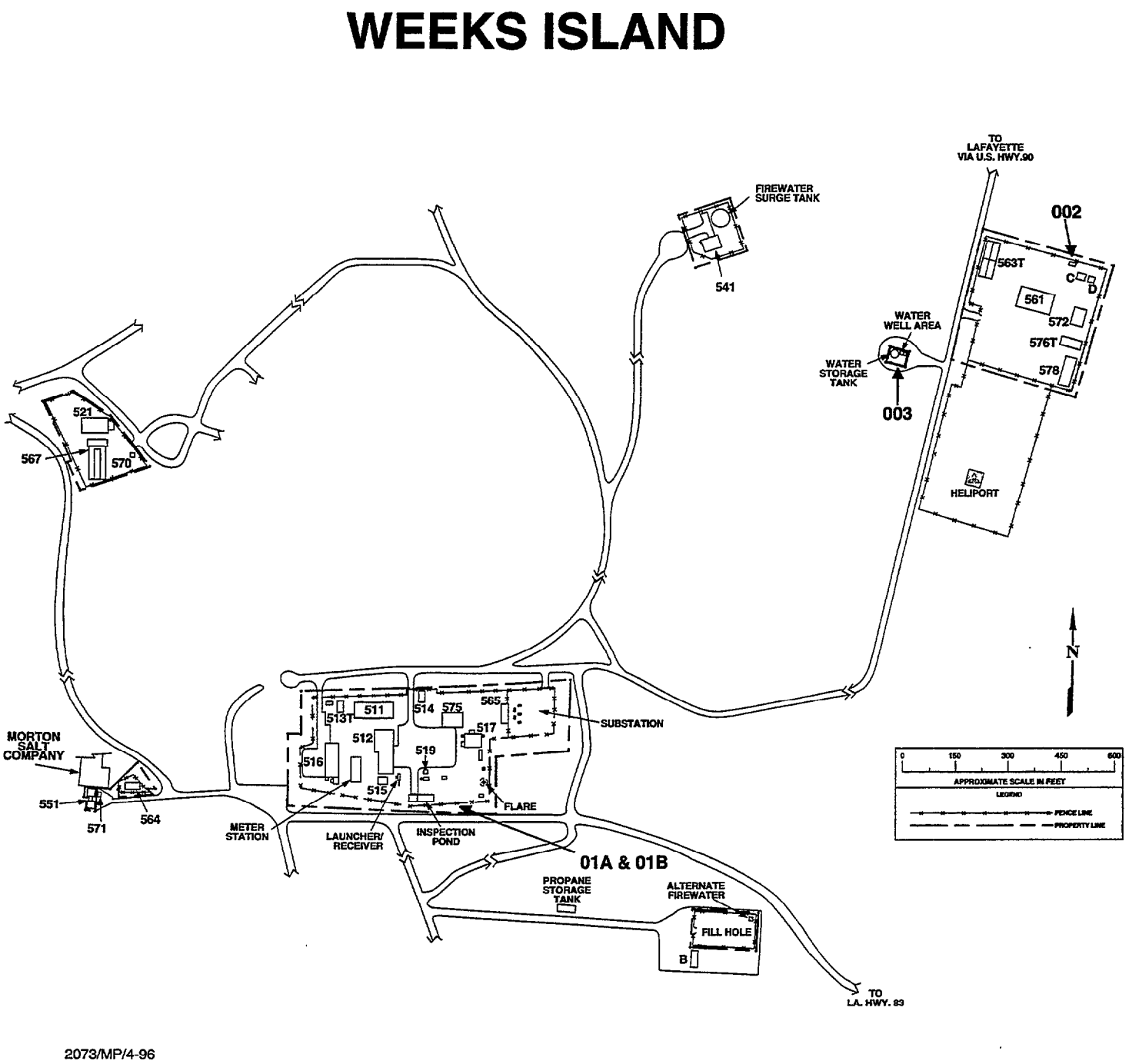


Figure 5-5
(Sheet 1 of 2). Weeks Island Environmental Monitoring Stations

Federal 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 West Hackberry

In 1996, six surface water quality stations (Figure 5-6) were monitored monthly at West Hackberry. Parameters monitored include pH, temperature, salinity (SAL), dissolved oxygen (DO), oil and grease (O&G), and total organic carbon (TOC) (Table 5-5).

5.2.6.1 Hydrogen Ion Activity (pH)

The pH of site and surrounding waters ranged between 7.0 and 9.0 s.u., and median values ranged from 7.3 to 8.3 s.u. Readings were consistently higher and exhibited less variability at the concrete north foam retention pond at the high pressure pump pad on the 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, which is buffered by the concrete retention pond. Surface water sampled at other stations was meteoric in origin.

Fluctuations observed are relatively minor and attributed to environmental and seasonal factors such as variation in rainfall, temperature, algae and biotic growth, and aquatic system flushing.

5.2.6.2 Salinity (SAL)

Meteorological factors such as wind, tide, and rainfall contributed to the salinity variation observed in brackish Black Lake (stations A, B, and C) and the Intracoastal Waterway (ICW) (station F). Salinity ranges observed in these water bodies (5.0 to 18.6 ppt in Black Lake and 7.0 to 7.8 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 (7.3 ppt) was lower than that of Black Lake (11.9 to 12.1 ppt).

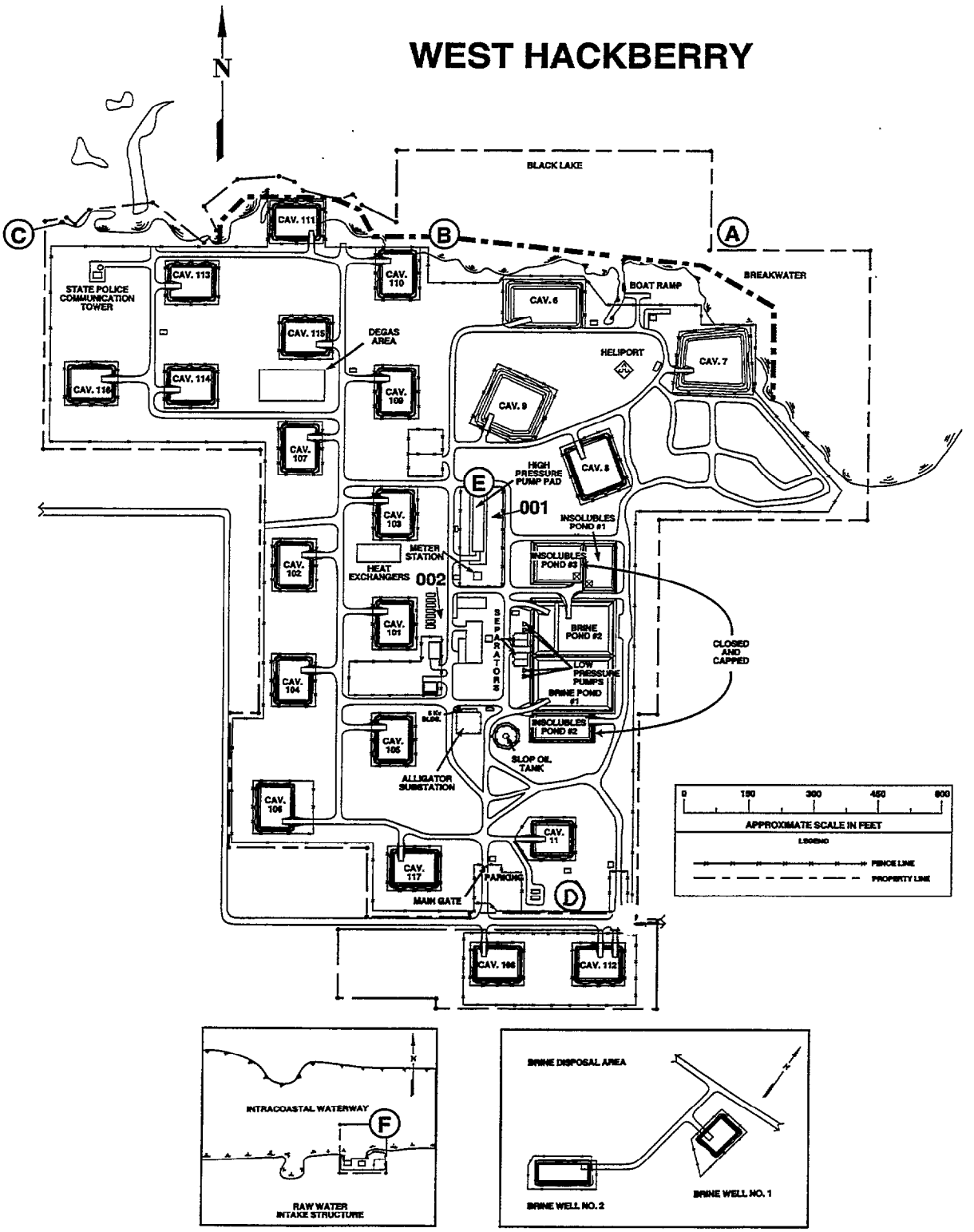


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Figure 5-6
(Sheet 1 of 2) West Hackberry Environmental Monitoring Stations

Federal 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. 1996 Data Summary for W. Hackberry Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Dissolved Oxygen (mg/l)	Total Organic Carbon (mg/l)
A							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	7.9	29.0	18.6	2.5	11.4	20.5
	Minimum	7.0	17.0	5.8	2.5	6.6	7.7
	Mean	NV	22.8	11.9	2.5	8.3	11.2
	Median	7.6	23.5	12.5	2.5	8.0	9.7
	Standard Deviation	NV	3.8	3.6	0.0	1.5	3.7
	Coefficient of Variation	NV	16.6	30.4	0.0	17.8	32.7
B							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	7.8	29.0	18.6	2.5	11.2	17.2
	Minimum	7.1	17.0	6.0	2.5	6.7	7.8
	Mean	NV	22.8	12.1	2.5	8.2	11.9
	Median	7.6	23.5	12.3	2.5	8.0	10.8
	Standard Deviation	NV	3.8	3.5	0.0	1.3	3.3
	Coefficient of Variation	NV	16.6	29.3	0.0	16.3	27.9
C							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	7.8	29.0	18.5	2.5	11.1	21.4
	Minimum	7.1	17.0	5.0	2.5	6.5	7.9
	Mean	NV	22.6	12.1	2.5	8.1	11.5
	Median	7.5	22.5	12.7	2.5	8.0	9.7
	Standard Deviation	NV	3.8	3.7	0.0	1.4	4.1
	Coefficient of Variation	NV	17.0	30.8	0.0	17.3	35.6
D							
	Sample Size	10	10	10	4	10	10
	Number of BDL			5	4		
	Maximum	8.4	26.0	1.0	2.5	16.0	29.8
	Minimum	7.1	18.0	0.6	2.5	1.8	1.9
	Mean	NV	22.2	0.9	2.5	8.0	17.3
	Median	7.6	22.0	1.0	2.5	7.7	18.3
	Standard Deviation	NV	3.4	0.1	0.0	3.9	8.2
	Coefficient of Variation	NV	15.1	16.3	0.0	49.3	47.3

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

Table 5-5 (Continued).
1996 Data Summary for W.Hackberry Monitoring Stations

Station	Statistical Parameters	pH (s.u.)	Temperature (deg. C)	Salinity (ppt)	Oil & Grease (mg/l)	Dissolved Oxygen (mg/l)	Total Organic Carbon (mg/l)
E							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	9.0	26.0	7.8	2.5	11.7	27.1
	Minimum	7.6	16.0	0.2	2.5	1.9	4.6
	Mean	NV	22.2	2.4	2.5	7.7	12.1
	Median	8.3	22.5	1.0	2.5	7.9	11.4
	Standard Deviation	NV	2.9	2.5	0.0	2.4	6.2
	Coefficient of Variation	NV	13.2	101.4	0.0	31.4	51.3
F							
	Sample Size	12	12	12	4	12	12
	Number of BDL				4		
	Maximum	7.8	29.0	7.8	2.5	9.3	20.1
	Minimum	7.0	19.0	7.0	2.5	5.6	3.5
	Mean	NV	23.0	7.3	2.5	7.3	11.6
	Median	7.3	22.5	7.3	2.5	7.1	10.4
	Standard Deviation	NV	3.5	0.2	0.0	1.2	4.5
	Coefficient of Variation	NV	15.3	3.2	0.0	16.4	39.3

Note: BDL = Number of samples that were below the detectable limit.
NV = Not a valid number or statistically meaningful.

This may be due to its closer proximity to brackish coastal waters and associated salt water intrusion, and to the larger surface area per volume of water in Black Lake, making it more susceptible to evaporative induced salinity effects.

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) reached 1.0 ppt, and salinity at the high pressure pump pad (station E) reached 7.8 ppt, which are common for this brackish environment.

5.2.6.3 Temperature

Observed temperatures in 1996 were consistent with observations at other sites and were indicative of regional climatic effects. No off-normal measurements were observed. Recorded temperatures ranged from 16°C to 29°C and were generally consistent among stations.

5.2.6.4 Dissolved Oxygen (DO)

The DO levels observed at all stations are suitable for aquatic life. Dissolved oxygen was somewhat variable at all 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 were sufficient to provide some aeration throughout 1996.

5.2.6.5 Total Organic Carbon (TOC)

Average annual TOC concentrations ranged from 11.2 to 17.3 mg/l. Monthly TOC concentrations were generally quite similar at all stations throughout 1996.

5.2.6.6 Oil and Grease (O&G)

Observed O&G levels were below the detectable level (5 mg/l) at all stations throughout 1996. 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 salinities observed throughout 1996 were consistent with the ambient brackish environment.

c. Oil and grease levels were below the detectable limit at all stations throughout 1996 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 were quite similar at all stations throughout the year suggesting no substantial transient biological events.

5.3 WATER DISCHARGE PERMIT MONITORING

The water discharge permit monitoring program fulfills the requirements of the EPA NPDES, and corresponding state TPDES, LWDPS, and the new LPDES 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 1996. 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; and

e. hydrostatic test water for piping or tanks (LA only).

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 1996, 8,464 measurements and 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 99.8 percent of the analyses performed. A total of 15 permit noncompliances were reported (Tables 5-8, 5-10, 5-13, and 5-15) during CY 1996. One (7 percent) of the permit noncompliances experienced on the project was due to a reporting error. Three (20 percent) were due to sampling, sample handling, or sampling related phenomena. Eleven samples were outside of permit parameter limits accounting for 73 percent.

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

Bayou Choctaw personnel performed a total of 1,085 measurements on permitted outfalls and reporting stations to monitor NPDES and state permit compliance during 1996. Table 5-6 provides the permit required monitoring parameters and limits for the Bayou Choctaw outfalls. There were zero noncompliances in 1996 resulting in a site compliance performance of 100 percent.

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 temporary permit was obtained for the stormwater discharges associated with the onsite degassing unit to cover the period April, 1996 through September, 1996.

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 co./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

During 1996, 2,538 measurements were performed to monitor NPDES and state discharge permit compliance. Table 5-7 provides the permit required monitoring parameters and limits for the Big Hill outfalls. There were five noncompliances during 1996 (Table 5-8) resulting in a 99.8 percent 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). The discharges at the site 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 1996 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 & 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 0_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	Flow	(report only)
(TPDES 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	Flow	report
(not used)	TSS	report
	pH	6.0 - 9.0 su

Table 5-8. 1996 Permit Noncompliances at Big Hill

Date	Outfall Location	Permit Parameter	Value (Limit)	Cause
05/20/96	N/A	DMR	N/A	DOE's signature of the March 1996 Discharge Monitoring Report (DMR) was inadvertently overlooked resulting in noncompliance.
02/01/96 02/02/96 02/05/96 02/06/96	Outfall 001	pH	< 6.0 (6.0 - 9.0 s.u.)	Samples of brine taken on four different days discharged at outfall 001 indicated pH readings below the 6.0 cutoff resulting in four noncompliances.

5.3.3 Bryan Mound

Bryan Mound personnel made 2,164 measurements on permitted outfalls for the purpose of monitoring NPDES and state discharge

permit compliance during 1996. Table 5-9 provides the permit required parameters and limits for the Bryan Mound outfalls. There were eight noncompliances during 1996 (Table 5-10) resulting in a 99.6 percent site compliance performance level.

Table 5-9. Parameters for the Bryan Mound Outfalls

Location/Discharge	Parameter	Compliance Range
Brine to Gulf	Flow	report only
	Velocity	>6.1 m/sec (20 ft/sec)
	Oil & Grease	<15 mg/l max
		<10 mg/l avg.
	TDS	(report only)
	TSS	(report only)
	pH	6.0 - 9.0 su
	Copper	<0.21 mg/l
	Biomonitoring	Lethal NOEC 1.53%
Stormwater	Flow	(report only)
	Oil and Grease	<15 mg/l
	TOC	< 50 mg/l
	pH	6.0 - 9.0 su
	Salinity	< 8 ppt
Sewage Treatment Plant	Flow	(report only)
		(RCT only)
		<.006 mgd max
		<.004 mgd avg.
	BOD_5	<45 mg/l max
		<20 mg/l avg.
	COD	<250 mg/l max (RCT only)
		<150 mg/l avg.
	Chlorine	1.0 mg/l
	pH	6.0 - 9.0 su
	TSS	<45 mg/l max
		<20 mg/l avg.

Table 5-10. 1996 Permit Noncompliances at Bryan Mound

Date	Outfall Location	Permit Parameter	Value (Limit)	Cause
08/19/96	Sewage Treatment Plant	Flow	11,000 gpd (6,000 gpd)	Excessive flow of 11,000 gallons per day was caused by mechanical failure of seat mechanisms in administration and control buildings.
07/19/97	Sewage Treatment Plant	Residual Chlorine	No sample	Failure to obtain residual chlorine sample due to breakdown in communications among operator, shift supervisor, and control room operator was recognized and addressed.
05/22/96 05/23/96	Sewage Treatment Plant	Flow	7,140 gpd 7,451 gpd (6,000 gpd)	Maximum permitted flow rate exceeded on two consecutive days caused by "free-flowing" toilet resulted in two noncompliances.
03/19/96	Brine to Gulf	pH	No sample	Failure to obtain pH sample on brineflow to the Gulf of Mexico.
01/04/96 01/05/96 01/08/96	Brine to Gulf	Oil & Grease	39.8 mg/l 23.7 mg/l 18.8 mg/l (15 mg/l)	Three samples of brine discharged to the Gulf of Mexico exceeded the oil & grease permit level resulting in three noncompliances. Possible cause was internal recirculation activities when the brine pond level was low which caused resuspension of oil-contaminated silts and anhydrites.

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). Under provisions of the new permit Bryan Mound was able to reduce the frequency of its biomonitoring to annual based on the lethal No Observed Effect Concentration (NOEC) being below the permitted limit. 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

At the St. James site 101 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 1996 resulting in a perfect (100 percent) compliance level.

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 & Grease	<15 mg/l
	pH	6.0 - 9.0 su
	TOC	<50 mg/l
Sewage Treatment Plant	Flow	(report only)
	BOD_5	<45 mg/l
	TSS	<45 mg/l
	pH	6.0 - 9.0 su

5.3.5 Weeks Island

During 1996, 230 measurements were performed on permitted outfalls to monitor NPDES compliance. Table 5-12 provides the permit required monitoring parameters and limits for the Weeks Island outfalls. There was one noncompliance in 1996 (Table 5-13) resulting in a site compliance performance level of 99.6 percent.

The water discharges at Weeks Island are regulated and enforced in accordance with the new LPDES program which incorporates the old EPA NPDES permit and the current LWDPS (state) water discharge

permit. There are separate outfalls (01B and 002) for each package sewage treatment plant. Outfall 01A handles all of the stormwater runoff collected in an onsite retention pond (Figure 5-7). There was no discharge from the iron removal unit (outfall 003) in 1996. The water condensing unit for the mine air (outfall 004) operated nearly continuously in 1996.

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
Mine Air Dryer Condensate Water	Flow	(report)
	pH	6.0 - 9.0 s.u.
	TOC	(report)

Table 5-13. 1996 Permit Noncompliance at Weeks Island

Date	Outfall Location	Permit Parameter	Value (Limit)	Cause
01/11/96	Sewage Treatment Plant, Outfall 01A/001	BOD_5	37 ppm (State monthly average limit = 30 ppm)	Sample was sent to contract lab for analysis with results indicating BOD_5 level exceeding state monthly average limit. Results were received within the following month; therefore, additional samples were not able to be taken to reduce average. "Free-flowing" toilet was repaired, allowing plant to return to normal operations mode.

5.3.6 West Hackberry

West Hackberry personnel performed 2,346 measurements on permitted outfalls to monitor NPDES compliance during 1996. Table 5-14 provides the permit required parameters and limits for the West Hackberry outfalls. There was one noncompliance during 1996 (Table 5-15); therefore, the 1996 site compliance level was 99.9 percent.

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 (20 ft/sec)
	Oil & Grease	<15 mg/l
	TSS	(report only)
	TDS	(report only)
	pH	6.0 - 9.0 su
	DO	detectable (when using 0_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. 1996 Permit Noncompliance at West Hackberry

Date	Outfall Location	Permit Parameter	Value (Limit)	Cause
01/03/96	Sewage Treatment Plant, Outfall 002	Fecal Coliform	(400 col/100 ml)	Samples indicated presence of high levels of fecal coliform due to lack of chlorination. Performance of chlorine test has been increased to once per shift.

The water discharges at the West Hackberry site are regulated and enforced in accordance with the new LPDES program which

incorporates the old EPA NPDES permit and the former LWDPS state water discharge permit. The three categories of discharges and their parameters 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. During 1996, Bryan Mound, Bayou Choctaw, and West Hackberry moved substantial amounts of oil and brine in conjunction with degas operations at those sites. Weeks Island also moved oil off site as part of decommission activities throughout 1996.

5.4.1 Oil Spills

State agencies require notification if an oil spill exceeds one barrel in LA or five barrels in TX or if the potential for impact is recognized by making required NRC notifications. There were four reportable oil spills during 1996 totaling 4.7 m^3 (29.5 bbls). No spills resulted in environmental damage.

In 1996, the total volume of oil moved (received and transferred internally) was approximately 24.9 million m^3 (157.112 mmb). The total number of reportable 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 1996.

Table 5-16. Number of Reportable 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	36.9 (232)	0.0007
1994	7	6.2 (39)	0.0003
1995	2	56.3 (354)	0.0006
1996	4	4.7 (30)	0.00002

The four reportable oil spills that occurred during 1996 are presented in Table 5-17. Oil spills of one barrel or greater are mid-level (by total volume) spilled during the 15 year period. No spills of oil occurred during the months of January, February, May, June, July, August, September, October, and December. No trend is readily apparent in the low number of event occurrences this year.

Table 5-17. 1996 Reportable Oil Spills

Date	Location	Amount	Cause/ Corrective Action
03/27/96	BC	Sheen	A sheen was observed on the East/West Canal. Further investigation revealed the sheen was caused by <1 qt. of oily fluid (transmission fluid). The fluid was present in the degas retention pond and was released when a subcontractor discharged the contents of the pond to the canal. Site management determined the release to be so slight that it would be allowed to dissipate.
04/16/96	WH	0.16 m^3 (1 Bbl)	2" inside manifold drain line failed causing release of approximately 1 barrel of crude onto well pad of Cavern 106. Cavern isolation and well head valves were locked out. All oil was contained within the dike walls.
11/21/96	BC	0.24 m^3 (1.5 Bbls)	Oil leak was discovered on ½" vent plug. Possible vibration caused vent plug to loosen. Release was contained immediately and clean-up activities commenced.
11/21/96	BM	4.3 m^3 (27 Bbls)	Tank cleaning contractor removed a spool piece on inlet piping to Tank #2 preparing to start tank cleaning process. Residual oil in spool piece exceeded capacity of containment basin and released oil into the diked tank area. Suction pump was placed on-line immediately, and a secondary containment dike was constructed to retain remaining release.

5.4.2 Brine Spills

In 1996, the six SPR sites reported five brine spills in quantities of one barrel (42 gallons) or greater or as required by regulation. Brine spills are reported if they may affect water quality. The five brine spills totaled 179.7 m^3 (1,130 bbls). None of the brine spilled resulted in environmental damage. No long-term adverse environmental impact was observed from any CY 96 SPR brine spill.

The SPR disposed of 12.87 million m^3 (80.38 mmb) of brine (mostly saturated sodium chloride solution, some discharges were of lower salinities than normally attributed to brine) during 1996. Approximately 87.5 percent of the brine was disposed in the Gulf of Mexico via the Big Hill (54.2 percent of the total), and the Bryan Mound (33.3 percent of the total) brine disposal pipelines. The remainder was disposed in saline aquifers via injection wells at the Bayou Choctaw (10.7 percent of the

total), and West Hackberry (1.8 percent of the total) sites. In 1996 less than 0.1 percent of the total was disposed at permitted off-site disposal wells. Saltwater recirculation was continued at the Weeks Island site throughout 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. This recirculating volume of 65,709 bbls is not considered in the disposal figures but is incorporated in the brine spill performance calculation.

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 through 1996.

The brine spills involving quantities in excess of 0.16 m^3 (1 bbl), both contained and uncontained, during 1996 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 1996, four of the five spills were the result of corrosion/erosion. The remaining spill was attributed to equipment failure. As indicated in Table 5-18, over the 15 year period of 1982 to 1996, CY '96 experienced the third lowest number of spill incidents.

Table 5-18. Number of Reportable Brine Spills

Year	Total Spills	Volume Spilled m^3 (barrels)	Percent Spilled of Total Throughput
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
1995	3	131.1 (825)	0.0028
1996	5	179.7 (1,130)	0.0014

Table 5-19. 1996 Reportable Brine Spills

Date	Location	Amount	Cause/ Corrective Action
02/08/96	BM	19.88 m^3 (125 Bbls)	During routine brine flow to the Gulf of Mexico, a failed gasket on a blind flange for a 3" diameter instrument test port of the site 24" diameter offshore brine disposal pipeline allowed brine to leak. Containment operations were successful in controlling the leakage to adjacent site drainageways where retrieval and flushing operations began. The failed flange gasket was replaced and a chain and lock was installed to hold the 3" valve in closed position.
7/18/96	BM	159 m^3 (1,000 Bbls)	Failure of 30" brine header piping connecting Phase III Caverns resulted in release of 1,000 barrels of brine. Spill caused fish kill in onsite freshwater pond. Quick response by ERT personnel reduced impact by rescue of 49 fish to another pond.
07/24/96	WH	0.32 - 0.48 m^3 (2-3 Bbls)	While brine pumps were being used to provide suction to High Pressure Pump injection pumps for equipment exercise, brine was discovered bubbling out of the ground. Exercise was halted and brine/raw water system depressured. Source was identified as 36" line to 8" line weld.
09/09/96	WH	0.16 m^3 (1 Bbl)	Discolored grass discovered on site. Excavation revealed pinhole leak in 36" brine-return line. Leak plugged, ultrasonic inspection performed to ensure pipeline integrity.
12/23/96	WH	0.32 m^3 (2 Bbls)	During pressurization for Caverns 109 and 112 following a drawdown sale movement, an underground brine leak was discovered. Pressurization was halted, pumps shut down, and header isolated. Cause was determined to be 36" line to 8" line weld - pinhole leak.

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 1996.

Brine and hydrocarbon contamination of ground water was 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 soil gas analysis. Phase II activities for verification of contamination was completed in 1996. Phase II consisted of sampling and testing ground water from monitoring wells that were installed in areas of potential contamination identified in the Phase I survey. The Phase II or "verification" step tested these water samples, on one occasion, for the presence of petroleum hydrocarbons, the presence of appreciable salinity and chloride content, or both. Details of this study and the additional data resulting from the field and lab work are provided in paragraph 6.7 of this section.

In the past, the SPR has used the traditional three to five well volumes evacuation in preparation for well sampling. Based on a comparative field study completed at the Big Hill site in 1995, the SPR is transitioning to a low flow sampling technique which greatly reduces the sampling time and generation of waste water. Implementation of this ground water sampling technique began at Big Hill and West Hackberry in 1995, and initial equipment installation work was completed at Bryan Mound near mid-year 1996.

Ground water data collected for the past five years and 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.

Historically, there have been four monitoring wells (MW1, MW2, MW3, and MW4) at the Bayou Choctaw site (Figure 6-1). These wells were drilled roughly 30 feet below land surface (bls) to monitor impact from the brine pond and other shallow contamination. The verification well study placed seven additional similarly screened wells around the main site and one remotely down near a selected brine disposal well pad. These wells have been added to the site's monitoring scheme to enhance evaluation of ground water flow direction and salinity movement. Details of the Phase II studies are located in paragraph 6.7 of this section.

Ground water salinities observed at the four historical 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.

Past surface brine spills and other activities from previous occupants of the area may have also affected the ground water salinity observed in these shallow wells. The salinity range observed at well MW3 is much greater than that of the other three historical wells. Ground water surface piezometric data of all the wells indicate that ground water movement is radial in all directions from the high point on the dome around Cavern 15. 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 southerly movement was captured by MW3. The historical graph indicates that the salinity is lessening as time goes on and the effects of the spill become either dilute or move past this monitoring point.

Long-term salinity trends have been established which, examined within the context of the radial ground water movement, assist in identifying possible areas or sources of contamination. Wells MW1 and MW2 both exhibit a continuing general decrease in salinity throughout 1996. Well MW1 is situated upgradient of the brine pond area, with respect to ground water movement and well MW2 appears to be immediately downgradient of the brine pond. A potential source of subsurface contamination may be residuals from historical activity that occurred along the northwest corner of the pond. Verification well PW2 encountered this existing affected area and details of that evaluation are located in paragraph 6.7 of this section. No trending data are currently available for the newly added verification wells. Although it has captured the most saline ground water on the site, MW3 is slowly decreasing in salinity over time. The steeply downward sloping salinity trend observed at MW3 over the past five years differs from that observed at the other pond wells. This appears to confirm that some other brine source, such as the piping leak found near the low pressure pumping pad, is affecting MW3.

Despite frequent fluctuations, there is no salinity trend observed at well MW4. The fresh water observed in early 1995 and later in 1996 is a sampling artifact. This well is situated away from and down gradient of the brine pond and the affects observed near higher salinity well MW3. Changes in sampling methodology implemented in 1995 and 1996 may have affected the historical trending at this position.

Future ground water data, including that from the newly added wells from the Phase II verification studies, and ongoing inspections of the brine pond and site piping will assist in determining if any contamination observed originated from SPR activities.

BAYOU CHOCTAW

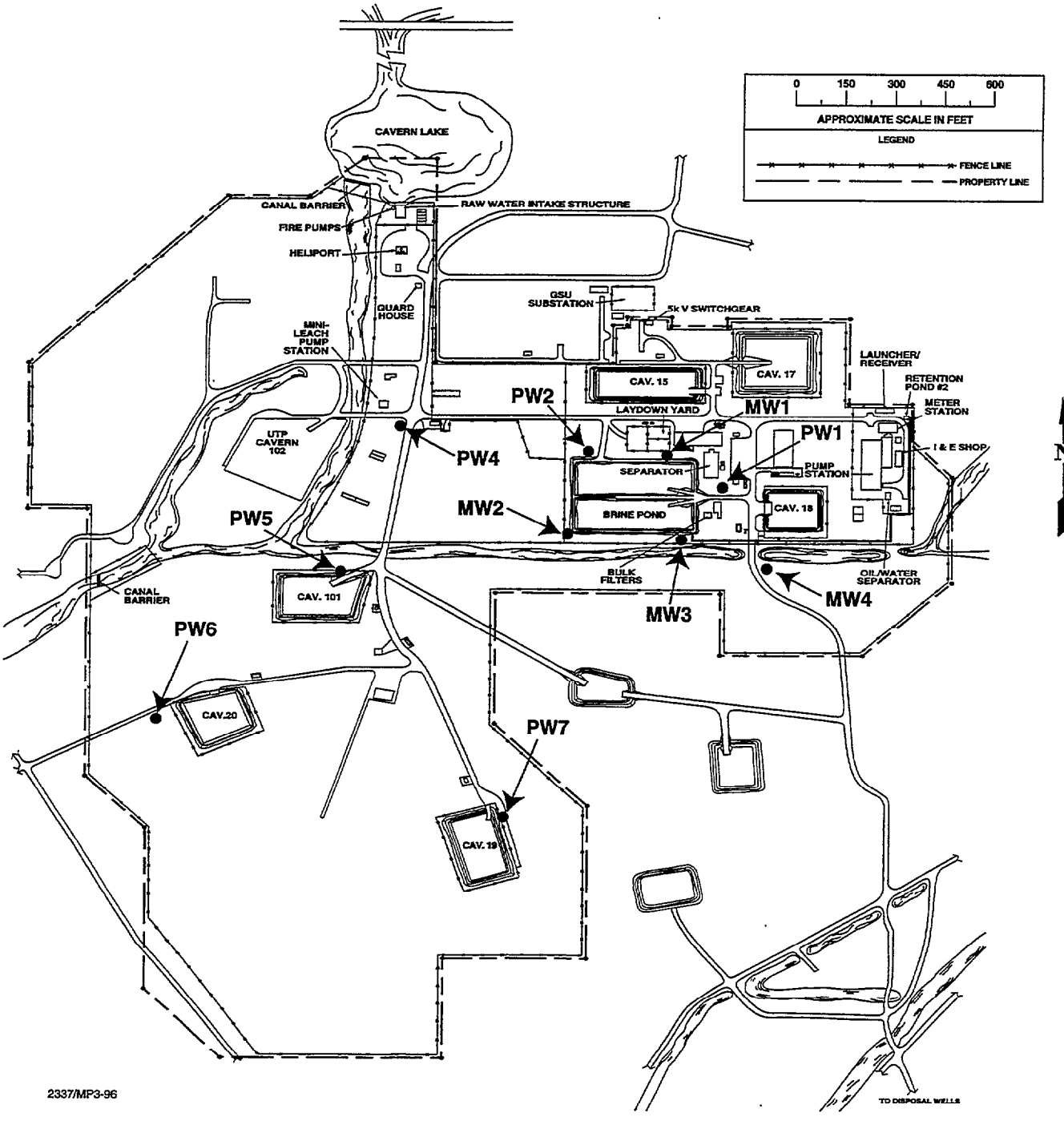


Figure 6-1.
Bayou Choctaw Ground Water Monitoring Wells

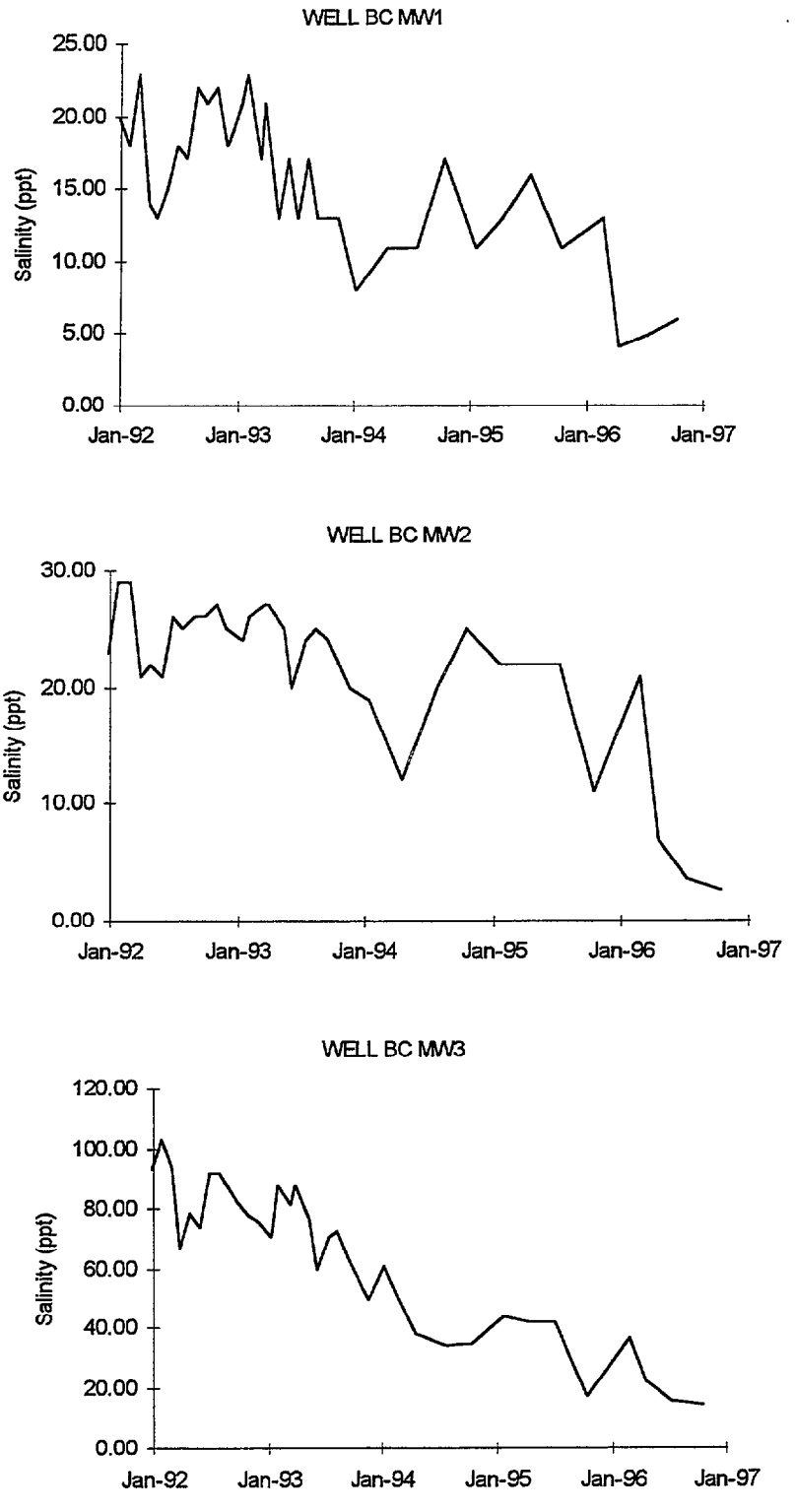


Figure 6-2.
Bayou Choctaw Ground Water Monitoring Well Salinities

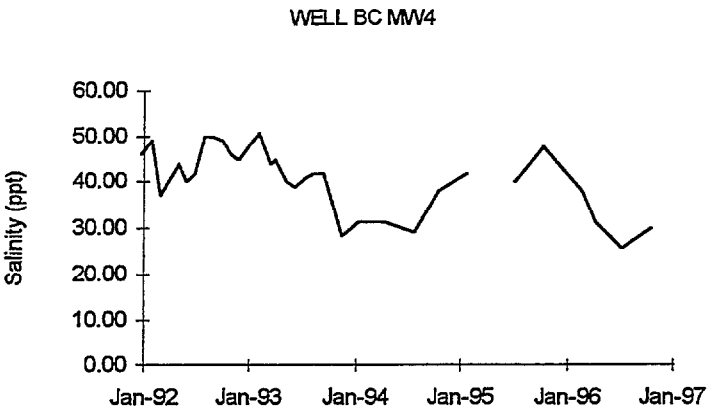


Figure 6-2. (Continued)
Bayou Choctaw Ground Water Monitoring Well Salinities

6.2 BIG HILL

The three major subsurface hydrological formations in the Big Hill area are the Chicot and Evangeline aquifers and the Burkeville 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. Big Hill began sampling these wells by the low-flow method in May 1995. The pond system is composed of three Hypalon-lined ponds, of which two have a protective concrete top coat. All three have an underdrain system contained within a slurry wall keyed to a clay bed. 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 detection limit for statistical

calculations. Observed salinity changes are too low to indicate contamination.

Also located on the site are 16 2-inch brine piping leak detection monitoring wells (wells MW2-1 to MW2-16). These wells were sampled by the traditional pump and purge technique and have been converted for low-flow sampling on a bimonthly schedule. Unlike those around the brine pond, these smaller wells are installed adjacent to buried onsite brine piping to detect brine, should a leak occur. In many instances they are not deep enough to intercept the shallow uppermost aquifer (Figure 6-3). As a result, two wells remain dry, four damaged and out-of-commission wells were not replaced in 1996, and the remaining 10 were sampled intermittently during the year using a modified low flow method. Salinity measurements at nine of the ten wells did not exceed 2.0 ppt. Only ground water from well MW2-15, east of Cavern 111, had an elevated salinity with measurements of 8.2 to 10.6 ppt. These salinities are attributed to the residual effect of a past brine piping failure. The observed salinity at this location has decreased over time from a 1994 maximum of 17.1 ppt.

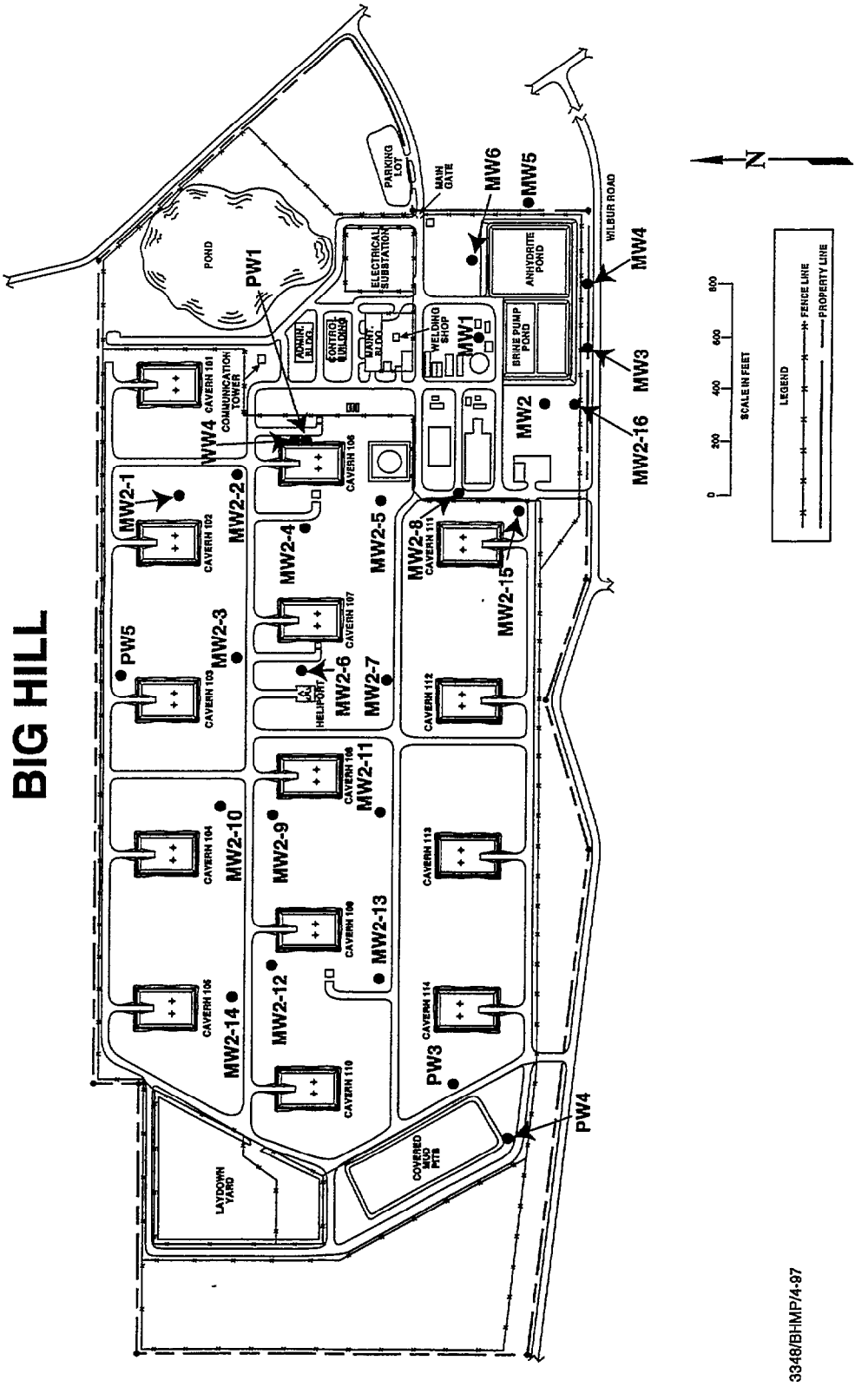


Figure 6-3.
Big Hill Ground Water Monitoring Wells

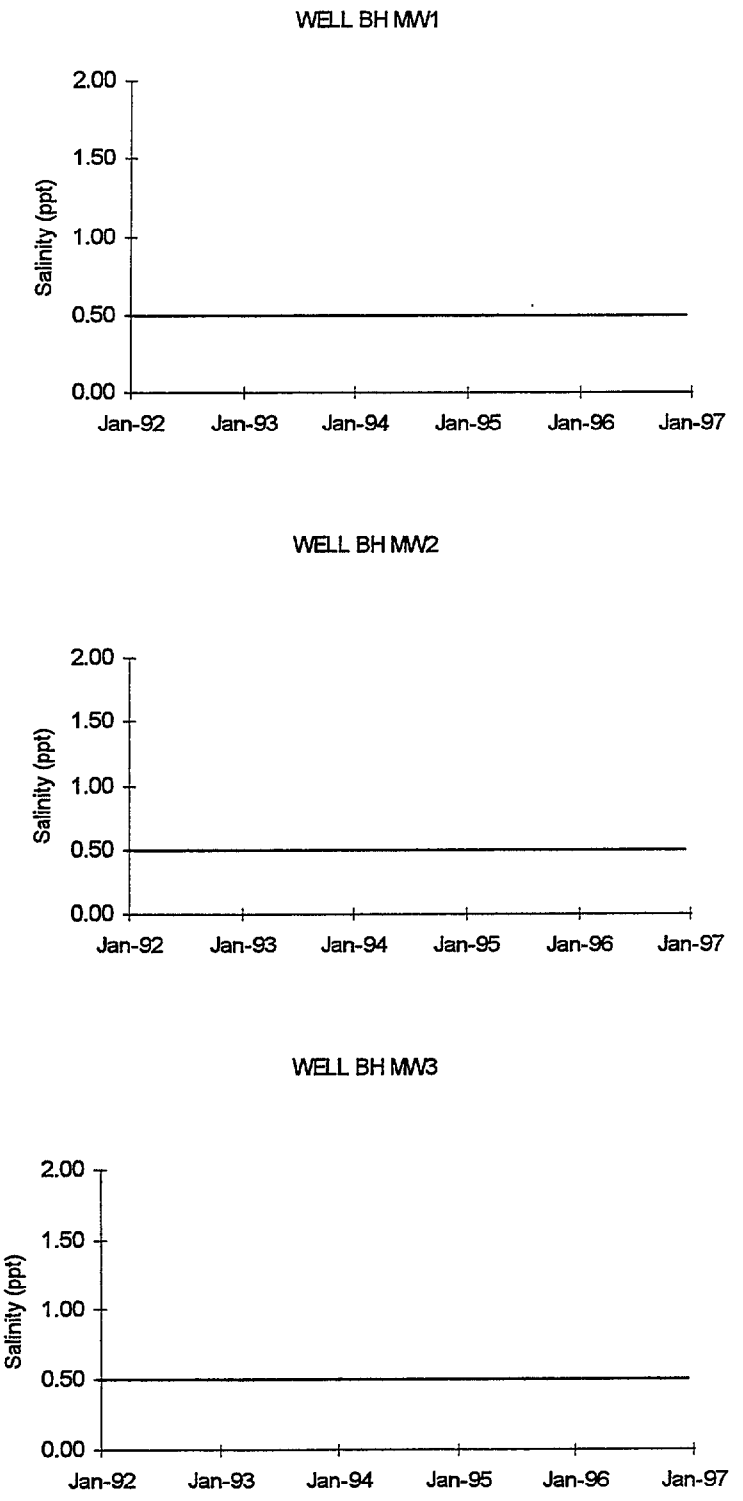


Figure 6-4.
Big Hill Ground Water Monitoring Well Salinities

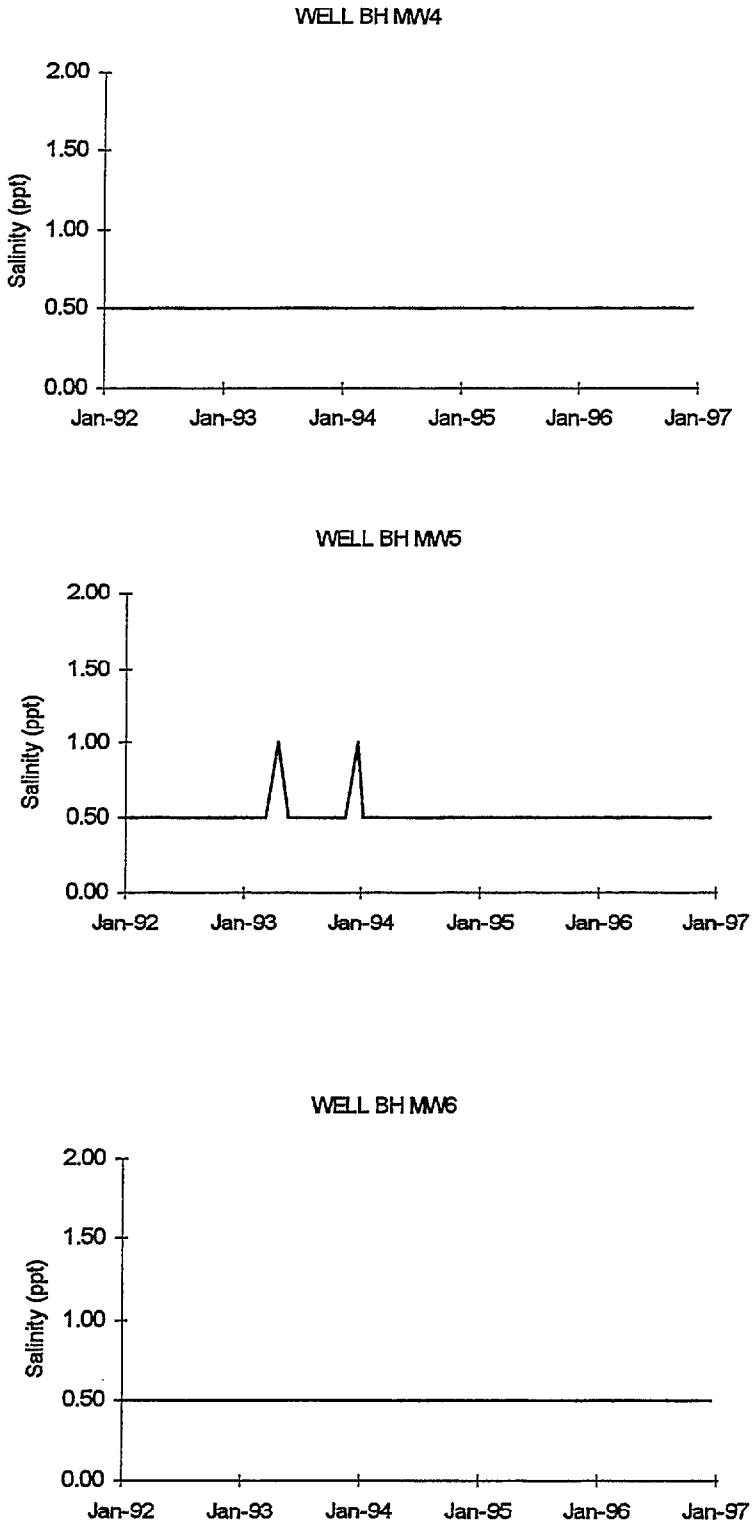


Figure 6-4. (Continued)
Big Hill Ground Water Monitoring Well Salinities

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. This generalization is confirmed by additional salinity data from the verification well study (VWS). 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 the Bryan Mound area. Other than the one time sampling of the six verification wells, ground water testing was temporarily suspended at Bryan Mound during 1996. This occurred primarily as a result of: delays involved with delivery of supplies for implementation of low flow sampling, conflicting priorities for field installation of the low flow sampling equipment once it arrived; both of which were exacerbated by changes in laboratory and sampling personnel responsible for the sampling. During the year, however, field work has been completed to reinstate the routine monitoring process at both the existing and the newly added VWS monitoring wells points.

Fifteen monitoring wells have been drilled at Bryan Mound in four phases between 1981 and 1990 (Figure 6-5). Sampling began shortly after installation. Bryan Mound began using a modified low flow technique for sampling these wells in September 1995. Wells BP1S, BP2S, and PZ2S are out of service due to casing damage. BP1S is discussed further below. Five additional shallow well locations and one additional deep well were installed and sampled one time in 1996 as part of the VWS. Details of that study are provided in paragraph 6.7 of this section.

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 combined effects of 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 for the Bryan Mound site (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 vicinity of a brine pond demolished by DOE in 1989. Historical operations (pre-dating DOE ownership) included brine retention in two separate elongated abandoned ponds reclaimed (filled) by DOE in this same area. These historical operations were associated with the brine generation process of a former owner/operator. The second area lies southeast of the security operations center (SOC), and the third lies south of the maintenance building.

Elevated salinity observed at shallow monitor wells PZ1S, MW1S, and BP1S since their installation has been speculated as associated with brine pond activity. The large brine pond with a Hypalon (chlorosulfonated polyethylene) membrane was constructed in 1978. The pond was subsequently renovated with installation of a new Hypalon liner and a concrete weight coat in 1982. The Bryan Mound brine pond is scheduled for replacement with an aboveground tank in FY 1998. Ground water salinity observed in the pond area and to the north and east could be the result of previous or continued seepage from the pond, from adjacent buried piping or from proximity to former (pre-DOE) operations. Salinity 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 apparent direct communication with the shallow zone in this area. Data from the VWS completed in the summer of 1996 indicate that the primary location of shallow zone salinity impact is in the area of well MW1S, which is loosely mirrored by elevated salinity in the underlying deep zone around MW1D. This is the location of former in-ground unlined brine retention from pre-DOE operations. The high salinity of the deep well may also indicate upgradient communication of the two zones in that area.

Until the current brine pond is taken out of service in fall 1997, annual structural inspections are made and reported as required to the RCT, indicating no obvious structural compromises of the pond's integrity.

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

A brine contamination source in a third area of elevated salinity, near the maintenance building, has not been identified or associated with any known historical operations or incidents, and probably pre-dates SPR activity. Salinity measurements 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, have remained relatively stable in the 5 to 10 ppt range. The ground water salinity at the northwest corner of the site is consistent with salinity observed in Blue Lake, the adjoining surface water feature.

Wide salinity fluctuations observed in Figure 6-6 graphs prior to 1993 are due to changing sampling methodology. Observed salinity was directly related to the degree and consistency of well purging prior to sampling. A consistent purging methodology was instituted in September 1993, and a modified version of the newer low flow technique sampling technique was instituted in the fall of 1995.

Salinity trends are evident in contaminated and uncontaminated areas. Elevated ground water salinity measurements in both zones in the brine pond and pump pad area have remained relatively constant overall, despite fluctuations encountered. (An increase in salinity is evident for 1995 at wells MW1S and MW1D.) High salinities observed in the shallow zone near the SOC and in both zones near the maintenance building appear to be stable or just slightly increasing over the long

term. Salinity observed in uncontaminated deep and shallow zones at the northwest corner of the site showed a slight increase in 1995.

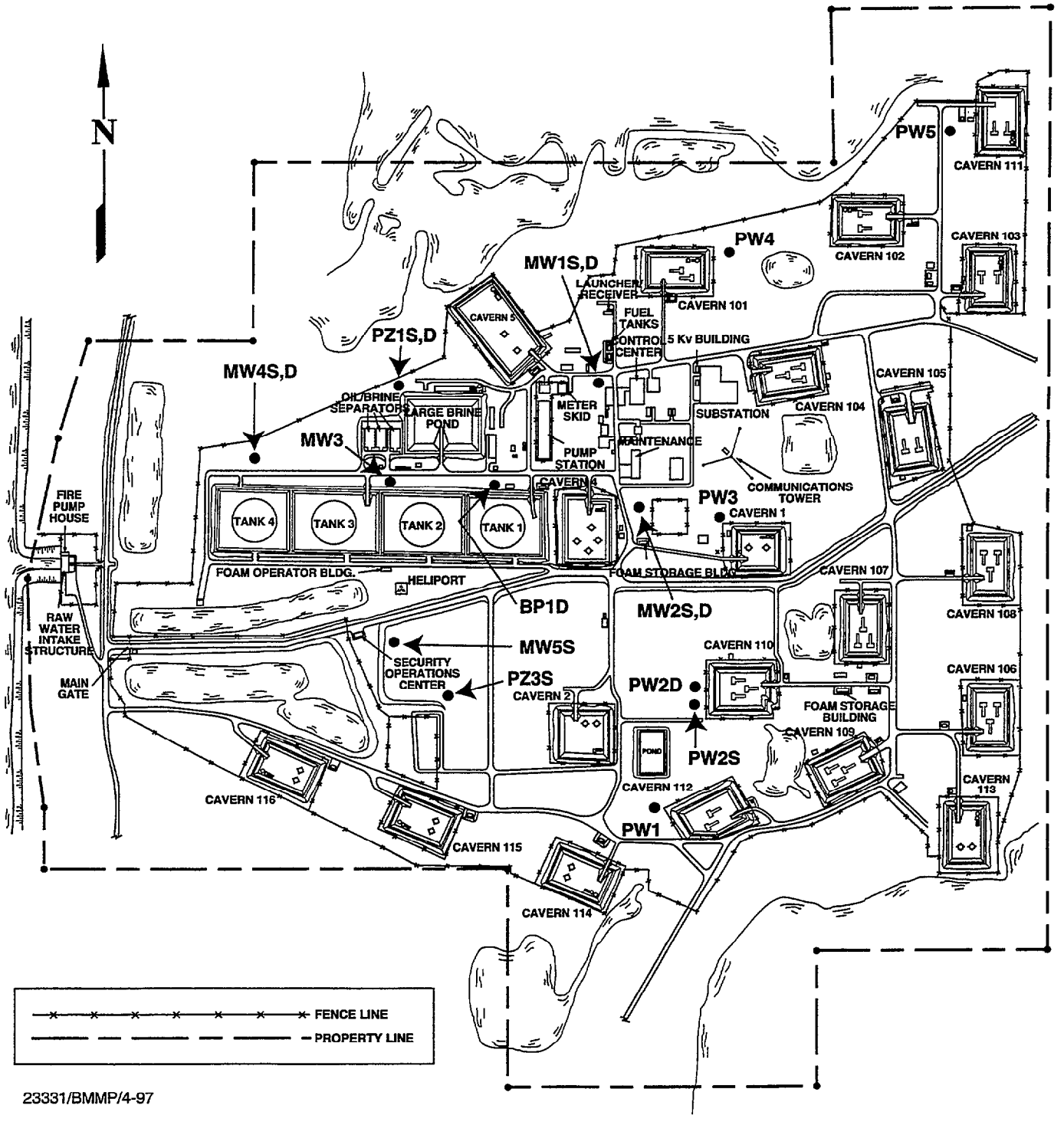


Figure 6-5.
Bryan Mound Ground Water Monitoring Wells

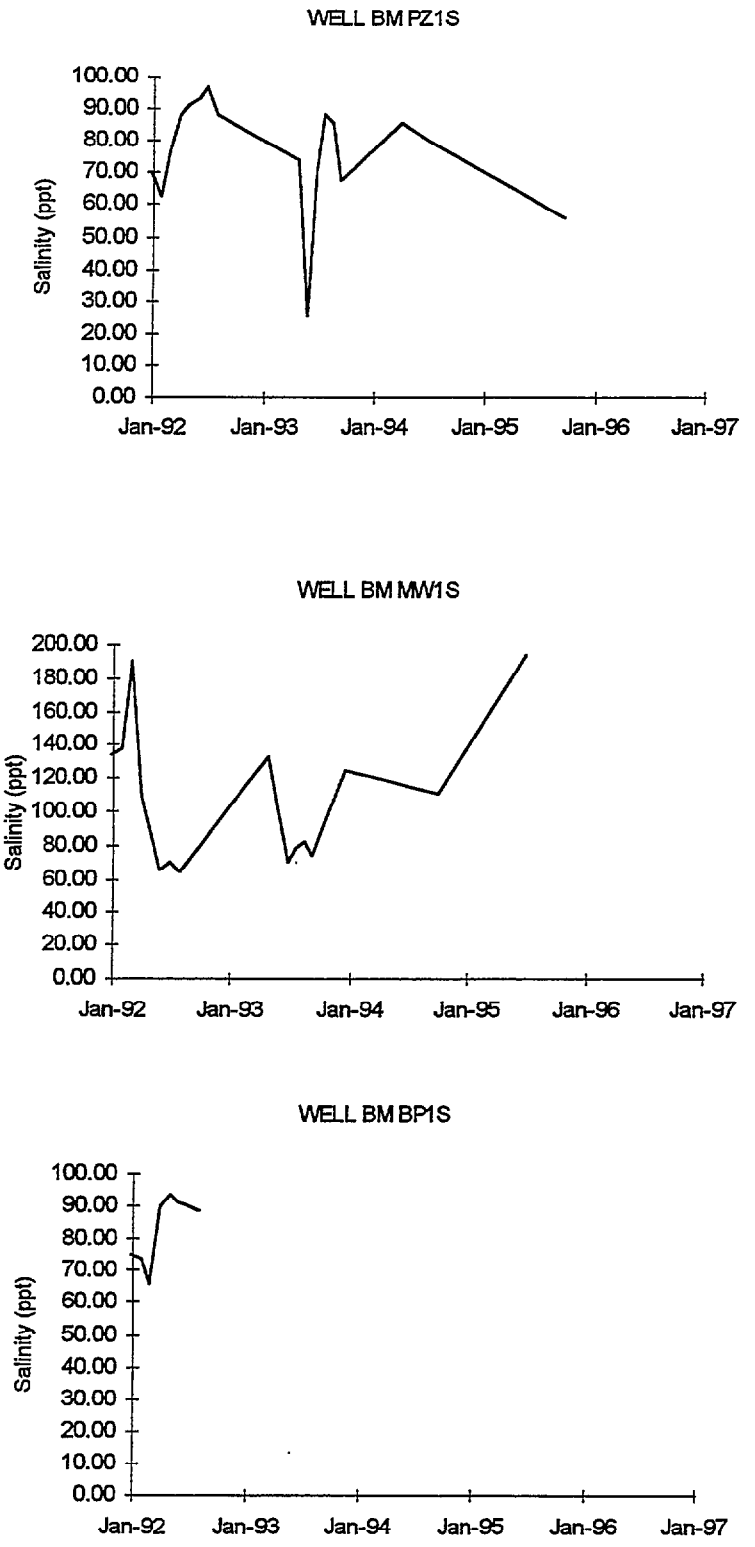
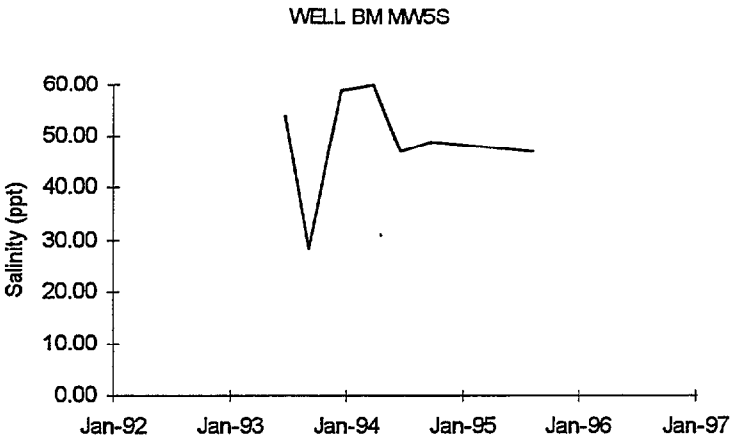
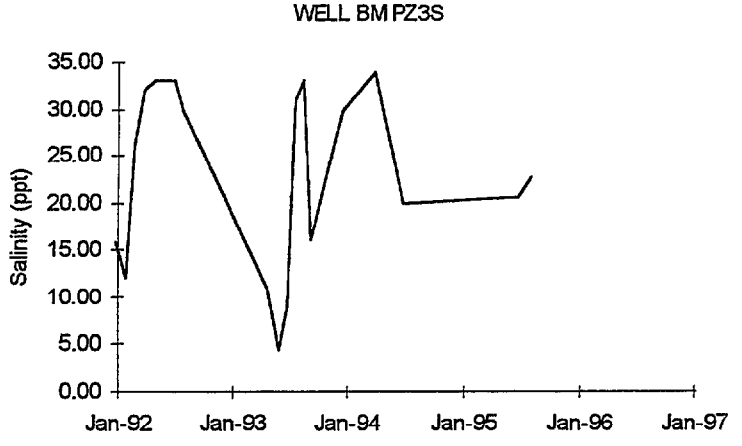


Figure 6-6.
Bryan Mound Ground Water Monitoring Well Salinities





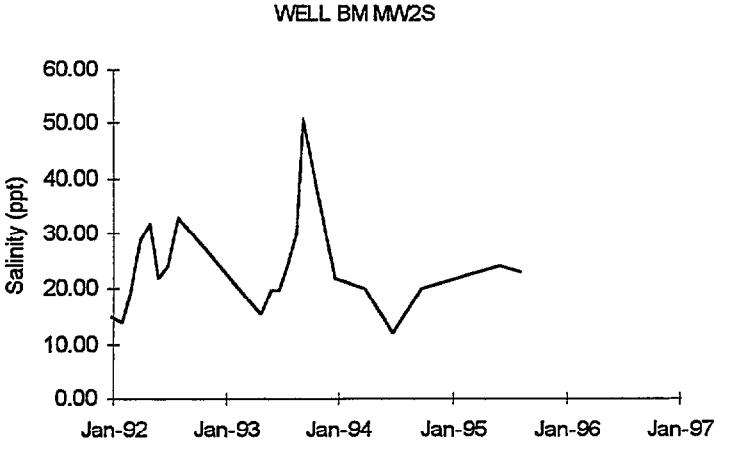
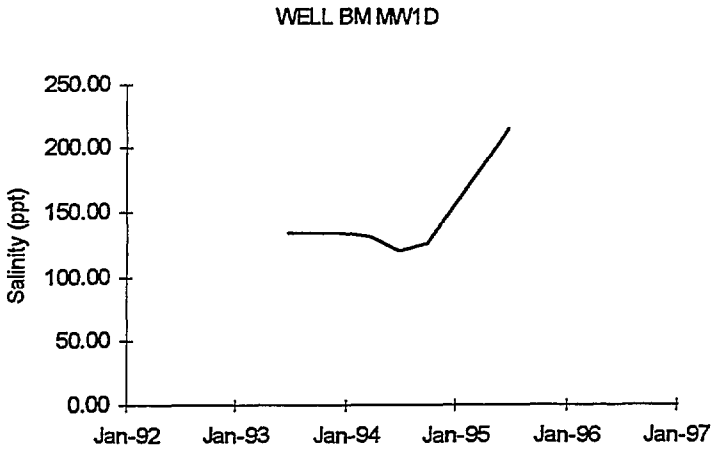
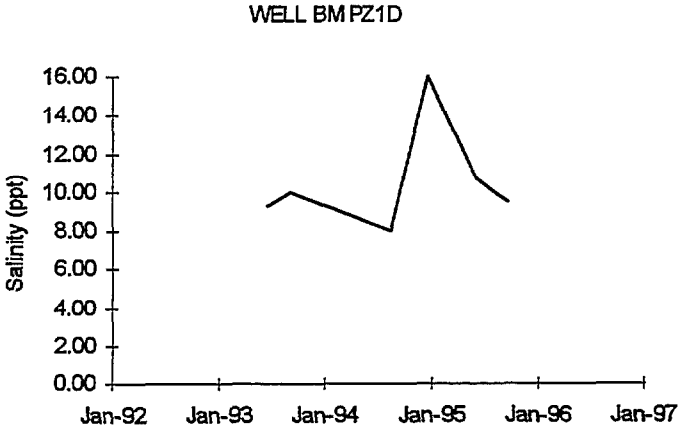


Figure 6-6 (Continued)
Bryan Mound Ground Water Monitoring Well Salinities





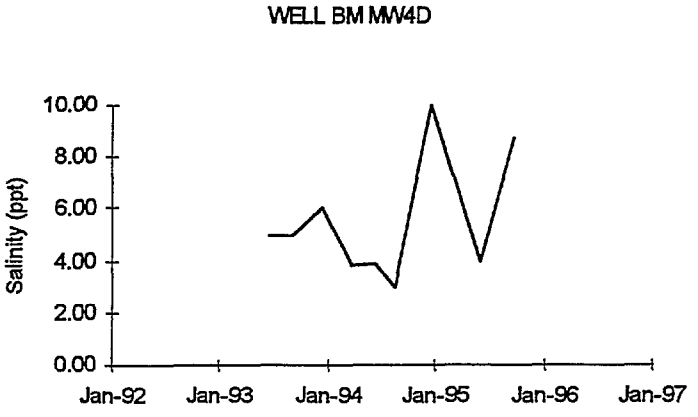


Figure 6-6 (Continued)
Bryan Mound Ground Water Monitoring Well Salinities

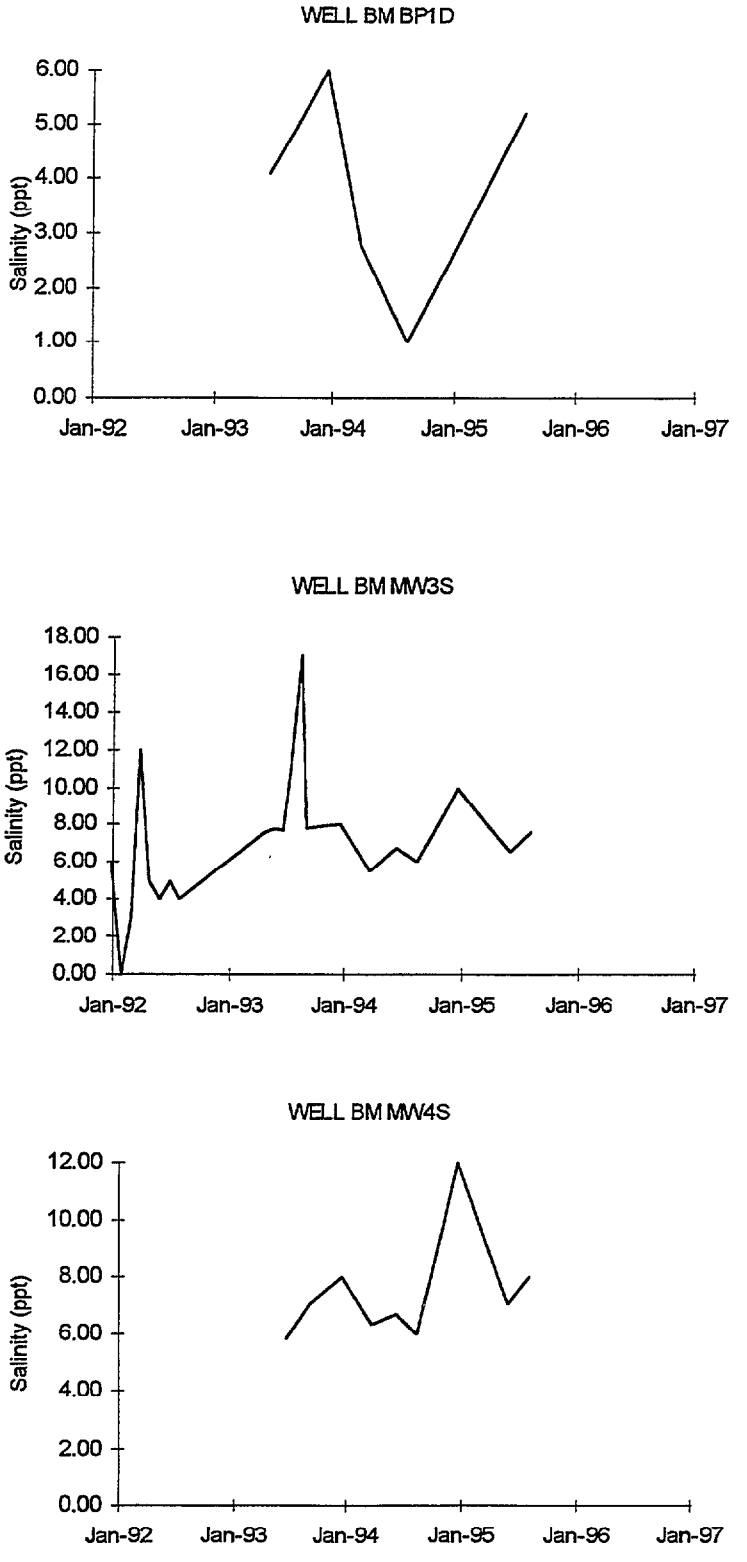


Figure 6-6 (Continued)
Bryan Mound Ground Water Monitoring Well Salinities

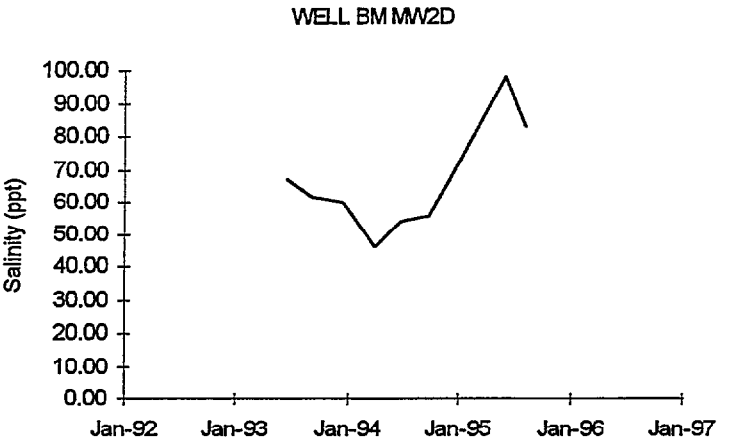


Figure 6-6 (Continued)
Bryan Mound Ground Water Monitoring Well Salinities

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 spills. Underground diesel and gasoline tanks removed in 1995 were found to have leaked. Resulting contaminated soil was removed and remediated to the satisfaction of the state.

6.5 WEEKS ISLAND

The Chicot formation is the principal aquifer in the Weeks Island area. The aquifer surface is at approximately 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 four years ago on Morton Property which could potentially affect crude oil storage in the underlying mine and has prompted further investigation and relocation of the crude oil stores and decommissioning of the Weeks Island site. The sink hole is located east of the mine's crude oil fill hole and has continued to grow since 1993 until arrested by construction and maintenance of a freeze wall plug created in the water table around the throat of a suspected crevasse leading down into the top of the salt formation. This plug has effectively abated communication of ground water with the oil storage chamber. Relocation of the bulk of the mine inventory to Bayou Choctaw and Big Hill began in 1995 and was completed in November 1996. Pumps are now being reconfigured for four phases of skimming operations designed to maximize removal of the remaining oil. Five ground water monitoring points outside of the freeze plug have been identified and background or ambient conditions are currently being monitored to assist with post decommissioning long-term monitoring.

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 213 m (700 ft) below land surface (bls). Zones contaminated and monitored at West Hackberry are near the surface, the shallow zone at roughly 6 m (20 ft) bls and the deep zone at roughly 15 m (50 ft) bls.

The 1991 Contamination Assessment Report and Remedial Alternatives Analysis 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. The West Hackberry brine pond is scheduled for decommissioning in October 1998.

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. West Hackberry began using the low flow technique for sampling these wells in December 1995. Salinity data gathered over the past five years at all wells are depicted in Figure 6-8. Four of the seven wells installed for VWS were retained for additional water level measuring points around the periphery of the main site. Details are provided in section 6.7

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

Observed recovery well salinity measurements depict a complex picture of ground water contamination beneath the pond system. Salinity is more elevated and spatially variable in the shallow zone than the deep zone with the exception of the two deep zone wells P1D and P4D on opposing west and east sides of the brine pond, respectively, where salinity inexplicable exceeds that of all other wells.

A brine plume exists in a east-northeastward shaped ellipse beneath the brine pond in the shallow zone from the southwest corner over to well P3-S, 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 graphs are attributed to salinity stratification in the wells and oscillating cones of depression. Prior to mid-1993, submersible recovery well pumps ran intermittently and could not maintain a stable cone of depression or resultant stable salinity. A salinity peak exceeding 200 ppt in January 1993 in Well P5S was caused by a brief siphoning of brine from the pond into the well.

A slight 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 elevated deep zone salinity is limited to wells P1D and P4D since no plume has been identified elsewhere in the deep well network. The salinity in 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 (although trending slightly downward). The salinity of deep recovery well RW5D south of P4D remains above ambient (17.0 ppt annual average) and may be located on 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 slight localized contamination. The source of contamination at P8 has not been determined. Temporarily elevated salinity observed at well P11 was caused by a brackish water leak four years ago from piping of a nearby 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 wells at the caverns and, with the exception of wells P12S and P13S, also intercept ambient ground water. Well P12S is the only down gradient monitoring well that intercepts the shallow zone brine plume extending eastward from the brine pond. Its salinity is elevated (35.75 ppt annual average in 1996) and has been generally consistent since sampling began in 1992 (range 23 to 39 ppt, Std. D = 4.58 ppt, avg. = 31.56 ppt, n = 19). Prior to 1995, well P13S was trending slightly upward, but it has since exhibited a declining trend.

The slightly elevated salinity may have resulted from residual localized contamination from a nearby brine line 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 indicate that the two zones are hydraulically separate; however, the potential is downward and combined with the increased density of saline water, contamination will tend to seek lower elevations through any breach or connection available between the two zones. The two zones behave as poorly confined units exhibiting static heads considerably above the elevations of an upper confining unit. Recharge would therefore be expected to occur somewhere offsite at an upgradient location; however, local topographic modifications of the surrounding area from the underlying salt piercement have locally modified ground water movement. From the addition of several outlying shallow wells placed for the VWS, we now find that ground water contours indicate a radial flow of water subparalleling surface topography off the dome, placing a recharge potential for the shallow zone directly under the main site in a N-S trending ridge. Insufficient data are available to assess the deeper zone in a similar fashion. Additional details of the VWS) results are located in section 6.7.

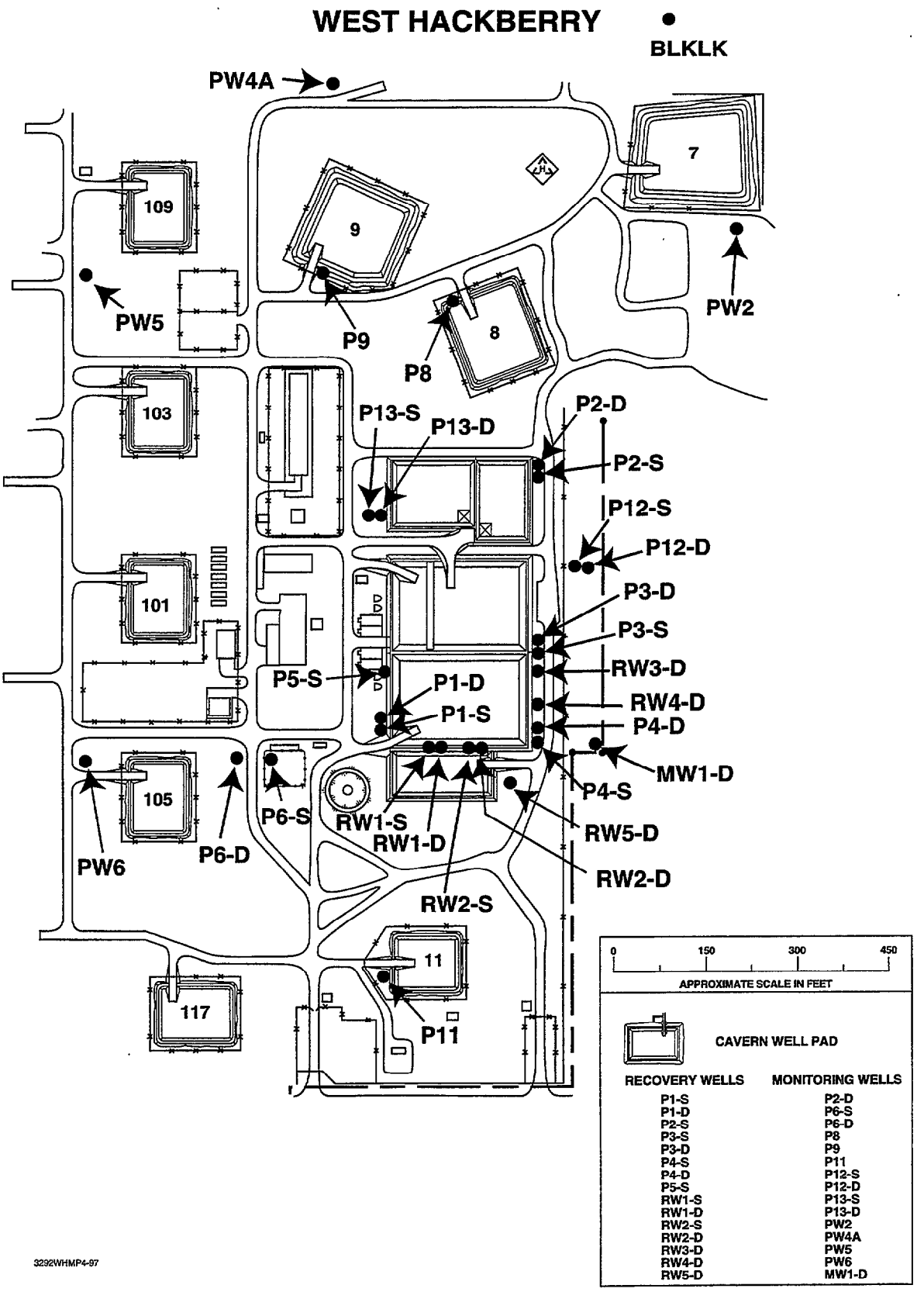


Figure 6-7.
West Hackberry Ground Water Monitoring Wells

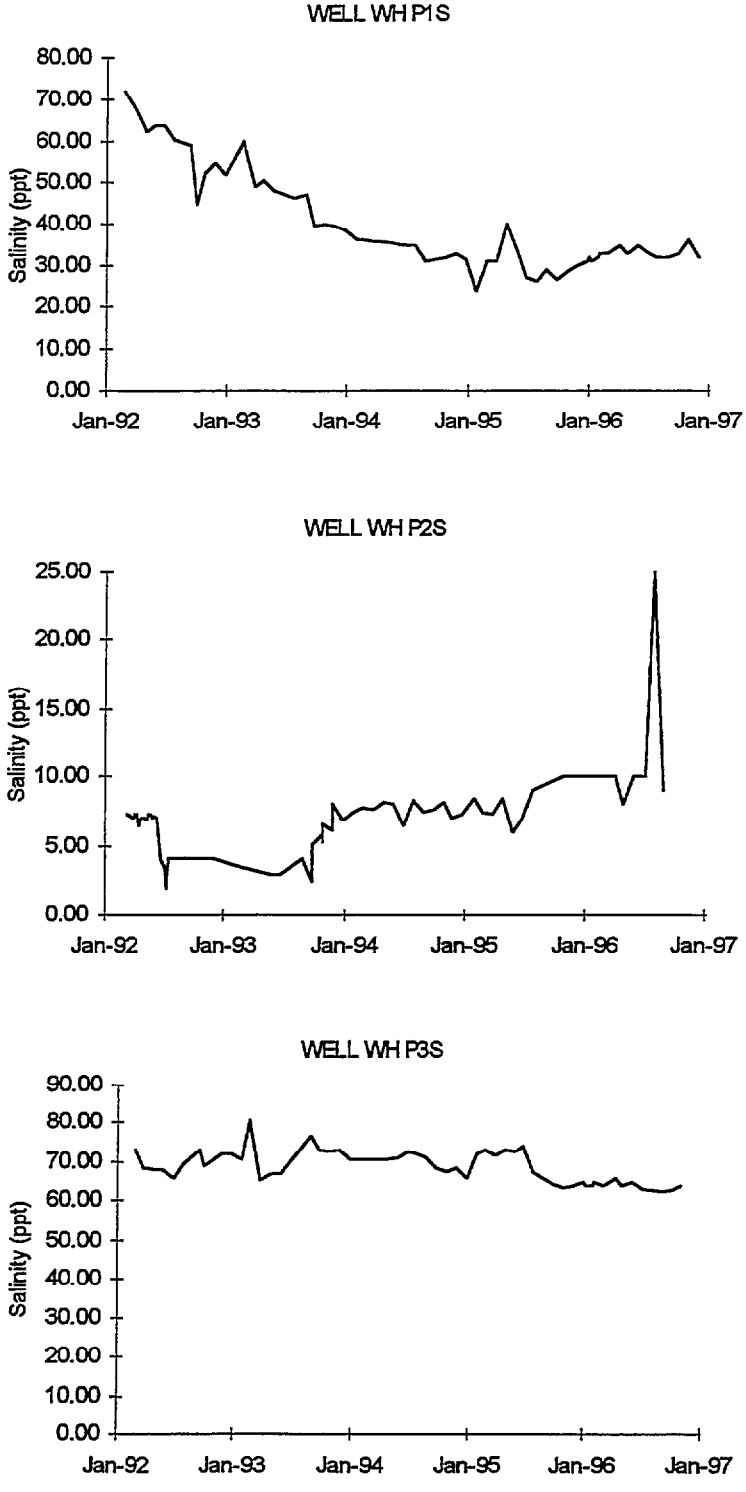


Figure 6-8.
West Hackberry Ground Water Monitoring Well Salinities

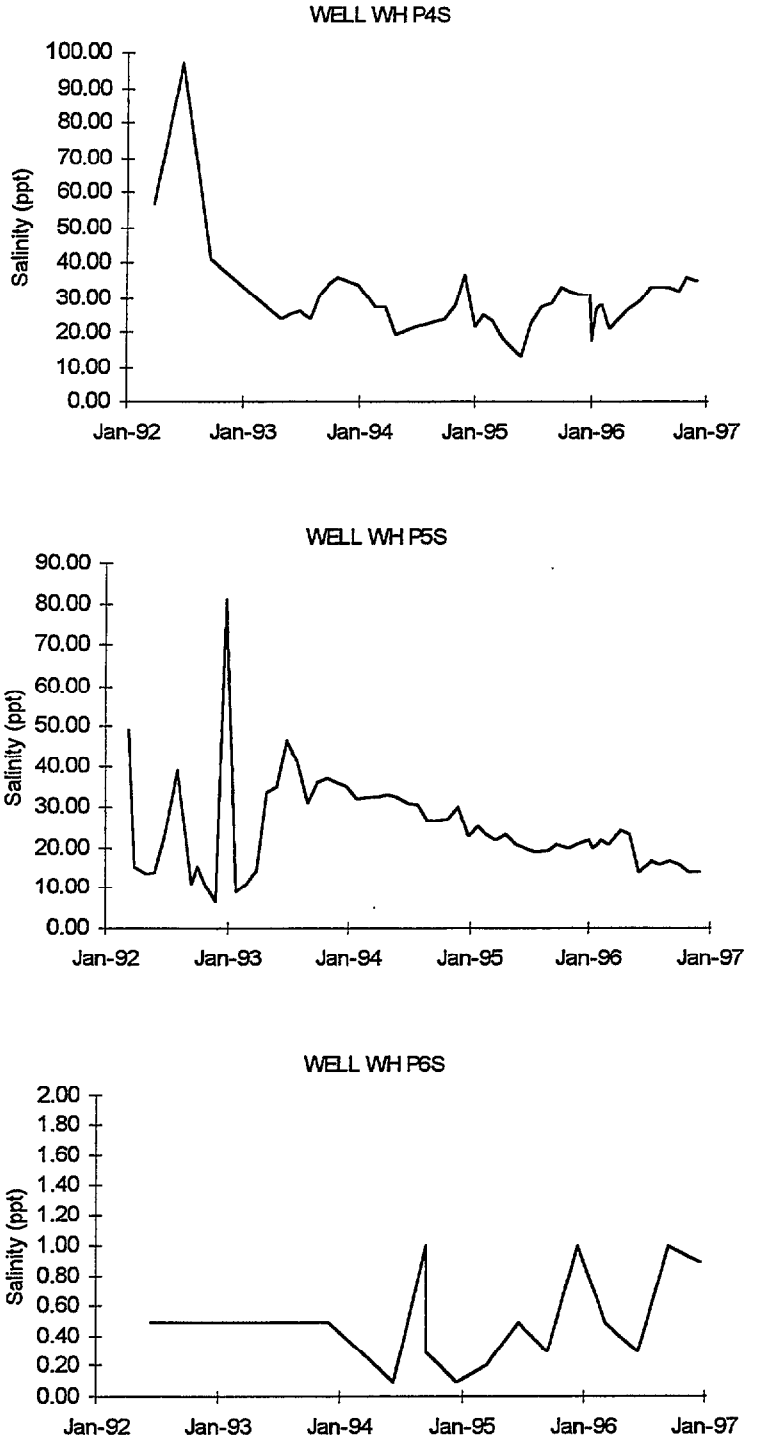
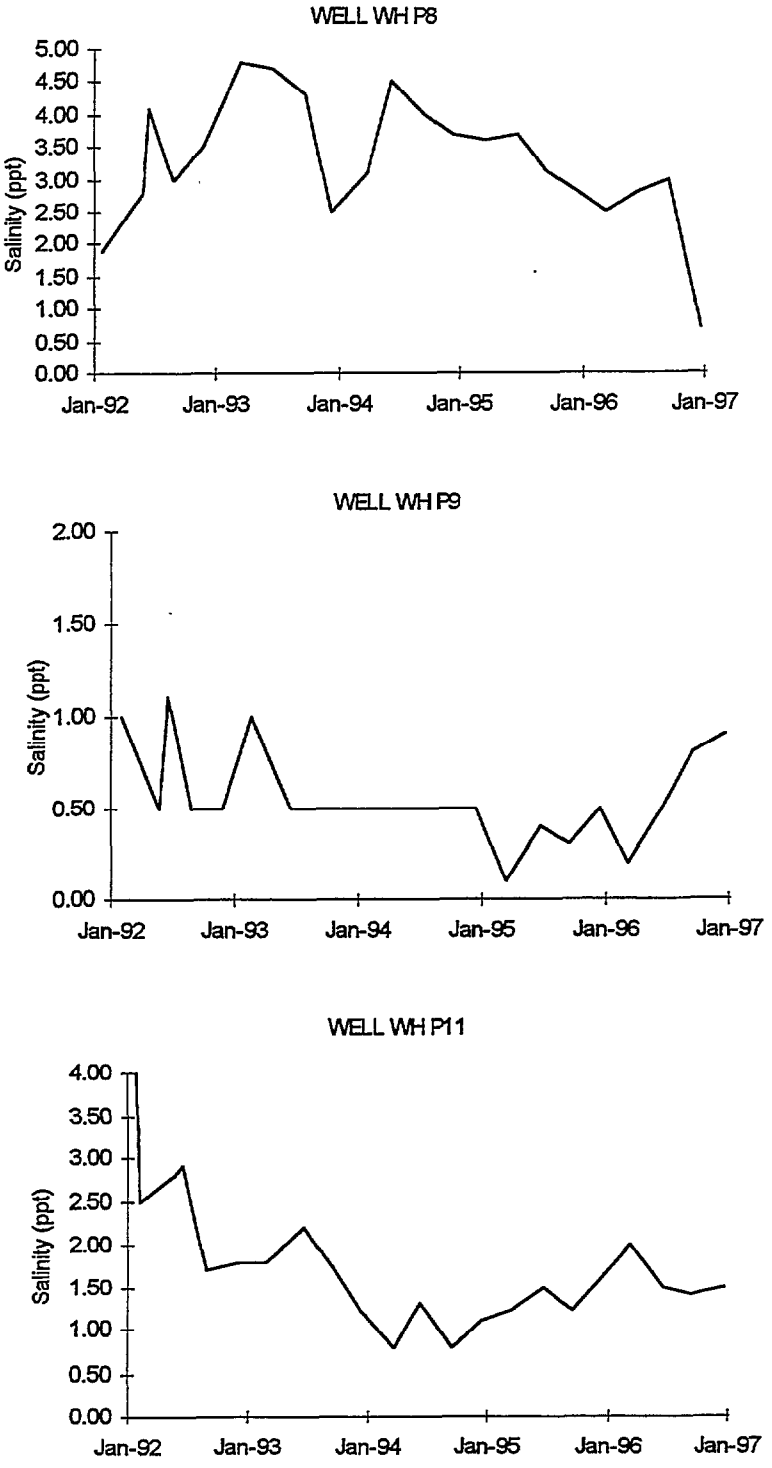


Figure 6-8 (Continued)
West Hackberry Ground Water Well Salinities



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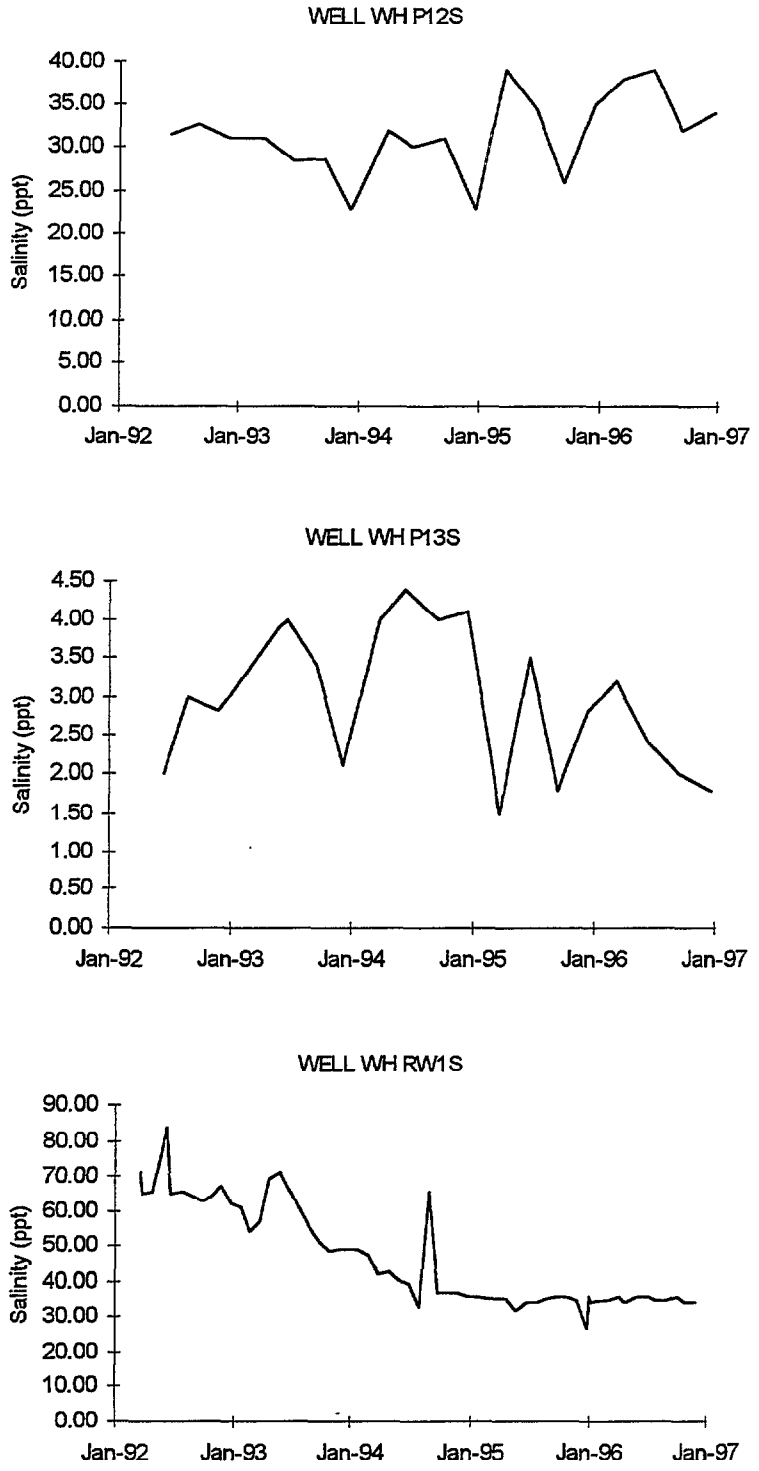
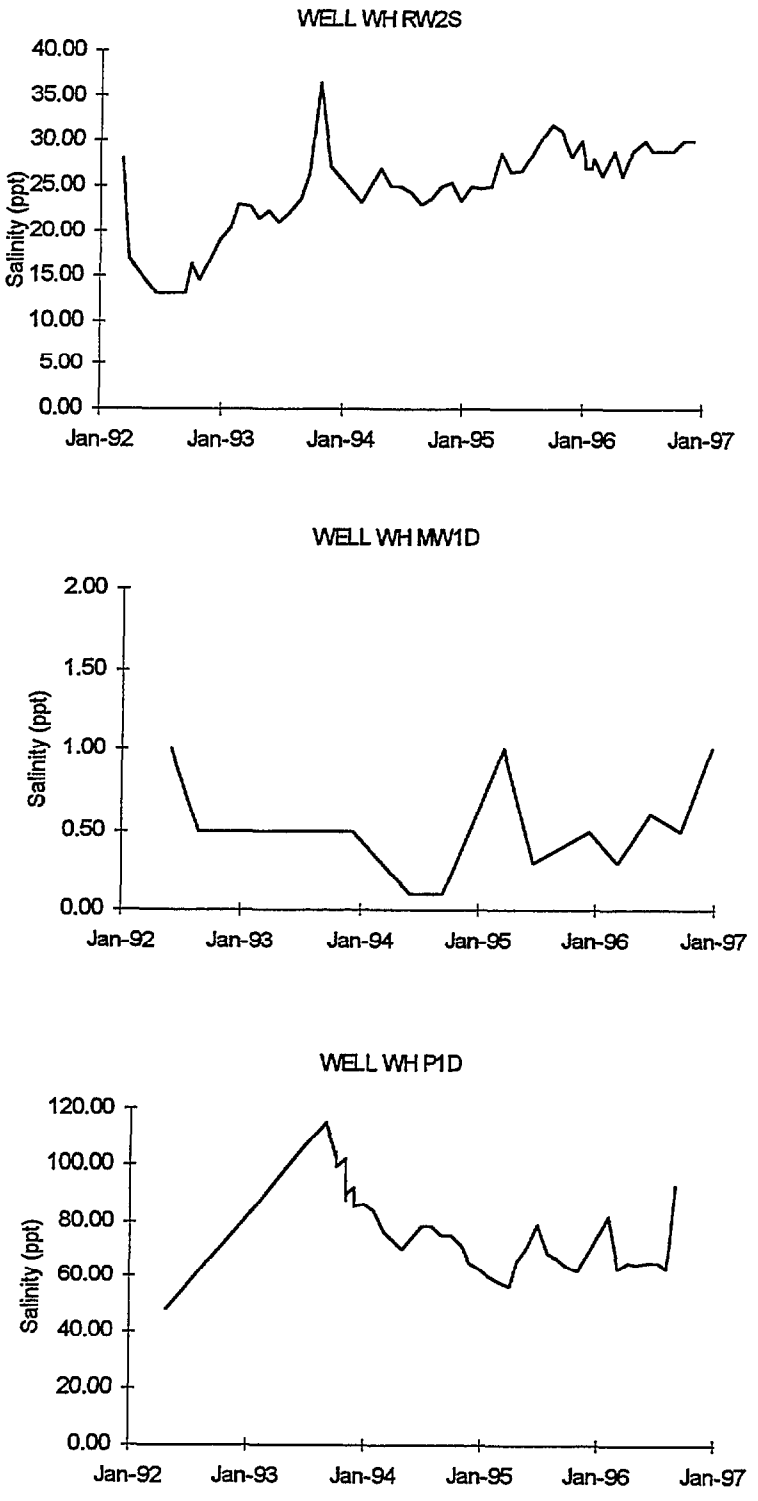


Figure 6-8 (Continued)
West Hackberry Ground Water Monitoring Well Salinities



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West Hackberry Ground Water Monitoring Well Salinities

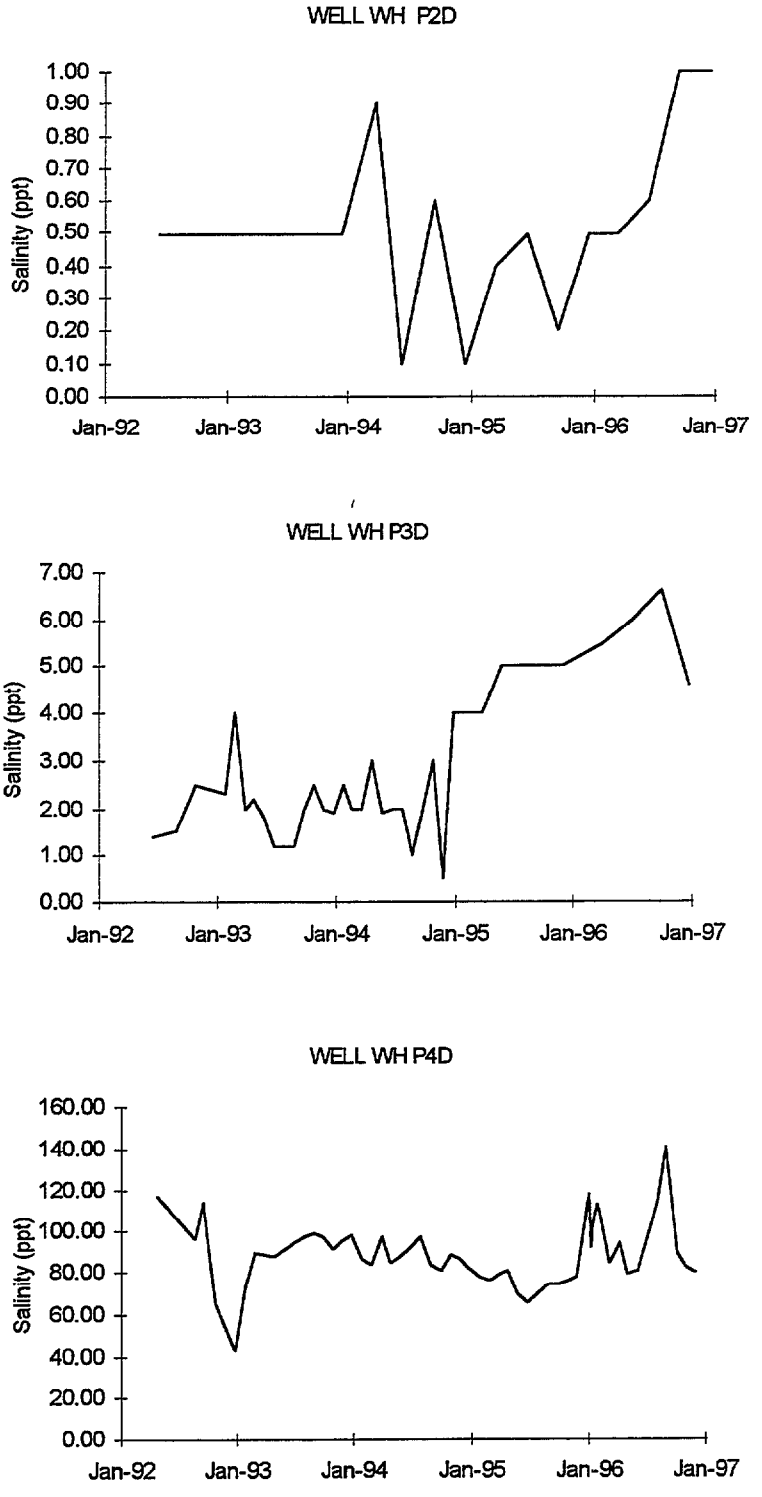

Figure 6-8 (Continued)
West Hackberry Ground Water Monitoring Well Salinities

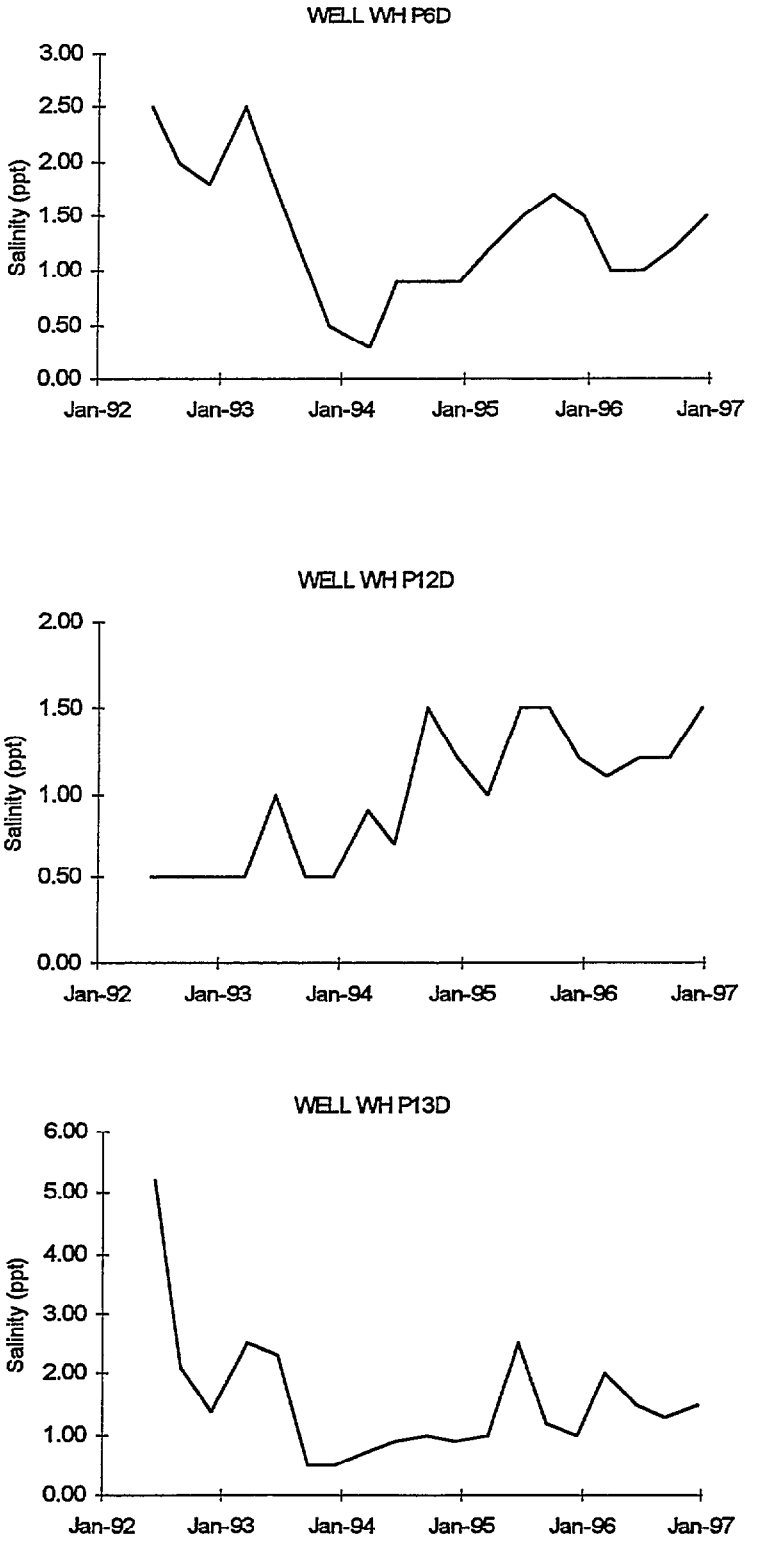

Figure 6-8 (Continued)
West Hackberry Ground Water Monitoring Well Salinities

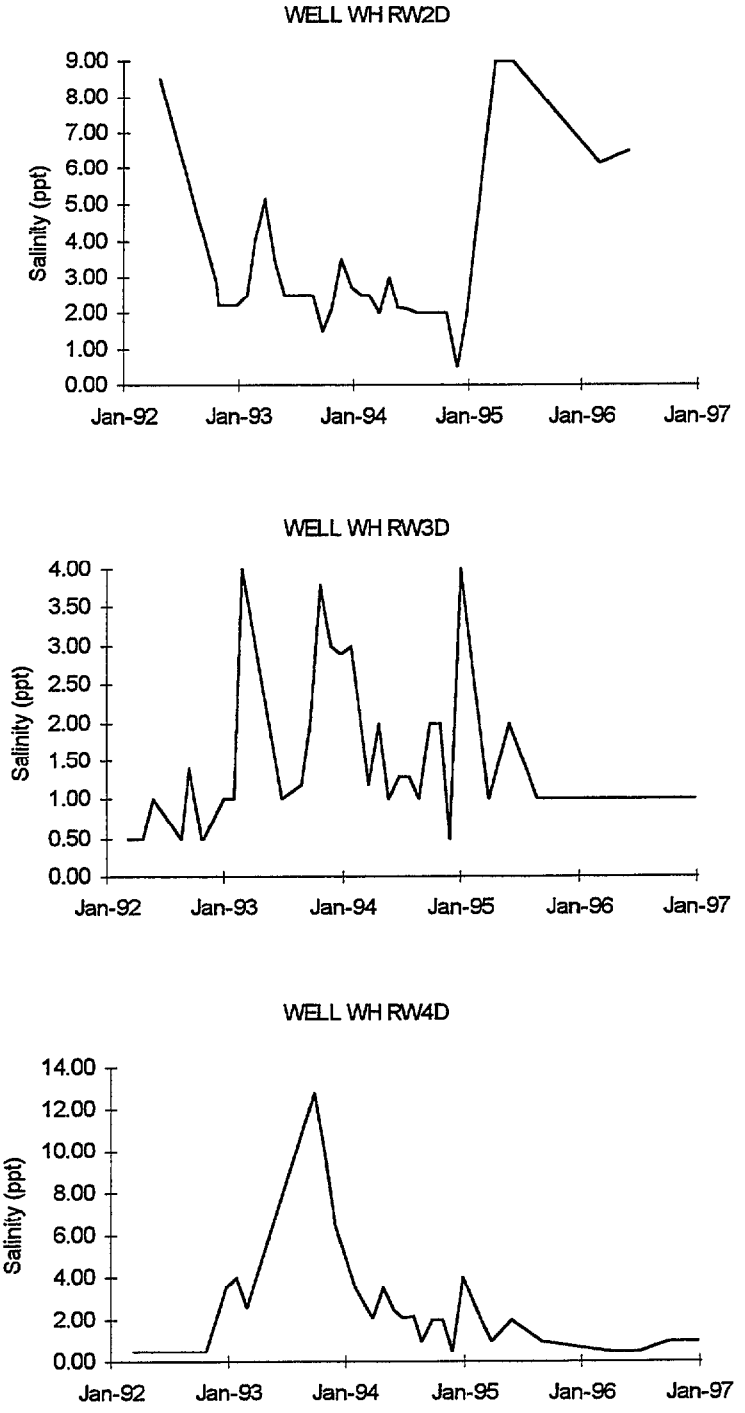

Figure 6-8 (Continued)
West Hackberry Ground Water Monitoring Well Salinities

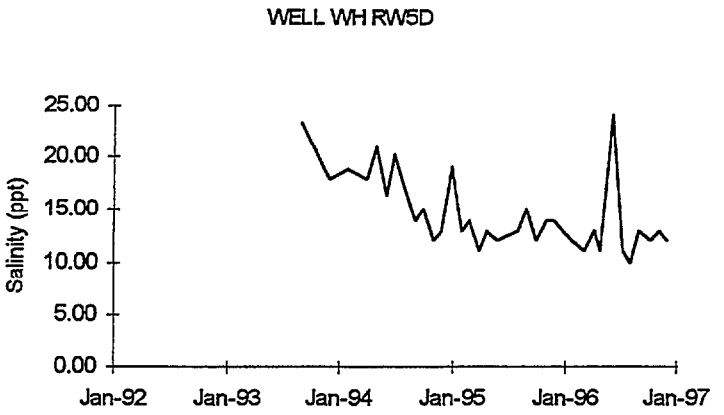

Figure 6-8 (Continued)
West Hackberry Ground Water Monitoring Well Salinities

6.7 VERIFICATION WELL STUDY (VWS)

The VWS was conducted at three Louisiana (West Hackberry, Bayou Choctaw, and Weeks Island) and two Texas (Bryan Mound and Big Hill) SPR sites. The main objective was to verify the results of a Baseline Hydrogeological Screening Survey of the sites for crude oil and brine impacts. Twenty-nine 2-inch diameter ground water monitoring wells were drilled, installed, developed, and sampled to evaluate the presence of suspected impacts utilizing a combination of field and laboratory analytical data. All verification monitoring well borings were logged and selected samples were screened for potential brine and/or crude oil impact. Table 6.1 Verification Well Study Results, provides a compilation of the field and laboratory chemical testing results.

Well installation field work for the VWS was conducted from March to April 1996. Samples were obtained and final test results received by May 1996. After review of the data and completion of a draft report, the final compilation of results was issued in September 1996. Total petroleum hydrocarbons (TPH) was used as the screening indicator for the presence of crude oil, salinity, or total dissolved solids (TDS), and chlorides were used to evaluate the presence of brine impacts. None

Table 6-1. - Verification Well Study Results

		LABORATORY VALUES			FIELD VALUES		VERIFICATION OF IMPACT(S)
		TPH	Chloride	TDS	pH	Cond.	
Site/Well No.	Purpose*	mg/l	ppt	ppt	s.u.	x1000	
BC:							
PW1	CO/NA	<1	36.2	***58.1***	7.7	>20	NO TPH; *SAL >10 ppt*
PW2	NA		41.2	***65.5***	10	>20	*above 10 ppt SAL*
PW4	NA		1.1	4.2	9.8	4.23	NONE
PW5	NA		19.1	***36.3***	10.9	>20	*above 10 ppt SAL*
PW6	CO/NA	<1	0.98	2.2	9	3.97	NONE
PW7	NA		2.2	4.7	10.9	2.1	NONE
PW8(BDW)	NA		16.8	***28.1***	11	>20	*above 10 ppt SAL*
BH:						NOTE: BH SALINITY CUT-OFF IS 1 ppt	
PW1	CO/NA	<1	0.66	1.7	6.9	>20	NONE; *SAL >1ppt*
PW2	CO	***1***			5.7	>20	NONE; *TPH at det. limit*
PW3	CO	<1			8.8	>20	NONE
PW4	CO	<1			9	>20	NONE
PW5	CO/NA	***1***	0.093	0.43	11.9	>20	NONE; *TPH at det. limit*
PW6	BG/NA		0.112	1.9	8.9	17.7	NONE; *SAL >1ppt*
BM:							
shallow wells:							
PW1	CO/NA	<1	19.2	***33.1***	9.2	>20	NO TPH; *SAL >10 ppt*
PW2S	CO/NA	<1	10.3	***18.6***	7.1	14.6	NO TPH; *SAL >10 ppt*
PW3	CO/NA	<1	35.6	***58.9***	6.6	15.9	NO TPH; *SAL >10 ppt*
PW4	CO	<1			7.9	>20	NO TPH; SAL?
PW5	CO/NA	<1	27.3	***49.7***	11.2	>20	NO TPH; SAL?
deep well(s):							
PW2D	NA		23.8	***39.9***	9.5	>20	*above 10 ppt SAL*
WH:							
PW1	CO/NA	<1	0.4	5.56	7.3	4.69	NONE
PW2	CO/NA	<1	3.34	5.78	7.5	10.23	NONE
PW3	CO/NA	<1	1.35	3.16	9.4	4.78	NONE
PW4	CO/NA	<1	0.27	0.332	11.1	0.29	NONE
PW5	CO	<1			9.6	1.03	NONE
PW6	CO	<1			7.5	0.5	NONE
PW7	NA		0.304	0.932	8.9	1.63	NONE
WI:							
PW1	CO	<1			11.8	14.96	NONE
PW3	CO/ust	***2***			10.2	3.03	*TPH (no action level)*
	CO=crude oil						
	NA=salt/salinity						
	BG = background						
	ust = underground storage tank						

of the samples tested for TPH indicated the presence of crude oil in the ground water samples obtained. Nine of the samples confirmed the presence of salinity impacts above the site-specific (ambient) cut-off levels established for the study.

The VWS was conceived to verify potential sources of underlying brine or crude oil contamination identified in a series of non-intrusive studies begun at Bryan Mound and West Hackberry in 1990 and completed for all sites in 1992. This phase of the long-term project completes the scope to establish baseline hydrogeological conditions at each SPR site. Characterization of the conditions relating to the shallow ground water regimes beneath each site now extend, not only to localized ground water contaminant concerns, but also to a better understanding of the overall existing hydrogeological conditions including: true (site-wide) ground water flow directions, localized lithostratigraphy represented by generalized cross-sections, permeabilty estimates from laboratory tests, field (slug) tests and particle size estimates, depths to first encountered ground water, soil types and physical characteristics of the underlying sediments placed into a context of site-specific [localized] geology.

6.7.1 Bayou Choctaw

Seven verification wells were installed at the Bayou Choctaw site. Two wells were placed to evaluate brine and crude oil impact; and five wells were placed to evaluate brine impact only. The site is underlain by silty and sandy clay units to the total depth explored (17 feet to 23 feet bls). Shallow ground water was first encountered at depths ranging from 7 to 18 feet bls. Total petroleum hydrocarbons (TPH) were not detected in the ground water samples collected. Isopleth maps of the three brine indicators (total chlorides, TDS, and field electrical conductivity) show elevated brine levels centered just north of the brine pond and extending southeast toward Cavern 18 and southwest toward Cavern 101. Based on the ground water flow direction, it appears the major source of brine may be either the brine pond, the associated piping, or historical activity. Long-term monitoring associates the dissipating plume confirmed moving southeasterly from the brine pond with a former (repaired) brine piping leak. Long-term monitoring results from the well MW-2, located

immediately downgradient of the existing pond, show a generally diminishing salinity trend which tends to attribute these impacts moving southwesterly from the pond to an unknown historical source. The most probable point of origin would be at the northwest corner of the brine pond where drawings indicate abandoned brine pipe terminations and former brine solids-filtration units operated by pre-DOE owners.

6.7.2 Big Hill

Six verification wells were installed at the Big Hill site. Two wells were installed to evaluate brine and crude oil impact, three wells were installed to evaluate crude oil impact alone, and a single well was installed to establish background or unaffected ground water quality data. The top of the first waterbearing zone occurs at depths 14 feet to 24 feet bls and consists of silty sands and fine sands. The ground water is found to flow southwesterly on the west side of the site and southeasterly on the east side of the site. TPH was detected in samples from two of the monitoring wells; however, the concentration was at the method detection limit of one mg/l for this test and is neither considered reliable confirmation nor at or exceeding any action level. Total chloride concentrations in ground water were 660 mg/l and 93 mg/l in wells PW-1 and PW-5, respectively. TDS concentrations from these same samples were 1700 mg/l and 430 mg/l, respectively. Based on these studies and the historical site data, crude oil and brine concentrations are indicative of background conditions rather than effects of any site operations.

6.7.3 Bryan Mound

Six VWS wells were installed at the Bryan Mound site. Four wells were installed to evaluate crude oil and brine impacts, one well was installed to evaluate crude oil impact alone, and another well was installed for brine impact alone. The site is underlain by a "shallow" waterbearing zone and an underlying "deep" waterbearing zone at generalized depths of 20 to 30 feet bls and 40 to 50 feet bls, respectively. TPH was not detected in any ground water samples evaluating potential crude oil impacts at the Bryan Mound site. Elevated levels of total chloride in shallow zone samples were found extending from the vicinity of the maintenance area southerly toward

Cavern 112. TDS and field conductivity readings were consistent with the total chloride concentrations and the basic historical measurements. Based on a northerly to northwest flow direction in the shallow zone, and data from previous investigations, it appears a general brine source is present at the midpoint of a line extending northwest from Cavern 1 toward Cavern 5 which includes the maintenance area and the eastern side of the brine pond. These are areas of known (pre-DOE) brine storage and potential impact.

6.7.4 Weeks Island

Two VWS wells were installed at the Weeks Island site to evaluate potential crude oil impacts. Wells PW-1 and PW-3 were placed at the western edge of the main site near the crude oil pump house and at a location south of the warehouse, in the construction staging area, respectively. An additional well M8 was completed for the purposes of post-decommissioning long-term monitoring as part of the field installation process. Field activities also included sampling and testing a set of initial samples for the Weeks Island Long-Term (WILT) monitoring network, consisting of the new well M8, and WILT monitoring wells M5, M6, and M7, to begin establishing pre-decommission conditions. The Weeks Island site is underlain by fine sands and silty clays to depths of 25 feet bls. Sands underlie these deposits to the depths explored in wells PW-1 and M8. TPH concentrations from all of the VWS samples taken ranged from the method detection limit of one mg/l to six mg/l. These levels do not indicate crude oil impact to the ground water at Weeks Island and the historical data base, continuing to be built, is confirming concentrations are below the method detection limit of five mg/l.

6.7.5 West Hackberry

Seven shallow VWS wells were installed at the West Hackberry site. Well PW-4D was plugged and abandoned after drilling 50 feet bls and failing to encounter a "deep" waterbearing zone, at this location. The site is underlain, for the most part, by two waterbearing zones. The shallow zone occurs at depths ranging from 6 to 13 feet bls and appears too thin to the north, south, and west of the existing brine pond. The deep zone is found at depths ranging from 40 feet to 50 feet bls. The

shallow ground water flow direction is radial from a north-south trending elongated topographic high area and is interrupted by an area of dewatering (pumping) being maintained under the brine pond by site recovery wells. Deep zone flow presumably mirrors shallow zone flow; however, all of the site's deep zone wells are situated on the east side of the topographic high and the direction appears northeasterly as with the overlying shallow zone. TPH was not detected in the ground water samples from any of the wells. Slightly elevated brine indicator levels (total chlorides, TDS, and field electrical conductivity) extend from just west of Cavern 6 easterly toward Cavern 7 and southwesterly toward Cavern 8. The radial pattern of the shallow ground water flow and the elevated historical salinity measurements in the existing well network indicate that the plausible source area is associated with the brine pond complex, as already confirmed by previous studies. The test results obtained from the samples taken from a well placed to assess brine impacts at the brine disposal well pad ,well PW-7, (remote from the main site) indicated total chloride and TDS concentrations below background levels.

7. QUALITY ASSURANCE

The SPR sites undergo periodic evaluation throughout the year in the form of yearly internal audits as well as inspections 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 program inspections at selected sites by state and federal environmental agencies.

7.1 FIELD QUALITY CONTROL

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

7.2 DATA MANAGEMENT

SPR data is generated by SPR and contractor laboratories. All data generated by SPR laboratories is recorded and maintained in bound, numbered, and signed laboratory notebooks. Contractor laboratory data and accompanying QC data is received by the site laboratory or Environmental department and retained on site as part of the original data file.

Water quality data is added to the Water Quality Database for retention, manipulation, and interpretation. This data is compiled and appears in various reports such as the Site Environmental Report, in support of assessments, evaluations, and development of appropriate responses.

7.3 EPA DISCHARGE MONITORING REPORT QUALITY ASSURANCE STUDY

The EPA entered the 16th 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 1996. Resultant data was provided to EPA, via their contractor, on a standard report form. The results of this study indicated that the SPR laboratories performed acceptably and are approved for continued DMR/NPDES analyses.

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 percent frequency to determine precision and accuracy, respectively. Analytical methodology is based on the procedures listed in Table 7-1. Several hundred of these quality assurance analyses were performed in addition to the 1995 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

Table 7-1. SPR Wastewater Analytical Methodology

Parameter	Method	Source*	Description
Biochemical Oxygen Demand	5210(B)	APHA	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)	APHA	Closed Reflux, Colorimetric
Fecal Coliform	Part III-C-2	EPA-2	Direct Membrane Filter Method
	9222(D)	APHA	Membrane Filter Procedure
Residual Chlorine	4500-Cl(G)	APHA	DPD Colorimetric
	330.5	EPA-1	Spectrophotometric, DPD
	8021	Hach	DPD Method
Oil & Grease (Total, Recoverable)	413.1	EPA-1	Gravimetric, Separatory Funnel Extraction
Total Organic Carbon	415.1	EPA-1	Combustion or Oxidation
	D4839-88	ASTM	Persulfate - UV Oxidation, IR
	5310(C)	APHA	
	D2579(A)	ASTM	Combustion - IR
	5310 (B)	APHA	
Dissolved Oxygen	D888-87(D)	ASTM	Membrane Electrode
	360.1	EPA-1	Membrane Electrode
	360.2	EPA-1	Winkler Method with Azide Mod.
	4500-O(C)	APHA	Winkler Method with Azide Mod.
	4500-O(G)	APHA	Membrane Electrode
Hydrogen Ion Conc. (pH)	D1293-84(A&B)	ASTM	Electrometric
	150.1	EPA-1	Electrometric
	4500-H^+(B)	APHA	Electrometric
Total Dissolved Solids (Residual, Filterable)	160.1	EPA-1	Gravimetric, Dried at 180°C
	2540(C)	APHA	Gravimetric, Dried at 180°C
Total Suspended Solids (Residual, Non-Filterable)	160.2	EPA-1	Gravimetric, Dried at 103-105°C
	2540(D)	APHA	Gravimetric, Dried at 103-105°C
Salinity	D4542-85 (Sect. 7)	ASTM	Refractometric
	2520(B) & 2510	APHA	Electrical Conductivity
	210B	APHA (16th Ed.)	Hydrometric
Biomonitoring	1006.0	EPA-3	Menidia beryllina 7 day survival
	007.0	EPA-3	Mysidopsis bahia 7 day survival
Copper	200.7	EPA-1	Inductively coupled plasma atomic emission spectrometric method for trace element analysis of water and waste

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

APHA = 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

EPA-3 = U.S. EPA, Short Term Methods for Estimnating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms, Document No. EPA/600/4-87/028.

accuracy and precision without the necessity of manual quality control chart preparation.

7.5 CONTROL OF SUBCONTRACTOR LABORATORY QUALITY ASSURANCE

The M&O Contractor subcontracts 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 maintained by the M&O Contractor Quality Assurance organization. The successful bidder must be on the approved vendors list prior to the start of the laboratory contract. Vendors on the approved list are periodically reassessed by the M&O Contractor Quality Assurance and Operations and Maintenance organizations.

Appendix A
SPR Environmental Standards

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Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
10 CFR 1021	MR	Compliance with the National Environmental Policy Act
10 CFR 1022	MR	Compliance with Flood Plain/Wetlands Environmental Review
29 CFR 1910 SUBPART H	CS	Hazardous Materials (1910.101 through .120)
33 CFR 64	CW	Markings of Structures, Sunken Vessels and Other Obstructions
33 CFR 67	CW	Aids to Navigation on Artificial Islands and Fixed Structures
33 CFR 68	CW	Private Aid to Navigation
33 CFR 126	CW	Handling Class I (Explosive) Materials or Other Dangerous Cargo
33 CFR 153	CW	Control of Pollution by Oil and Hazardous Substances, Discharged Removed
33 CFR 154	CW	Facilities Transferring Oil or Hazardous Material in Bulk
33 CFR 156	CW	Oil and Hazardous Material Transfer Operations
33 CFR 158	HW	Reception Facilities for Oil, Noxious Liquid Substances, and Garbage (MARPOL)
33 CFR 322	CW	Permits for Structures or Work in or Affecting Navigable Waters of the U.S.
33 CFR 323	CW	Permits for Discharges of Dredged or Fill Material into Waters of the U.S.
33 CFR 325	CW	Process of Department of Army Permits
33 CFR 326	CW	Enforcement
33 CFR 328	CW	Definition of Waters of the United States
33 CFR 329	CW	Definition of Navigable Waters of the United States
33 CFR 330	CW	Nationwide Permits
36 CFR 800	MR	Advisory Council on Historical Preservation
40 CFR 52	CA	Approval & Promulgation of Implementation Plans
40 CFR 53	CA	Ambient Air Monitoring
40 CFR 60	CA	Standards of Performance for New Stationary Sources
40 CFR 60, Appendix A	CA	Determination of Emissions from Volatile Compounds Leaks
40 CFR 61	CA	National Emission Standards for Hazardous Air Pollutants
40 CFR 63	CA	National Emission Standards for Hazardous Air Pollutant for Source Categories
40 CFR 66	CA	Assessment and Collection of Noncompliance Penalties
40 CFR 70	CA	State Operating Permit Programs
40 CFR 80	CA	Regulations of Fuels and Fuel Additives
40 CFR 81	CA	Designation of Areas for Air Quality Planning Purposes
40 CFR 82	CA	Protection of Stratospheric Ozone
40 CFR 109	CW	Criteria for State, Local, and Regional Oil Removal Contingency Plans
40 CFR 110	CW	Discharge of Oil
40 CFR 112	CW	Oil Pollution Prevention
40 CFR 116	CW	Designation of Hazardous Substances
40 CFR 117	CW	Determination of Reportable Quantities for Hazardous Substances
40 CFR 121	CW	State Certification of Activities Requiring a Federal License or Permit
40 CFR 122	CW	EPA Administrated Permit Programs: NPDES
40 CFR 124	CW	Procedures for Decision Making
40 CFR 125	CW	Criteria and Standards for NPDES
40 CFR 129	CW	Toxic Pollutant Effluent Standards
40 CFR 131	CW	Water Quality Planning and Management, Water Quality Standards

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
40 CFR 133	CW	Secondary Treatment Regulation
40 CFR 136	CW	Guidelines Establishing Test Procedures for the Analysis of Pollutants
40 CFR 141	CW	National Primary Drinking Water Regulations
40 CFR 142	CW	National Primary Drinking Water Implementation Regulations
40 CFR 143	CW	National Secondary Drinking Water Regulations
40 CFR 144	CW	Underground Injection Control Program
40 CFR 146	CW	Underground Injection Control Programs: Criteria and Standards
40 CFR 147	CW	State UIC Programs
40 CFR 149	CW	Sole Source Aquifers
40 CFR 152	CS	Pesticide Registration and Classification Procedures
40 CFR 156	CS	Labeling Requirements for Pesticides and Devices
40 CFR 170	CS	Worker Protection Standards (Pesticides)
40 CFR 171	CS	Certification of Pesticide Applicators
40 CFR 220	CW	General
40 CFR 228	CW	Ocean Dumping
40 CFR 243	HW	Guidelines for Storage and Collection of Residential, Commercial, and Institutional Solid Wastes
40 CFR 247	HW	Comprehensive Procurement Guideline for Products Containing Recovered Materials
40 CFR 260	HW	Hazardous Waste Management System: General
40 CFR 261	HW	Identification and Listing of Hazardous Waste
40 CFR 262	HW	Standards Applicable to Generators of Hazardous Wastes
40 CFR 263	HW	Standards applicable to transporters of hazardous wastes
40 CFR 264	HW	Standards for Owners and Operators of Hazardous Waste, Treatment, Storage, and Disposal Facilities
40 CFR 266	HW	Standards for Management of Specific Hazardous Wastes
40 CFR 268	HW	Land Disposal Restrictions
40 CFR 272	HW	Approved State Hazardous Waste Management Programs
40 CFR 273	HW	Standard for Universal Waste Management
40 CFR 279	HW	Standards for Management of Used Oil
40 CFR 280	HW	Technical Standards and Corrective Action Requirements for Owners and Operators of UST
40 CFR 282	HW	Approved Underground Storage Tank Programs
40 CFR 300	CS	National Oil and Hazardous Substances Pollution Contingency Plans
40 CFR 302	CS	Designation of Reportable Quantities and Notification
40 CFR 355	CS	Emergency Planning and Notification
40 CFR 370	CS	Hazardous Chemical Reporting: Community Right-to-Know
40 CFR 372	CS	Toxic Chemical Release Reporting: Community Right-to-Know
40 CFR 373	CS	Reporting Hazardous Substance Activity When Selling or Transferring Federal Real Property
40 CFR 401	CW	General Provisions
40 CFR 403	CW	General Pretreatment Regulations for Existing and New Sources of Pollution
40 CFR 700	CS	General

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
40 CFR 761	CS	PCB Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
40 CFR 763	CS	Asbestos
40 CFR 1500	MR	Purpose, Policy and Mandate
40 CFR 1501	MR	NEPA and Agency Planning
40 CFR 1502	MR	Environmental Impact Statement
40 CFR 1503	MR	Commenting
40 CFR 1504	MR	Predecision Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory
40 CFR 1505	MR	NEPA and Agency Decision Making
40 CFR 1506	MR	Other Requirements of NEPA
40 CFR 1507	MR	Agency Compliance
40 CFR 1508	MR	Terminology and Index
40 CFR 1515	MR	Freedom of Information Act Procedures
40 CFR 1516	MR	Privacy Act Implementation
49 CFR 130	CS	Oil Spill Prevention and Response Plans
49 CFR 171	TS	General Information, Regulations, and Definitions
49 CFR 172	TS	Hazardous Materials Tables and Hazardous Materials Communications Regulations
49 CFR 173	TS	Shippers - General Requirements for Shipments and Packaging
49 CFR 177	TS	Carriage by Public Highway
49 CFR 194	TS	DOT Response Plans for Onshore Pipelines
49 CFR 195	TS	Transportation of Hazardous Liquids by Pipeline
49 CFR 199	TS	Drug Testing
50 CFR 10	MR	General Provisions
50 CFR 17	MR	Endangered and Threatened Wildlife and Plants
EO 11988	CW	Floodplain Management
EO 11990	CW	Protection of Wetlands
EO 11991	MR	Protection/Enhancement of Environmental Quality
EO 12856	PP	Right-to-Know and PPA Compliance
EO 12873	PP	Federal Acquisition, Recycling, and Waste Prevention
EO 12898	MR	Environmental Justice
33:LAC I.3	MR	Adjudications
33:LAC I.15	MR	Permit Review
33:LAC I.39	CW	Notification Regulations and Procedures for Unauthorized Discharge
33:LAC III.1	CA	General Provisions
33:LAC III.2	CA	Rules and Regulations for the Fee System of the Air Quality Control Programs
33:LAC III.5	CA	Permit Procedures
33:LAC III.7	CA	Ambient Air Quality
33:LAC III.9	CA	General Regulations on Control of Emissions and Emission Standards
33:LAC III.11	CA	Control of Emissions of Smoke
33:LAC III.13	CA	Emission Standards for Particulate Matter (including standards for some specific facilities)

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
33:LAC III.14	CA	Conformity
33:LAC III.15	CA	Emission Standards for Sulphur Dioxide
33:LAC III.17	CA	Control of Emission of Carbon Monoxide (new sources)
33:LAC III.21	CA	Control of Emission of Organic Compounds
33:LAC III.25	CA	Miscellaneous Incineration Rules
33:LAC III.29	CA	Odor Regulations
33:LAC III.31	CA	Standards of Performance for New Stationary Sources
33:LAC III.51	CA	Comprehensive Toxic Air Pollutant Emission Control Program
33:LAC III.53	CA	Minor Sources of Toxic Air Pollutants
33:LAC III.56	CA	Prevention of Air Pollution Emergency Episodes
33:LAC III.60	CA	Division's Source Test Manual
33:LAC V.1	HW	General Provisions and Definitions
33:LAC V.9	HW	Manifest System for TSD Facilities
33:LAC V.11	HW	Generators
33:LAC V.13	HW	Transporters
33:LAC V.15	HW	Treatment, Storage and Disposal Facilities
33:LAC V.18	HW	Containment Buildings
33:LAC V.19	HW	Tanks
33:LAC V.21	HW	Containers
33:LAC V.22	HW	Prohibitions on Land Disposal
33:LAC V.26	HW	Corrective Action Management Units and Temporary Units
33:LAC V.37	HW	Financial Requirements
33:LAC V.39	HW	Small Quantity Generators
33:LAC V.40	PP	Used Oil
33:LAC V.41	PP	Recyclable Materials
33:LAC V.49	HW	Lists of Hazardous Wastes
33:LAC VI.1	HW	General Provisions and Definitions (solid waste regulations)
33:LAC VI.51	HW	Fee Schedules
33:LAC VII.3	HW	Scope and Mandatory Provisions of the Program
33:LAC VII.5	HW	Solid Waste Management System
33:LAC VII.7	HW	Solid Waste Standards
33:LAC VII.9	HW	Enforcement
33:LAC VII.103	PP	Recycling and Waste Reduction Rules
33:LAC VII.105	PP	Waste Tires
33:LAC IX.1	CW	General Provisions
33:LAC IX.3	CW	Permits
33:LAC IX.5	CW	Enforcement
33:LAC IX.7	CW	Effluent Standards
33:LAC IX.9	CW	Spill Prevention and Control
33:LAC IX.11	CW	Surface Water Quality Standards
33:LAC IX.13	CW	Louisiana Water Pollution Control Fee System Regulation
33:LAC IX.15	CW	Water Quality Certification Procedures

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
33:LAC IX.17	CW	Rules Governing Disposal of Waste Oil, Oil Field Brine, and All Other Materials Resulting From the Drilling for, Production of, or Transportation of Oil, Gas or Sulphur (as amended January 27, 1953)
33:LAC IX.19	CW	State of Louisiana Control Commission
33:LAC IX.23	CW	The LPDES Program Definitions and General Program Requirements
33:LAC XI.1	HW	Program Applicability and Definitions
33:LAC XI.3	HW	Registration Requirements, Standards and Fee Schedule
33:LAC XI.5	HW	Spill and Overfill Control
33:LAC XI.7	HW	Methods Release Detection and Release Reporting, Investigation, Confirmation and Response
33:LAC XI.9	HW	Out of Service UST Systems and Closure
43:LAC I.1	CW	General Rules and Regulations
43:LAC I.5	CW	State Lands
43:LAC I.7	CW	Coastal Management
43:LAC XI.3	TS	Underwater Obstructions
43:LAC XI.5	TS	Pipeline Safety
43:LAC XVII.1	CW	Class I, III, IV, and V Injection Wells (Statewide Order 29-N-1)
43:LAC XVII.3	CW	Hydrocarbon Storage Wells in Salt Dome Cavities (Statewide Order 29-M)
43:LAC XIX.1	CW	General Provisions (Statewide Order 29-B)
43:LAC XIX.2	CW	Fees
48:LAC V.75	CW	Sewerage Program
48:LAC V.77	CW	Drinking Water Program
70:LAC XIII.1	CW	Water Wells
70:LAC XIII.3	CW	Water Well Construction
70:LAC XIII.5	CW	Plugging and Sealing Abandoned Water Wells and Holes
70:LAC XIII.7	CW	Reporting Abandoned Wells and Holes
16:TAC I.3	CW	Oil and Gas Division
25:TAC I.301	CW	Wastewater Surveillance and Technology
25:TAC I.325	HW	Solid Waste Management
25:TAC I.337	CW	Water Hygiene
30:TAC I.101	CA	General Provisions
30:TAC I.103	CA	Procedural Rules
30:TAC I.105	CA	Enforcement Rules
30:TAC I.111	CA	Control of Air Pollution from Visible Emissions and Particulate Matter
30:TAC I.112	CA	Sulfur Compounds Control of Sulfur Dioxide
30:TAC I.113	CA	Toxic Materials
30:TAC I.114	CA	Control of Air Pollution from Motor Vehicles
30:TAC I.115	CA	Control of Air Pollution from Volatile Organic Compounds
30:TAC I.116	CA	Control of Air Pollution by Permits for New Construction or Modification
30:TAC I.117	CA	Nitrogen Compounds
30:TAC I.118	CA	Episode Control Procedures
30:TAC I.119	CA	Carbon Monoxide
30:TAC I.122	CA	Federal Operating Permits

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
30:TAC I.279	CW	Water Quality Certification
30:TAC I.281	CW	Applications Processing
30:TAC I.285	CW	On-site Wastewater Treatment
30:TAC I.290	CW	Water Hygiene
30:TAC I.295	CW	Water Rights, Procedural
30:TAC I.297	CW	Water Rights, Substantive
30:TAC I.307	CW	Surface Water Quality Standards
30:TAC I.312	HW	Sludge Use, Disposal, and Transportation
30:TAC I.325	CW	Certificates of Competency
30:TAC I.327	CW	Spill Prevention and Control
30:TAC I.330	PP	Municipal Solid Waste
30:TAC I.334	HW	Underground and Aboveground Storage Tanks
30:TAC I.335	HW	Industrial Solid Waste and Municipal Hazardous Waste
30:TAC I.337	CW	Enforcement
30:TAC I.338	CW	Water Well Drillers Rules General Provisions
30:TAC I.343	CW	Oil and Hazardous Substances General Provisions
30:TAC 116.211	CA	Standard Exemption List, TNRCC, Jun 1996
31:TAC I.15	CW	Planning Division
31:TAC I.19	CW	Oil Spill Prevention and Response
31:TAC I.20	CW	Natural Resource Damage Assessment
31:TAC I.21	CW	Oil Spill Prevention and Response Hearings Procedures
31:TAC II.57	MR	Fisheries
31:TAC II.65	MR	Wildlife
31:TAC II.67	MR	Resource Protection
31:TAC XVI.503	CW	Coastal Management Program
No number	CA	Technical Guidance Package for Chemical Sources, Storage Tanks, TNRCC, Feb 1995
No number	CA	Technical Guidance Package for Chemical Sources, Equipment Leak Fugitives, TNRCC, Mar 1995
R.S. 30:2361-2379 SARA Title III	CS	Hazardous Materials Information Development, Preparedness and Response Act
TCRA, 505-507 SARA Title III	CS	Texas Tier Two Reporting Forms and Instructions
EPA 100-K-93-001	PP	Pollution Prevention and Right-to-Know in the Government, Executive Order 12856
EPA 453/R-93-026	CA	Protocol for Equipment Leak Emission Estimates, Jun 1993
EPA 530/R-93-001	CW	RCRA Groundwater Monitoring; Draft Technical Guidance
EPA 600/2-85/105	CW	Practical Guide for Groundwater Sampling
EPA 600/4-78-012	CW	Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms
EPA 600/4-79-019	CW	Handbook for Analytical Quality Control in Water and Wastewater Laboratories
EPA 600/4-79-020	CW	Methods for Chemical Analysis of Water and Wastes
EPA 600/4-82-029	CW	Handbook for Sampling and Sample Preservation of Water and Wastewater

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
EPA/600/4-83-039	CW	Addendum to Handbook for Sampling and Sample Preservation, EPA 600/4-82-029
EPA/600/8-78-017	CW	Microbiological Methods for Monitoring the Environment, Water and Wastes
EPA/600/R-92/088	PP	Facility Pollution Prevention Guide
EPA 833-R-92-002	PP	Storm Water Management for Industrial Activities
EPA, ISBN:0-86587-279-1	CW	EPA Groundwater Handbook
EPA, ISBN:0-86587-752-1	PP	EPA Waste Minimization Opportunity Assessment Manual
EPA Region IV	MR	Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, 4/1/86
DOE/EH-0350	CA	Management of Polychlorinated Biphenyls (PCBs)
DOE/EH-0358	MR	Performance Objectives and Criteria for Conducting DOE Environmental Audits
DOE/EM-0276	PP	Annual report on Waste Generation and Waste Minimization Progress 1991 - 1992
DOE/EM-0276	PP	Annual report on Waste Generation and Waste Minimization Progress 1993
DOE/FM-0145	PP	Waste Minimization/Pollution Prevention Crosscut Plan 1994
DOE Guideline	PP	DOE Waste Minimization reporting Requirements, Nov. 1994
DOE Handbook	PP	Guidance for the Preparation of the Waste Minimization and Pollution Prevention Awareness Plan, Dec 1993
DOE Handbook	PP	Pollution Prevention Handbook
DOE Handbook	PP	Waste Minimization Reporting System (Wmin) User's Guide
DOE Memorandum	PP	EPA's Interim Final Guidance to Hazardous Waste Generators on the Elements of a Waste Minimization Program
DOE Order 5400.1	MR	General Environmental Protection Program
DOE Order 5480.4	MR	Environmental Protection, Safety, and Health Protection Standards
DOE Order 5480.19	MR	Conduct of Operations
DOE Order 5482.1B	MR	Environment, Safety, and Health Appraisal Program
DOE Order 5484.1	MR	Environmental Protection, Safety, and Health Protection Information Reporting Requirements
DOE Order 5700.6C	MR	Quality Assurance
DOE Order 6430.1A	MR	General Design Criteria
DOE Order M 231.1-1	MR	Environment, Safety, and Health Reporting Manual
DOE Order M 232.1-1	MR	Occurrence Reporting and Processing of Operations Information
DOE Order O 210.1	MR	Performance Indicators and Analysis of Operations Information
DOE CRD 210.1	MR	Contractor Requirements Document - Performance Indicators and Analysis of Operations Information
DOE Order O 231.1	MR	Environment, Safety and Health Reporting
DOE MAN 231.1	MR	ES&H Reporting Manual
DOE CRD 231.1	MR	Contractor Requirements Document - ES&H Reporting
DOE Order O 231.2	MR	Environmental Protection, Safety And Health Protection Information Reporting Requirements
DOE Order O 232.1	MR	Occurrence Reporting and Processing of Operations Information
DOE CRD 232.1	MR	Contractor Requirements Document - Occurrence Reporting and Processing of Operations Information

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
DOE Order O 430.1	MR	Life-Cycle Asset Management
DOE Order O 430.2	MR	In-House Energy Management
DOE Order O 451.1	MR	National Environmental Policy Act Compliance Program
DOE Order O 460.1	TS	Packaging and Transportation Safety
DOE Order O 460.2	TS	Departmental Materials Transportation and Packaging Management
DOE Order O 1700.1	MR	Freedom of Information Act
DOE Order P 450.1	MR	Environment, Safety and Health Policy for the DOE Complex
DOE Order P 450.2	MR	Identification, Implementation, and Compliance with Environment, Safety and Health Requirements
DOE Order P 450.3	MR	Sufficient Process for Standards-based Environment, Safety and Health Management
DOE S-0118	PP	Pollution Prevention Program Plan
DOE Standard Spec. 17900	PP	Paint Repair of Exterior Metal Surfaces
No number	MR	Environmental, Safety, and Health Management Plan (FY 1998 - FY 2002)
SEN-15-90	MR	National Environmental Policy Act
SEN-22-90	HW	DOE Policy on Signatures of RCRA Permit Applications
SEN-37-92	PP	Waste Minimization Crosscut Plan Implementation
AL 5500.11	MR	Drill and Exercise Program Plan
ASE 5400.48	MR	Annual Site Environmental Report
ASI 3400.1	MR	Conduct of Training for the SPR M&O Contractor
ASI 4400.4	PP	Supply Services Manual
ASI 5400.15	MR	Environmental Instructions Manual
ASI 5480.19	MR	Conduct of Operations at the SPR
ASI 5480.26	CW, HW	ES&H Training Requirements
ASI 5700.15	MR	Quality Assurance Manual
ASI 6430.15	MR	Design Review Procedure
ASL 1000.15	MR	Self-Assessment Program Implementation Plan
ASL 4700.1	MR	Configuration Management Plan and Procedures
ASL 5499.30	CW	Cavern Inventory & Integrity Control Plan
ASL 5500.1	MR	Emergency Management Plan
ASL 5500.10	MR	Emergency Readiness Assurance Plan
ASL 5500.25	MR	Emergency Response Team Organization and Training Plan
ASL 6400.18	MR	Drawdown Management Plan
ASL 6400.31	MR	Drawdown Readiness Program Plan
ASP 5000.8	MR	Master Action Tracking Management and Control System
ASP 5400.2	MR	Environmental
ASR 5480.49	MR	Environmental, Safety and Health (ES&H) Orientation Video Program
ASR 5700.3	MR	Independent Quality Assurance Assessments
ASR 7000.1	MR	Readiness Review Board
ASR 7000.2	MR	SPR Crosstalk Information Exchange Program
BCL 5400.16	CW	Bayou Choctaw Spill Prevention, Control, and Countermeasures Plan
BHL 5400.21	CW	Big Hill Spill Prevention, Control, and Countermeasures Plan
BML 5400.17	CW	Bryan Mound Spill Prevention, Control, and Countermeasures Plan

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
D506-02569-09	TS, CS	Hazardous Materials Packaging & Transportation Plan
D506-03287-09	HW,PP,CW	Pollution Prevention Plan
MSL 7000.133	CW, HW	Laboratory Programs & Procedures
NOL 5400.44	CW	New Orleans Warehouse Spill Prevention, Control, and Countermeasures Plan
No number	CW,PP,CA, HW,CS	Environmental Exhibit 6.6
No number	CW	SPR Groundwater Protection Management Program
No number	PP,HW	SPR Qualified Products List
No number	MR	SPRPMO Environmental, Safety and Health Manual
No number	MR	SPRPMO Level III Design Criteria
WHL 5400.20	CW	West Hackberry Spill Prevention, Control, and Countermeasures Plan
WIL 5400.19	CW	Weeks Island Spill Prevention, Control, and Countermeasures Plan
120 IAC	IS	Boiler And Pressure Vessels - Degas Project Only
055-001-01049-4	CW	Quality Criteria for Water
ACP USCG	CW	Area Contingency Plan for New Orleans
ACP USCG	CW	Area Contingency Plan for Morgan City
ACP USCG	CW	Area Contingency Plan for Lake Charles
ACP USCG	CW	Area Contingency Plan for Port Arthur
ACP USCG	CW	Area Contingency Plan for Galveston
ACP-EPA	CW	Area Contingency Plan for EPA Region 6
AIHMM	PP	Hazardous Materials Management Education Program Observations and Recommendations: Environmental Mgmt, Hazardous Waste Minimization, and Pollution Prevention for the SPR Operations
American Public Health Assoc.	CW	Standard Methods for the Examination of Water and Wastewater
AP-42	CA	Compilation of Air Pollutant Emission Factors, Mobile Sources
API	MR	Amer. Petroleum Institute - Recommended Practices and Guides
API - Standard	CA	API Standard 653 for Tank Inspection, Repair, Alteration, and Reconstruction
CERI-89-224	CW	Seminar on Site Characterization for Subsurface Remediations
LP 92-03	PP	Pollution Prevention Assessment Manual for Texas Businesses
MP 94W0000131	CA	SPR Gas and Geothermal Heat Effects on Crude Oil Vapor Pressure, Dec. 1994
No number	CW	Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook (LDOTD and LDEQ)
No number	CW	Earth Manual, 2nd Ed.
No number	CW	Engineering Geology Field Manual
No number	CW, CA	Environmental Monitoring Plan
No number	CW	Groundwater Manual
No number	CW	Groundwater Program
No number	CA	Louisiana Air Permit Procedures Manual, Jun 1995
No number	CW	Louisiana's Suggested Chemical Weed Control Guide for 1994 (LA Cooperative Extension Services)
No number	CA	Nonattainment New Source Review Guidance Manual, Oct 1993

Strategic Petroleum Reserve Environmental Standards

STANDARD	AREA	DESCRIPTION
No number	CW	The Sterling Brine Handbook (Int'l Salt Co.)
No number	CW	Water Measurement Manual
OSWER-9950.1 (1986)	CW	RCRA Groundwater Technical Enforcement Guidance Document (TEGD)
RBCA (OS21)	CW	Proposed Approach for Implementing a Louisiana Dept. of Env. Quality Risk-Based Corrective Action Program
RG-133	PP	Pollution Prevention Assessment Manual
Water Supply Paper 1473	CW	Study and Interpretation of the Chemical Characteristics of Natural Water (HEM)
Y-87-1	CW	Corps. of Engineers Wetlands Delineation Manual

KEY TO ACRONYMS:

API American Petroleum Institute
CA Protection of Air Quality
CFR Code of Federal Regulations
CS Control of Toxic Substances
CW Protection of Water Quality
EO Executive Order
ESH Environmental, Safety, and Health Directorate
HW Solid and Hazardous Waste Generation and Control
LAC Louisiana Administrative Code
M Manual (DOE)
MR Management, Oversight, and Reporting
O Order (DOE)
P Policy (DOE)
PP Pollution Prevention and Waste Minimization
RCRA Resource Conservation and Recovery Act
SEN Secretary of Energy Notice
TAC Texas Administrative Code
TS Transportation Safety

Appendix B
SPR Environmental Policy Statements

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ENVIRONMENTAL POLICY STATEMENT FOR THE STRATEGIC PETROLEUM RESERVE PROJECT MANAGEMENT OFFICE

It is the policy and practice of the Strategic Petroleum Reserve Project Management Office (SPRPMO), as an operating unit of the U.S. Department of Energy (DOE), to conduct its operations in a safe and environmentally sound manner. Secretary O'Leary has made it clear that protection of the environment and the public are responsibilities of paramount importance to our facilities.

SPRPMO is firmly committed to ensuring incorporation of all Departmental and national environmental protection goals in the daily conduct of our business. We have an equal commitment to advance the goals of restoring and enhancing environmental quality and ensuring public health.

It is SPRPMO's policy and practice to conduct our operations in compliance with applicable environmental statutes, regulations, and standards. In addition, SPRPMO is committed to good environmental management of all our programs at our facilities.

Management and Operations contractors also share our responsibilities for good environmental management. We expect our management and operating contractors to conduct facility operations in an environmentally sound manner that limits the risks to the environment and protects the public health. Our contractors must recognize and accept that the Department's criteria for awarding their fees reflects DOE's increased emphasis of environment, safety and health.

In addition, it is SPRPMO's policy to undertake appropriate measures to prevent the generation of contaminants, wastes, and other residual materials requiring disposal or release to the environment through source reduction and recycling. Where the generation of such wastes cannot be avoided, SPRPMO will take actions to reduce their volume and toxicity and ensure proper disposal.

It is SPRPMO's goal to create a pollution prevention ethic within the work place. To this end, all facility mission statements and project plans shall recognize a requirement for pollution prevention. Pursuant to DOE policy, a program to develop employee pollution prevention awareness through specific training, special campaigns, and incentive programs will be implemented at each site. As part of this program, employee initiative in the establishment of sound pollution prevention and waste minimization practices will be encouraged by all levels of facility management.

In the final analysis, reaching the goals that have been established by the Secretary will depend upon each and every employee's contribution. I need your help as we strive to achieve environmental excellence throughout the Strategic Petroleum Reserve.

William C. Gibson, Jr.
Project Manager
Strategic Petroleum Reserve

Dyn McDermott Corporate Environmental Policy

DynMcDermott Petroleum Operations Company (DM) is committed to continued excellence, leadership, and stewardship in protecting the environment. DM will conduct the management and operating activities of the Strategic Petroleum Reserve (SPR) sites with the highest regard for the protection of human health and the environment. Environmental protection is a primary management responsibility, as well as the responsibility of every employee.

In keeping with this policy, our objective as a company is to reduce waste and achieve minimal adverse impact on air, water, and land through excellence in environmental control.

Our Environmental Guidelines include the following:

Environmental protection is a line responsibility and an important measure of employee performance. In addition, every employee is responsible for environmental protection in the same manner he or she is for safety.

Reducing or eliminating the generation of waste has been and continues to be a prime consideration in research, process design, and operations; and is viewed by management like safety, yield, and loss prevention.

Source Reduction/Waste Minimization (reuse and recycling) of materials has been and will continue to be given first consideration prior to classification and disposal of waste.

DM will fully comply with federal, state, and local environmental rules, regulations, statutes, and permits.

DM will consider pollution prevention, waste minimization, and affirmative procurement in all levels of decision-making and ensure that SPR environmental programs are implemented.

C. Curtis Johnson — Date 5/3/96

DynMcDermott Corporate Waste Management Policy

DynMcDermott Petroleum Operations Company (DM) is committed to manage waste through excellence in environmental control. Waste management is every employee and contractors responsibility.

A written waste determination must be made by the person who first causes a material to have no further use. Due to the technical nature, all waste determinations must be approved by DM Environmental Programs, the group that has corporate responsibility for the DM Waste Management Program, prior to transportation of the material off site.

Employees and contractors may not transport waste off-site unless they are licensed transporters and on the SPR Qualified Disposers, Transporters, and Recyclers List.

All wastes generated on-site will be maintained (contained, collected, characterized, and disposed) in accordance with all applicable federal, state, and local environmental rules, regulations, statutes, permits, and DM policies.

Wastes generated by contractors off-site are the contractor's responsibility (manifested under the contractor waste generator and transporter EPA Identification Numbers). Wastes generated by contractors on-site are the SPR site's responsibility (manifested under the DOE waste generator EPA Identification Number). Contractors planning to generate waste on-site must provide a waste management plan detailing waste minimization activities for approval by the DM Environmental Programs group prior to start of work.

C. Curtis Johnson — 6/10/96
C. Curtis Johnson — Date
President and CEO

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