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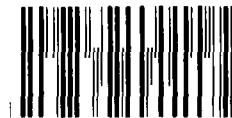
United States General Accounting Office 130595

Report to the Chairman, Subcommittee on
Environment, Energy, and Natural
Resources, Committee on Government
Operations
House of Representatives

July 1986

OIL RESERVE

Status of Strategic Petroleum Reserve Activities as of June 30, 1986



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**Resources, Community, and
Economic Development Division****B-208196**

July 25, 1986

The Honorable Mike Synar
Chairman, Subcommittee on Environment,
Energy, and Natural Resources
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

On December 9, 1985, you requested that we continue to report on a quarterly basis, at least through fiscal year 1986, on the Department of Energy's (DOE's) progress in developing, filling, and operating the Strategic Petroleum Reserve (SPR) and in complying with the requirements of applicable law. A list of prior SPR quarterly reports is contained in appendix III

This report discusses events and activities related to the administration's progress in developing, filling, and operating the SPR during the third quarter of fiscal year 1986. Specifically, it notes the following:

- The administration has no official plans to revise the moratorium-based fiscal year 1987 SPR budget submitted in February 1986, to recognize congressional actions affecting SPR development and oil fill. However, DOE informally provided documentation on revised fiscal years 1986 and 1987 funding needs to staffs of the Senate and House Committees dealing with DOE funding. Based on the release for obligation of the \$156.8 million of DOE's earlier deferral of funds, DOE estimated that for fiscal year 1987, an appropriation of \$108.6 million is needed with no leaching, and \$147.4 million is needed if leaching is resumed.
- As of June 30, 1986, DOE planned to stop oil fill at 503 million barrels. In a May 22, 1986, report to the Secretary of Energy, we expressed our views on DOE's site development and plans to stop oil fill operations.¹ We made recommendations concerning continued SPR storage capacity development and oil fill purchases in the current period of available storage capacity and funding and low oil prices.
- DOE added 4.9 million barrels of crude oil to the SPR, bringing the total inventory level to 501.8 million barrels. The oil fill rate averaged 53,800 barrels per day.

¹Low Oil Prices Favor Increased Purchases (GAO/RCED-86-158, May 22, 1986) Although DOE has not responded to our recommendations, the issue of continued oil fill was presented to the President's Domestic Policy Council for consideration in early June 1986. The council is expected to recommend a course of action to the President in the near future.

- As of June 30, 1986, payments made from the oil acquisition and transportation account during the quarter totaled \$63 million; unpaid obligations totaled \$63 million; and unobligated funds available for oil purchases totaled \$590 million.
- After delays resulting from administration attempts to defer funds and impose a moratorium on development, construction activities at Big Hill and oil distribution enhancement activities at the Bryan Mound site have resumed.
- Various contracts for the operation of the SPR are nearing their expiration dates or the option dates for their renewal, notably the contract for the purchase of oil from Petroleos Mexicanos, the Mexican national oil company, which expires on August 31, 1986.
- The first award-fee payment to Boeing, the SPR management, operations, and maintenance contractor, was based on an overall satisfactory performance rating. The fee totaled about \$1.4 million, or about 55 percent of the \$2.6 million maximum award-fee pool available.
- DOE has taken or planned various corrective actions for improving future SPR sales as a result of DOE's assessment of the results of the recently conducted oil drawdown test and sale exercise.

Details related to these events and activities are provided in appendixes I and II.

Objectives, Scope, and Methodology

We limited our review, because of the time allowed, to providing primarily statistical information and highlights of major activities that occurred during the period. To obtain this information, we reviewed DOE program documents, publications, and studies, and interviewed DOE managers and operations personnel responsible for planning and managing activities associated with developing and operating the SPR facilities. We also interviewed employees of DOE contractors. In addition, we observed the oil drawdown exercise, which was conducted at the Weeks Island site in April 1986.

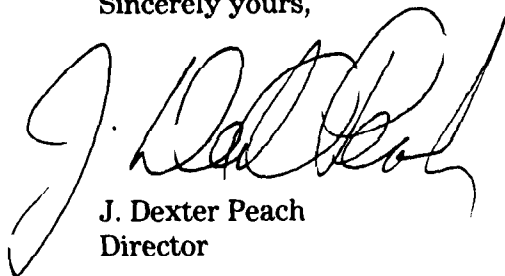
Our review was performed in accordance with generally accepted government auditing standards, except that we did not verify the volumes or quality of oil that DOE received or the available capacity of SPR storage facilities. The effort required to do this was beyond the scope of this report.

In accordance with your request, we did not obtain official agency comments. However, we provided DOE program officials with a draft of this

report and discussed its factual accuracy with them. We made appropriate revisions as necessary.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days after the date of this letter. At that time, we will provide copies to the Secretary of Energy and other interested parties and make copies available to the public upon request.

Sincerely yours,



J. Dexter Peach
Director

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Abbreviations

API	American Petroleum Institute
ARCO	Atlantic Richfield Company
DOE	Department of Energy
GAO	General Accounting Office
I&C	instrumentation and control
IFB	invitation for bid
MOM	management, operations, and maintenance
OMB	Office of Management and Budget
PEMEX	Petroleos Mexicanos
RWIS	raw water intake structure
SPR	Strategic Petroleum Reserve

Status of Strategic Petroleum Reserve Activities as of June 30, 1986

The Energy Policy and Conservation Act (Public Law 94-163, Dec. 22, 1975), as amended, authorized the creation of a Strategic Petroleum Reserve (SPR) to store up to 1 billion barrels of oil for use in the event of an oil supply disruption. To meet the act's goals, the Department of Energy (DOE) established a three-phase plan to store 750 million barrels of oil.

Phase I of the SPR plan involved the storage of about 260 million barrels of oil and is now complete. It consisted of acquiring and modifying for oil storage existing caverns in salt deposits at Bryan Mound, Texas; Bayou Choctaw, Sulphur Mines, and West Hackberry, Louisiana; and a salt mine at Weeks Island, Louisiana, as well as constructing a marine terminal at St. James, Louisiana.

Phase II involves creating new caverns through a leaching program at three of the Phase I sites to increase SPR capacity to about 550 million barrels. The leaching program entails pumping fresh water into salt deposits and removing the resultant brine. DOE injects oil into the top of the cavern as the leaching process creates the storage capacity. However, as we previously reported, Phase II leaching was stopped on December 31, 1985, in anticipation of a proposed moratorium on further SPR development to be included in the administration's fiscal year 1987 budget.¹ The budget also proposed terminating oil fill when a 500-million-barrel inventory level was reached. However, in accordance with requirements for filling the SPR in the Consolidated Omnibus Budget Reconciliation Act of 1985,² the oil fill level was raised to 502 million barrels, and on June 23, 1986, DOE announced that it would purchase enough additional oil to bring the SPR inventory level to approximately 503 million barrels. As of June 30, 1986, however, DOE had no further plans to resume leaching or continue oil fill.³ Consequently, a final completion date for Phase II storage capacity development and ultimate oil fill remains uncertain.

Phase III, which was originally scheduled for completion in 1990, was designed to create additional capacity to reach the 750-million-barrel goal by expanding three existing storage sites and developing a new site

¹Status of Strategic Petroleum Reserve Activities as of December 31, 1985 (GAO/RCED-86-84, Jan. 29, 1986)

²The Consolidated Omnibus Budget Reconciliation Act of 1985 (Public Law 99-272) stipulates a minimum fill rate of 35,000 barrels per day for the SPR during fiscal years 1986, 1987, and 1988 until the SPR contains at least 527 million barrels of oil

³Leaching activities at West Hackberry and Bryan Mound were resumed on July 3, 1986

at Big Hill, Texas. Because of the time needed to develop capacity, activities associated with Phases II and III have overlapping schedules. The administration's moratorium proposals on SPR development also make this completion schedule uncertain.

The SPR storage sites are connected by pipeline to three marine terminals for crude oil deliveries during site development and for oil drawdown and distribution during an oil supply disruption:

- Seaway complex: The Bryan Mound storage site is connected to Phillips Petroleum Company's terminal (formerly the Seaway terminal) in Freeport, Texas.
- Texoma complex: The West Hackberry and Sulphur Mines storage sites are connected to Sun Oil Company's terminal in Nederland, Texas. The Big Hill storage site, when completed, also will be connected to the Sun terminal.
- Capline complex: The Weeks Island and Bayou Choctaw storage sites are connected to DOE's St. James marine terminal.

The SPR Program Office in Washington, D.C., has overall programmatic management and planning responsibility for achieving the goals and objectives of the SPR program. Responsibility for SPR project management and implementation activities is assigned to the Oak Ridge Operations Office (Operations Office) in Oak Ridge, Tennessee. These activities, as delegated by the Operations Office, are carried out through the Project Management Office (Project Office) in New Orleans, Louisiana. On March 28, 1985, DOE signed a 5-year management, operations, and maintenance (MOM) contract with Boeing Petroleum Services, Inc., to provide the necessary qualified personnel and services to run the government-owned SPR facilities. DOE will retain responsibility for the overall project management and project technical direction, while the contractor will be responsible for the SPR's day-to-day management.

This report discusses activities affecting the SPR that occurred during the quarter ending June 30, 1986, including (1) the status of DOE's fiscal year 1987 budget proposals, (2) oil fill activities, (3) the status of the oil acquisition and transportation account, (4) storage site activities, (5) contract terminations and anticipated contract changes in the near future; (6) the result of DOE's initial assessment of Boeing's performance as the SPR MOM contractor, (7) corrective actions taken and planned as a result of DOE's assessment of the results of the recently conducted oil drawdown test and oil sale, and (8) our views on continued storage capacity development and oil purchases.

Fiscal Year 1987 SPR Budget

The administration's fiscal year 1987 SPR budget initially identified a total requirement of \$149.9 million of nonphase-specific development and management funds. No funds were requested for storage capacity development and oil fill since the budget proposed a moratorium on capacity development effective January 1, 1986, and discontinuing oil fill at the 500-million-barrel level. In addition, the administration submitted with the budget, deferrals of approximately \$198 million in the SPR appropriation for capacity development and about \$578 million of SPR petroleum account funds. The administration did not request new budget authority for fiscal year 1987. On the basis of the budget proposal, the balances of unobligated funds appropriated in prior years (primarily, the amounts proposed for deferral) were expected to be sufficient to sustain activities essential for maintaining SPR facilities in a standby-readiness state and to continue the distribution enhancement program.

Since the budget proposal was sent to the Congress in February 1986, however, two major events have occurred that affect SPR development. On April 11 the Office of Management and Budget (OMB) released \$156.8 million in deferred funds for continuing SPR construction, and on June 26, Congress completed actions on the 1986 Urgent Supplemental Appropriations Act,⁴ which rejected the administration's deferral of \$41 million in the construction fund and \$578 million in the oil account. In addition to the recent funding support, various amendments and resolutions have been introduced in the House and Senate that affect SPR development and oil fill. This legislation is virtually all positive in its support of the SPR, encouraging both the continued development and expansion of storage capacity as well as further acquisition and oil fill.⁵

DOE officials have told us that currently they have no plans for issuing a revised fiscal year 1987 budget. However, on May 2, 1986, DOE officials provided informal documentation to the staffs of the Senate and House committees dealing with DOE funding needs. Based on the release for obligation of the \$156.8 million of DOE's earlier proposed deferral of funds, \$127.9 million will be expended for construction activities in fiscal year 1986, and \$28.7 million in fiscal year 1987. On the basis of the expenditures, DOE anticipates a need for \$108.6 million for SPR activities for fiscal year 1987. In the event cavern leaching activities are

⁴The President signed the Bill into law on July 2, 1986

⁵For example, S. 2375 proposes an additional \$1 billion in appropriations for each of fiscal years 1987, 1988, and 1989 for acquisition of additional oil for the SPR

resumed and continued through fiscal year 1987, DOE estimates the fiscal year 1987 SPR funding need will be about \$147.4 million.

SPR Oil Fill Activities

DOE reported that 4.9 million barrels of crude oil were added to the SPR inventory during the quarter ending June 30, 1986, increasing the total SPR inventory to 501.8 million barrels. The 500-millionth barrel of oil was received at the SPR on June 1, 1986. All oil delivered this quarter was purchased under DOE's 1981 contract with Petroleos Mexicanos (PEMEX), the Mexican national oil company. This contract expires on August 31, 1986, unless DOE takes steps to extend it. The average fill rate for the quarter was about 53,800 barrels per day. The cumulative average fill rate for the first 9 months of fiscal year 1986 was about 49,500 barrels per day. (See fig. II.1 and table II.1 for further information on SPR oil acquisition and fill activities.) Although DOE's fiscal year 1987 budget included a proposal to stop filling the SPR at 500 million barrels, DOE headquarters issued instructions to the Project Office to continue filling until the SPR contained 502 million barrels in accordance with the Consolidated Omnibus Budget Reconciliation Act of 1985. On June 23, 1986, the Project Office was instructed to add an additional one million barrels of oil to the SPR to achieve a 503-million-barrel level. This last purchase is made possible because oil prices have been lower than DOE estimated.

Of the 501.8 million barrels of oil in storage, 38 percent is sweet (low sulfur) crude, 50 percent is sour (high sulfur) crude, and about 12 percent is a combination of lower quality crude oils. (See table II.1 for SPR oil quality specifications.) The sweet/sour crude oil mix will not change if the SPR oil inventory is capped at about the 503-million-barrel level, which DOE plans to achieve in late July 1986.

Status of SPR Oil Acquisition and Transportation Account

According to DOE, its oil acquisition and transportation account provides funds for (1) SPR oil procurements, (2) associated transportation costs, such as pipeline, tanker, and marine terminal activities, (3) operation and maintenance of the SPR terminal at St. James, (4) U.S. Customs duties, and (5) miscellaneous costs, such as administrative costs, associated with acquiring and transporting the oil. A DOE official told us that in the event of an SPR oil drawdown, this account also would fund the federal cost of withdrawing the oil from the storage caverns and transporting it to the point where private purchasers would take title. Receipts from the sale of oil also go into this account.

During the quarter, DOE made payments of \$63 million for oil acquisition and transportation. Program Office personnel stated that as of June 30, 1986, DOE had unpaid obligations of about \$63 million and unobligated funds of about \$590 million. About \$578 million of the unobligated funds account were in a deferred status until the President signed the 1986 Urgent Supplemental Appropriations Act.

SPR Site Development and Enhancement Activities

Overall, as a result of DOE's earlier moratorium and the deferral of funds, SPR development activity has been delayed, in some cases as much as 6 months. In view of the 1986 Urgent Supplemental Appropriations Act provisions, which overturned all SPR deferrals by the administration, DOE plans to resume leaching activities at the West Hackberry and Bryan Mound sites, including additional surface development activities. At the end of fiscal year 1988, DOE anticipates that it will have developed storage capacity to the 600-million-barrel level. The completion of surface construction activities by that time will allow DOE to continue SPR development to its full 750-million-barrel storage capacity. The following sections discuss activities that have taken place during the quarter at the various sites and the SPR enhancements program.

West Hackberry

The West Hackberry site received 4.6 million barrels of crude oil this quarter, almost all of the oil that was added to the SPR. The oil was injected into storage capacity developed prior to the leaching moratorium directed by the Program Office, effective January 1, 1986. As of June 30, 1986, 15 of the 16 Phase II caverns contained oil with one cavern in the leaching-only stage. Six are full, containing a total of 60 million barrels; 5 are in the final-fill stage, containing a total of 42.4 million barrels, with an additional capacity of about 7.6 million barrels; and 4 are in standby status, containing about 11.8 million barrels. The one Phase III cavern at the site is also in a standby status.

In our January 1986 and April 1986 reports,⁶ we discussed the Phase II cavern that is in the leaching-only stage. This cavern has been subject to testing and evaluation because of a leaching problem and a concern over cavern leaks. The data from the last test to detect cavern roof leaks that continued through May 1986 is being analyzed. However, a Boeing cavern engineer stated that preliminary tests detected no roof leaks.

⁶Status of Strategic Petroleum Reserve Activities as of December 31, 1985 (GAO/RCED-86-84, Jan. 29, 1986); Status of Strategic Petroleum Reserve Activities as of March 31, 1986 (GAO/RCED-86-151, Apr. 18, 1986)

This engineer said that plans are to leave the nitrogen in the cavern until the data analyses are completed, then to bleed off the nitrogen and recover the oil (less than 10,000 barrels) that was injected during the leaching, but was trapped in the cavern's roof until it was displaced by the nitrogen. This process is expected to be completed in August 1986. The Boeing engineer also stated that the cavern's well requires changes to the piping to permit leaching once cavern development is resumed. In the interim, the cavern could be used, if needed, to temporarily store up to about 3.5 million barrels of oil, although technical factors and costs may limit such use ⁷

Our April 1986 report discussed a corrosion problem in the crude oil pipeline between West Hackberry and the Sun Oil Company marine terminal in Nederland, Texas. Repairs were made to a 6-foot corroded section of this 42-inch pipeline. A Boeing engineer told us that the subcontractor, C.E. Vetco, ran an instrumented pig (an electronic measuring tool) through the pipeline from the Sun Oil terminal to West Hackberry during the period May 20 to May 23, 1986. The full report from C.E. Vetco on the results is expected in July 1986. The Boeing engineer told us preliminary information indicates that the pipeline has no other significant corrosion problems

The instrumentation and control (I&C) work that started in July 1985 to convert the West Hackberry raw water intake structure (RWIS) from a manned (manual) operation to an unmanned (automatic mode) operation continued during this quarter. The firm-fixed price contract with Coggins Systems, Ltd., for this work was extended from April 12 to June 6, 1986, because additional software to be used in an electrical energy management control system was needed. However, the contract has not been closed, pending (1) resolution of punch-list items (incomplete work noted by DOE in its walk-through inspections of the construction work) compiled during a 7-day performance acceptance test of the RWIS, March 24 to April 1, 1986, which was not successful and (2) final acceptance evaluation by the DOE Readiness Review Board. The West Hackberry DOE site manager stated that the Readiness Review Board began its evaluation in late June 1986 to determine whether the contractor's work can be accepted and the RWIS turned over to DOE. This evaluation will include assessing the original contract scope, contract modifications, inspection

⁷On July 7, 1986, a blowout occurred at the cavern. Preliminary estimates indicate about half of the oil was blown out of the cavern with the nitrogen gas and brine. Oil recovery and cleanup efforts are underway and the cause of the blowout is under investigation by DOE.

documents, punch-list items, and any other documents needed to evaluate the contractor's compliance and performance. The site manager said that there are no plans for a second contractor-run performance test, but DOE will request Boeing to run a full operational test for final system testing and operational readiness review of the RWIS to be completed by July 31, 1986.

In our January 1985 and April 1986 reports, we discussed the West Hackberry brine disposal line rupture that shut down the site's leaching activities on December 8, 1985, and Boeing's study of West Hackberry repair options, including the condition of other brine disposal lines. Boeing issued a report entitled West Hackberry Brine Line Failure Analysis, dated May 5, 1986. According to this report, a 10-foot long section of the West Hackberry brine line at a point 9 miles from the site contained severe channeling (corrosion) along the bottom of the pipe where the failure occurred. The pipe wall loss was gauged at about 80 percent and significant pipe wall loss overall was identified for about 400 feet on either side of the rupture. The study attributed this corrosion principally to dissolved oxygen in the brine, which formed a highly corrosive electrolyte. The West Hackberry Boeing site manager said that temporary repairs to replace the section that failed were completed on June 6, 1986, and hydrostatic and flow tests were conducted to check for leaks. The brine disposal line began functioning again on June 19, 1986, with an interim capacity of 420,000 barrels per day. A larger project is underway to replace up to 2,700 feet of the brine line. A firm-fixed price contract to replace about 1,700 feet of the brine line was awarded on May 20, 1986, to Woodson Construction Company for about \$1.5 million. The scheduled completion date for this part of the contract is August 13, 1986. When the pipe replacement work is completed, the brine disposal capacity of the repaired pipeline is estimated at 500,000 barrels per day. If technically feasible, an instrumented pig may be used to verify the overall condition of the pipeline. Subsequently, the pipeline's capacity may be increased beyond 500,000 barrels per day.

A site drawdown exercise has been scheduled at West Hackberry for July 15 and 16, 1986. A DOE management official stated that the goal is to move 1.2 million barrels of oil to the Sun Oil Company marine terminal in a 16-hour period, and to test the RWIS by achieving a 1.45-million-barrel raw water daily flow rate.

Bryan Mound

The Bryan Mound site received only one shipment of crude oil this quarter because of a continuing project that began in March 1986 to

change the configuration of a Bryan Mound Phase I cavern to improve the site's drawdown capability.

Bryan Mound cavern 5 consists of two vertically aligned cavities or sections, separated by a web of salt, but connected by a narrow opening similar to an hourglass that restricts oil flow during drawdown. When the cavern was acquired, two wells were drilled into the lower cavity, with the piping for one well passing through the narrow opening. This was to be used to inject raw water into the cavern during drawdown, with the second well carrying the oil up to the surface. In the late 1970's, large chunks of undissolved salt and mineral impurities (anhydrites) dropped from the walls of the upper cavity. This clogged the narrow opening and pinched off the pipe string that passed through the opening. These factors combined to reduce the overall drawdown efficiency of the cavern

Our April 1986 report discussed plans for two projects to improve cavern 5 drawdown performance and the overall drawdown capability of the site. The first project was completed on May 8, 1986, and involved injecting about 3 million barrels of water, which passed through the oil in the upper cavity and the narrow opening, to leach a larger opening as the water passed through to the lower cavity. The water displaced about 3.2 million barrels of crude oil, which was transferred to Phase I cavern number 4. A Boeing engineer informed us that although sonar surveys have not been taken to gauge the increase in the size of the opening, an electronic tool used to log the location of oil and brine interface passed easily and cleanly through the opening (in the past, the logging tool would scrape and hang up on the ledge of the opening).

A second project for the cavern was approved by the SPR Program Office and started on June 6, 1986. A Boeing cavern engineer explained to us that the project proposes to leach specific areas of the lower cavity while simultaneously continuing to leach the narrow opening to join the cavern's two sections into a more unified single-cavern configuration. The engineer said that the project will require an estimated 15 months, and the 30.8 million barrels of sweet crude oil now in storage will no longer be stored in this cavern when the project is completed: 30 million barrels will be transferred, in stages, to three Phase III caverns of 10-million-barrel capacity each and the additional 800,000 barrels will be transferred to cavern number 4. The oil transfers will occur as leaching progresses on the Phase III caverns and on the Phase I cavern 5. When the project is completed, cavern 5 will be designated for sour oil storage. The overall project objective is to achieve a sweet crude oil drawdown

capability at the site of 1.1 million barrels daily, which is not possible now because of the cavern 5 configuration.

A DOE official also told us that a drawdown exercise is planned for Bryan Mound for August 26 and 27, 1986. This official said that the drawdown goal is to move crude oil for 12 hours at a daily rate of 1.1 million barrels and for 2 hours at a daily rate of 1.3 million barrels. About two-thirds of the drawdown quantity will be sour crude oil and will be transferred to a nearby tank farm (Jones Creek), and one-third will be sweet crude oil transferred in a loop through a pipeline from the site to the nearby Phillips marine terminal and returned

Boeing's May 5, 1986, report included an evaluation of the Bryan Mound brine disposal line. According to this report, the brine disposal line contained no observed channeling and is within safe operating parameters. The report noted that in the past, the Bryan Mound on-site brine line had experienced channeling, which had been repaired.

Bayou Choctaw

In our April 1986 report, we discussed the fact that DOE had awarded a firm-fixed price contract on December 18, 1985, to Dilco, Inc., for about \$4.3 million to drill a second well and complete the surface piping construction for the Phase II cavern. On March 31, 1986, DOE gave the contractor notice to proceed with this work, which is to be completed in about 425 days and is now underway.

Also in our April 1986 report, we discussed the suspended development of the Phase III cavern 101 because of DOE's proposed moratorium. Following our opinion that construction funds for this project could not be redeferred under the Impoundment Control Act of 1974, and the subsequent release of the funds, DOE initiated contracting action for this Phase III project. DOE released the invitation for bid (IFB) on June 16, 1986, for construction of surface piping at the cavern and tie-in of the cavern to the oil, water, and brine pipelines. A pre-bid conference was held in New Orleans on June 30, 1986, for prospective bidders. Bids are due on July 16, 1986, and the work is estimated to be completed in August 1987.

The Boeing brine line failure analysis report included an evaluation of the condition of Bayou Choctaw's brine disposal line. The report stated that the oxygen content in the brine line was high, causing general channeling and pitting of the pipeline similar to that found in the West Hackberry pipeline.

A Boeing contracting official stated that two areas of the brine disposal pipeline are candidates for repair work. One area is located at a point where the brine pipeline goes underground to leave the site. About 10 feet of a 26-inch pipe at this point may need replacing, and if so, an IFB for this work is expected within 60 days of the decision to do the work. The other section of pipeline that may need repair is located in an underground stretch of 24-inch pipe leading to the disposal wells. Boeing has not determined the extent of the problem, but repairs at this point could involve from 10 to 50 feet of pipeline. The extent of the problem is expected to be defined in the next quarter.

Boeing conducted an oil drawdown exercise at the Bayou Choctaw site over about a 46-hour period from May 6 to May 8, 1986, and declared it an "unequivocal success." During the exercise, Boeing transferred about 920,000 barrels of oil from the site to the St. James terminal at an average oil flow rate of about 477,500 barrels per day. The exercise was designed to reach a predicted flow of oil to the terminal of 474,000 barrels per day. The exercise began on May 6, 1986, at 10:00 a.m. and, by 11:30 a.m., had achieved an oil flow rate of 449,000 barrels per day. From 2:15 p.m., a 459,000-barrel-per-day flow rate was maintained for 6 hours, and, by 12:00 p.m., the flow rate was maintained at about 474,000 barrels per day for 32 hours. The exercise operated and tested pumps in various parallel configurations.

During the drawdown, two brine water injection pumps failed to start automatically because of a problem in the control room instrumentation circuit board. The problem was evaluated during the exercise and the two pumps were started manually. A third pump shut down because of a temporary power brown-out and also was manually re-started. At the St. James terminal a meter prover, which checks meter calibrations, failed but had no effect on the exercise. Overall, however, Boeing determined that the objectives of the exercise were substantially met.

Weeks Island

The Weeks Island site conducted an oil drawdown exercise over a 41-hour period from April 22 to April 24, 1986. About 1.1 million barrels of crude oil were transferred to the St. James terminal up to a peak transfer rate of 690,000 barrels per day. Prior to the test, computerized modeling projections established the 690,000-barrels-per-day rate as the maximum transfer rate, about 100,000 barrels per day above the 590,000 barrels-per-day design capacity for the site. Boeing declared the exercise an "unequivocal success," and stated that the exercise met all objectives.

During the drawdown, both the submersible pumps in the mine and the booster pumps were operated in different sequences. A pressure switch that was relocated earlier—an action determined necessary during the coordinated test-sale exercise—operated successfully. The drawdown exercise began at about 8:00 a.m. on April 22, 1986, and, by 1:00 p.m., oil flow was at 580,000 barrels per day. The flow rate was gradually increased until it stabilized at 620,000 barrels per day for two 8-hour periods. Over the following few hours, the flow rate was gradually raised to the 690,000-barrel-per-day rate. The system was operated at that rate for an additional 16 hours. The final period of the exercise tested varying accelerated and decelerated flow rates. The test was concluded at about 6:00 a.m. on April 24, 1986.

Only minor problems occurred during the course of the exercise. In one case, a booster pump failed to start because of problems with instrumentation and settings at low pumping rates. As a result, an auxiliary pump was brought on-line. In another case, a photographer using flood lights set off a fire alarm in the pump manifold room down in the mine. Also in the manifold room, personnel thought they smelled hydrogen sulfide emanating from one of the pumps, which had been shut down as a precaution. Monitoring equipment did not confirm the hydrogen sulfide leak. At another point in the exercise, a minor oil leak occurred above ground, adjacent to automatic sampler equipment. The automatic sampler equipment may be relocated at some future time. Overall, at both Weeks Island and the St. James terminal, the exercise was completed as planned.

Sulphur Mines

DOE has not made final plans regarding future operations at the Sulphur Mines site. Studies have been conducted but no decision has been made pending resolution of policy and budget issues, primarily whether DOE should go beyond the current 503-million-barrel level of the SPR.

DOE has provided OMB with both the economic and technical considerations involved with the closing of the Sulphur Mines site. If the site is abandoned and the oil removed, 26 million barrels of current storage capacity will be lost permanently since the site has been developed with a single drawdown option. According to DOE officials, replacement storage capacity would probably be developed at Big Hill or West Hackberry.

According to DOE, closing the site has both economic and technical merit. The economic and technical advantage of closing Sulphur Mines will

remain whether the decision to close the site and develop other storage capacity is made now or as late as 1992. DOE projects over a \$10-million cost saving in the first 5 years through the consolidation of storage capacities and a \$90-million saving over a 20-year period. However, closing the site would require an initial investment of about \$5 million to decommission the site—well-plugging and surface restoration costs—and about \$8 million to leach incremental storage capacity and inject oil at the West Hackberry site.

From a technical standpoint, closing the site and transferring the oil to West Hackberry would increase the current drawdown capability from 1 million barrels to 1.4 million barrels per day. It also would increase the time for sustaining the maximum drawdown rate from 91 to 124 days.

Big Hill

Construction work at the Big Hill site under the I-A and I-B contracts has been completed. Under the I-A contract (construction of on-site buildings and other central facilities, a leaching system, piping, and instrumentation for five caverns), DOE took possession of the warehouse building on June 27, 1986. Other facilities constructed under the contract, although completed, will not be accepted by DOE until punch-list items are completed. Under the I-B contract, DOE took possession of the RWIS facility, although additional corrective actions are to be taken on certain punch-list items.

On February 18, 1986, DOE began assessing the contractor \$20,500 per day in penalties for not completing the contracts as scheduled. These penalties continue until DOE has accepted the work as substantially complete. Negotiations are underway to assess the appropriate amount of penalty costs that are due from the contractors.

On May 6, 1986, DOE and the firms of Gregory and Cook, and Reading and Bates, signed a \$34.4-million stage I-C contract for construction at the Big Hill site of a 13.2-mile brine disposal line; a 5.3-mile raw water line; and an overhead power transmission line between the RWIS and the site. These firms have entered into a joint venture agreement to proceed with these projects. The work is to be completed over a 340-day period. On May 15, 1986, they were given limited notice to proceed and initiated the purchase of the materials and supplies for the work. Full notice to proceed with construction will be given when the contractors obtain DOE approval on their plan for quality assurance and safety during the conduct of the work.

A second contract—stage I-D—was awarded on May 13, 1986, to Michael Curran and Associates, Inc., to construct a 25.2-mile crude oil pipeline from the Big Hill site to the Sun Oil terminal. Limited notice to proceed was given on May 15, 1986, enabling the contractor to start purchasing materials and supplies. The work is scheduled to be completed over a 435-day period. Full notice to proceed was given by DOE on June 20, 1986.

A third contract will also be entered into for surface construction work at nine caverns at the site, including pipeline tie-ins to all of the caverns at the site so they can be connected to the oil, brine, and water systems. An IFB was issued on June 9, 1986, with a bid-opening planned for August 8, 1986. All three of the construction contracts have resulted because of the release for obligation on April 11, 1986, of \$156.8 million of construction funds previously deferred by DOE.

SPR Oil Distribution Enhancements

In our April 1986 report, we discussed DOE's proposed enhancements to correct problems in the SPR oil distribution system caused when Texoma Pipeline Company and Seaway Pipeline, Inc., sold their interstate crude oil pipelines. DOE initially estimated that the required enhancements would cost \$97 million.

Proposed distribution enhancements for the Seaway complex consist of constructing a 40-inch, 46.2-mile pipeline from Bryan Mound to Texas City, Texas, and modifying the Phillips Petroleum Company's marine terminal at Freeport, Texas, and the Atlantic Richfield Company (ARCO) tank farm and marine terminal at Texas City. This project will increase Bryan Mound's current distribution capability from 390,000 barrels per day to 1 million barrels per day. Land acquisition for the new pipeline is continuing, with the Army Corps of Engineers performing real estate appraisals and negotiating with land owners.

According to a contract specialist, an IFB for the crude oil pipeline was issued May 1, 1986. Bids were opened on June 20, 1986. DOE awarded the contract for the pipeline construction on July 1, 1986. The contract specialist estimates that the cost will be about \$23.5 million and that construction work could start as early as August 1, 1986.

As we noted in our April report, DOE and ARCO signed a 5-year terminal enhancement and service contract for about \$12.6 million. Contract negotiations between DOE and Phillips for Seaway terminal enhancements and distribution services have not started but are planned for

July 14, 1986. At this time, DOE does not know how long these negotiations will take.

With regard to the Capline distribution system, DOE officials proposed metering and piping modifications for the St. James terminal and a direct pipeline connection between the Capline and St. James terminals. DOE estimated that these enhancements would increase the Capline complex's distribution capability to 830,000 barrels per day. According to an SPR official, conceptual design work for the enhancements has been initiated and is being discussed with Capline officials.

Contract Terminations and Anticipated Changes

Various prime contracts will expire or have options extended in the next few months: Petroleos Mexicanos (oil purchases); Aerospace Corporation (engineering support services); and Wells Fargo (site security). In addition, the initial period of a contract with Walk, Haydel, and Associates, Inc., which provides architectural and engineering services for DOE's capital improvement program, expired on May 31, 1986. However, DOE exercised the first of three 1-year options available under the contract at an estimated cost of \$7.9 million.

A second Walk, Haydel, and Associates, Inc. contract for architectural and engineering services involved with construction work for the Big Hill site expires July 31, 1986. DOE has proposed that the contractor extend the present contract through September 1986, and has proposed a second extension for the period October 1986 through June 1988. A DOE contract specialist told us that negotiations between DOE and the contractor will begin about the first week in July, with the contract modification to be awarded on July 18, 1986.

The PEMEX contract, under which DOE has been buying oil since 1981, expires on August 31, 1986. DOE is considering extending the contract beyond the expiration date or negotiating a new contract. Negotiations are also scheduled between DOE and PEMEX for July 9 to 11, 1986, on contract adjustments for demurrage and oil quantity that would apply to PEMEX shipments to the SPR since October 1, 1983. We reported on negotiated adjustments agreed to between DOE and PEMEX for shipments prior to October 1, 1983, in our October 15, 1984, report.⁸ The discussion on oil quantity adjustments will involve factors and standards developed by the American Petroleum Institute (API) based on past shipment

⁸Status of Strategic Petroleum Reserve Activities as of September 30, 1984 (GAO/RCED-85-40, Oct. 15, 1984).

experience. Demurrage adjustment factors to be discussed will be similar to factors involved in earlier discussions, but with an additional discussion of provisions for vessel layover time.

The first-year option period of the contract with Aerospace, which provides independent engineering analysis support services to DOE's program and project offices, expires on October 19, 1986. In a letter of intent dated June 2, 1986, DOE advised Aerospace that it wants to exercise the contract's final 1-year option. Under the option, Aerospace would continue to provide support services to the Program Office, but services to the Project Office would be on an as-needed basis only. Aerospace would no longer maintain a local SPR presence as it has in the past and Boeing would perform the routine engineering work that Aerospace had been providing. DOE will request a proposal from Aerospace in July 1986.

The contract with Wells Fargo, which provides security services for the SPR, expires September 30, 1986. Boeing is assuming protection services responsibility and will be subcontracting these services in the future.

A Boeing contracts official told us that it issued a request for proposals on March 14, 1986, for SPR protection services. Boeing conducted site tours for interested parties March 30 through April 4, 1986. The cut-off date for proposals was May 2, 1986. Boeing has since narrowed the list from eight to four companies. Discussions were held between Boeing and the four companies June 3-6, 1986. Boeing provided each company with questions, which were to be answered and submitted with final proposals by June 19, 1986. Boeing contract officials are evaluating the proposals and plan to select a subcontractor by mid-July. Boeing contract officials and DOE are evaluating the proposals and plan to make the selection of the contractor and complete negotiations for the subcontract by August 1986. The protection services contract will be a cost-plus-award-fee type, with a base term of 3 years, and two 1-year options. The phase-in period will be the month of September 1986, and the effective date of the contract is October 1, 1986.

Payment of Boeing's First Award Fee for SPR Operations

Boeing, the prime contractor for the management, operation, and maintenance of the SPR, was awarded \$1.4 million for the first award fee period, October 1, 1985, through March 31, 1986. This fee amounts to 55 percent of the \$2.6-million maximum award fee pool available and represents, in DOE's judgement, an overall satisfactory performance rating, which means DOE rated Boeing better than satisfactory in some activities

and less than satisfactory in others. Boeing previously received a fixed-fee of about \$1.3 million for the first 6 months of the contract, April 1, 1985, through September 30, 1985.

The award fee plan identified, for assessment of performance, 12 objectives and 46 separate performance criteria in 10 functional areas. The plan emphasized technical areas, such as operations, maintenance, engineering, construction, and quality assurance, as well as general management support areas, such as financial and property management, procurement, and security.

DOE cited significant Boeing accomplishments that included attaining leaching and fill objectives; developing and implementing a viable quality assurance program; maximizing awards to small disadvantaged businesses; initiating system analysis plans; establishing a strong internal audit program; completing efficient and effective maintenance shutdowns for the West Hackberry and Bryan Mound sites; and expediting oil deliveries for the test sale.

DOE cited the following areas as needing improved performance: more timely correction of problems affecting site operations; reducing maintenance backlog; strengthening capital improvement program management; improving coordination and communication between the New Orleans office and oil storage sites; integrating environmental, health, and safety considerations into Boeing's management system; improving subcontract administration; developing and implementing a security plan; strengthening variance analysis and cost forecasting aspects of financial management; and implementing the property management system.

SPR Oil Test Sale

On the basis of comments from purchasers and a DOE test monitoring team, the oil drawdown and test sale exercise DOE conducted between November 18, 1985, and January 31, 1986, identified prospective refinements to SPR procedures to improve overall effectiveness in responding to an energy emergency. As a result, DOE is developing an updated mailing list, and in the future, express mail—overnight delivery—will ensure that prospective purchasers of SPR oil receive requests for bids and other necessary bidding documents on a more timely and consistent basis. Forms used in the process are being simplified and instructions clarified. In addition, DOE is revising two SPR manuals dealing with

drawdown management activities to reflect the updated SPR organization and roles, as well as the role of Boeing in SPR management, operations, and maintenance. DOE will also update the SPR oil accountability manual to clarify oil delivery documentation practices during a drawdown. Additional specifications and characteristics on the eight types of SPR oil that may be sold were revised and published; criteria for government liability for demurrage were established; and a formula to calculate price adjustments on final oil deliveries was established. Also under consideration as a result of the test sale is the development of a mock drawdown and oil delivery exercise to be conducted in 1987, which would simulate the SPR system under emergency conditions at maximum drawdown rates.

GAO Report on SPR Oil Purchases

In our May 22, 1986, report, we informed the Secretary of Energy that we did not agree with DOE's announced plans to stop filling the SPR in July 1986. DOE proposed suspending oil purchases and SPR development as a budget-cutting measure and because DOE believed it would have stored, at that time, sufficient oil to meet a 90-day contingency supply commitment in the event of a supply disruption.

We stated that suspending oil purchases at that time did not appear prudent under the present circumstances of (1) low oil prices, which will not hold indefinitely, (2) nearly \$580 million of unobligated funds in the oil account, and (3) storage capacity that is or can be made available. Based on this assessment, we also stated that (1) filling the SPR should continue at maximum rates to attain the statutory requirement for a 527-million-barrel inventory level and (2) because of the relatively small cost of leaching and injecting oil into the storage caverns, and the prospect of rapidly increasing import levels, DOE should resume SPR storage capacity development beyond the 527-million-barrel level.

Our report noted that by using currently available appropriated funds and some temporary storage, DOE could have about 73 million barrels of additional storage space available in fiscal year 1987, thus providing the SPR with a total storage capacity of 600 million barrels.⁹ We pointed out that DOE's actions, which slowed efforts to develop and fill the SPR, were being taken despite continued congressional support for a 750-million-barrel SPR.

⁹DOE told us that because of events that took place after our May report was issued, about 14 of the 73 million barrels of space may not be available until fiscal year 1988

We recommended that the Secretary of Energy direct the SPR project manager to

- Continue oil purchases at maximum fill rates beyond the July 1986 cut-off date and attain the 527-million-barrel inventory level.
- Resume cavern leaching activities as soon as possible, to achieve 600 million barrels of capacity by the end of fiscal year 1987.
- Continue filling the SPR beyond the 527-million-barrel level at rates commensurate with oil prices, import levels, and availability of funding and storage capacity.

We further recommended that, in order to take these actions, the Secretary should request approval from OMB to release the amount of previously deferred funds needed.

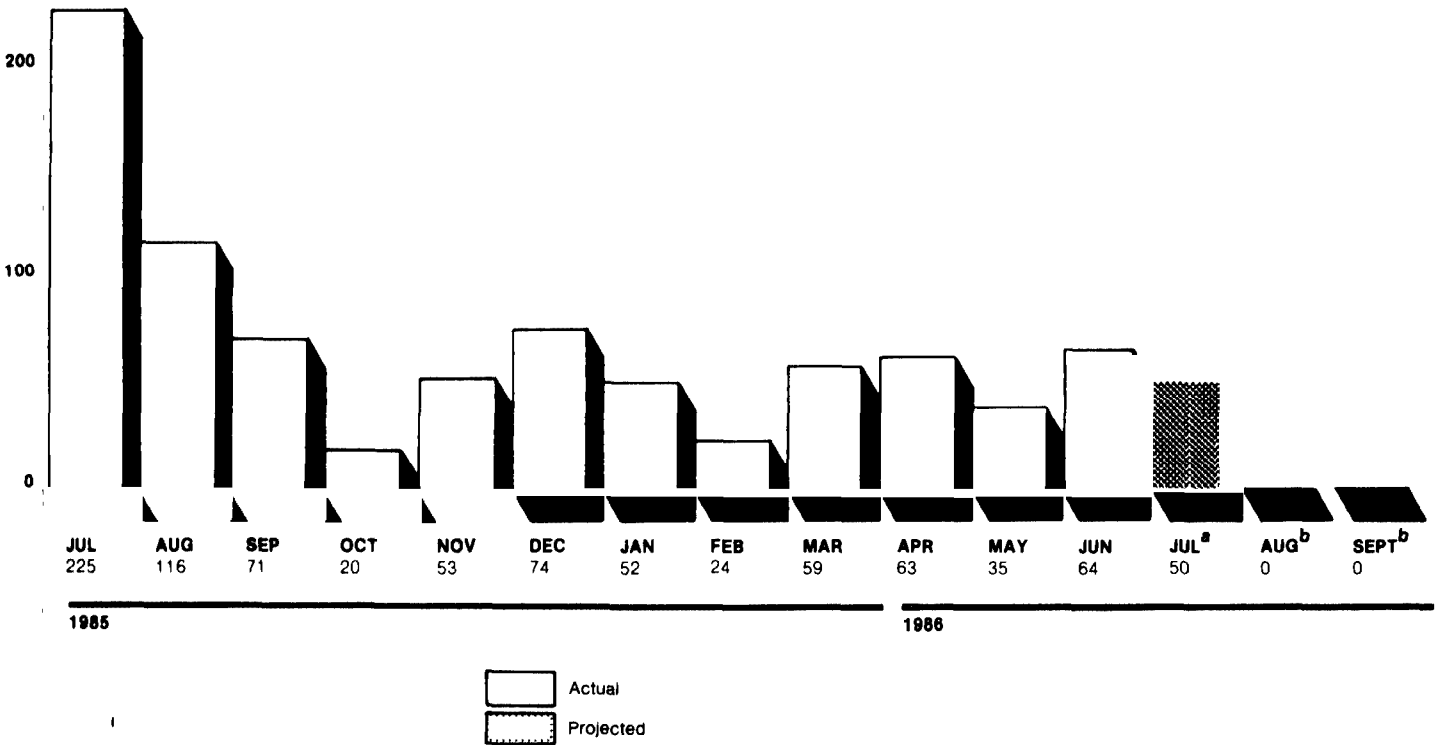
The Chairmen of the House Committee on Government Operations and the Subcommittee on Environment, Energy, and Natural Resources, Committee on Government Operations, endorsed the GAO report, while urging the Secretary of Energy to continue filling the SPR. They stated that our recommendations were in line with recent proposals by the House Budget Committee to increase funding for oil purchases for the SPR in fiscal year 1987 and to maintain a significant level of fill for the SPR during fiscal years 1988 and 1989.

According to the 1987 budget justifications, any suspension of development and fill of the SPR because of a moratorium would be periodically reevaluated in light of changes in world oil markets and the federal government's fiscal situation. In that regard, the Secretary of Energy has suggested the administration continue filling the SPR at a rate to ensure a 750-million-barrel SPR. The issue was presented in early June 1986 to the President's Domestic Policy Council for consideration, along with various oil fill alternatives. The Council is expected to recommend a course of action to the President in the near future.

Figure and Tables on the Status of the Strategic Petroleum Reserve

Figure II.1: Average Daily SPR Oil Receiving Rate

300 Volume (barrels per day) in thousands



^aDaily receiving rate for July, August, and September 1986 based on DOE projection of future deliveries and is subject to change

^bOil purchases beyond July 31, 1986, have been suspended

**Appendix II
Figure and Tables on the Status of the
Strategic Petroleum Reserve**

Table II.1: SPR Oil Deliveries by Crude Type as of June 30, 1986

	Type I ^a	Types II-V ^b	Type VI ^c	Type VIa ^d	Maya ^e	Total
Volume delivered (millions of barrels)	250	192.2	31.4	16.6	11.6	501.8
Percentage of total oil delivered	50	38	6	3	2	99 ^f

^aHigh-sulfur crude (from 0.5 to 1.99 percent sulfur content) with an API gravity range of 30 to 36 degrees. Type I oil includes Arabian Light and Isthmus crudes. The oil industry uses degrees of API gravity to measure an oil's specific gravity. API gravity measures the mass of a fluid relative to water and ranges from 10 degrees for very heavy crude to 45 degrees for very light crudes.

^bHigh-quality crudes with a low sulfur content (maximum 0.5 percent sulfur content) and an API gravity range of 30 to 45 degrees. These types include some North Sea and West African crudes.

^cType VI was established for Alaskan North Slope crude, an intermediate-sulfur crude (maximum 1.25 percent sulfur content) with an API gravity range of 26 to 30 degrees.

^dType VIa was established for the Maya/Isthmus blend under the PEMEX contract. The blend is a high-sulfur mixture with an API gravity of at least 28 degrees.

^eMaya crude is a lower quality oil having a maximum sulfur content of 3.5 percent and an API gravity of at least 22 degrees. As of April 1984, Maya crude was no longer being acquired as part of the PEMEX contract.

^fPercentages do not add to 100 due to rounding.

Source: DOE.

**Appendix II
Figure and Tables on the Status of the
Strategic Petroleum Reserve**

**Table II.2: Status of the SPR Oil
Acquisition and Transportation Funds
as of June 30, 1986^a**

Dollars in Millions	
	Amount
Funds made available	
Carryover from fiscal year 1981	\$ 1,806
Fiscal year 1982 appropriations	3,687
Fiscal year 1983 appropriations	2,074
Fiscal year 1984 appropriations	650
Fiscal year 1985 appropriations	2,050
Total funds made available	\$10,267
Funds used or committed	
Fiscal year 1982 payments	3,687
Fiscal year 1983 payments	1,641
Fiscal year 1984 payments	2,328
Fiscal year 1985 payments	1,621
Estimated fiscal year 1986 payments ^b	330
Estimated DOE unpaid obligations as of June 30, 1986 ^c	60
Total funds used or committed	\$ 9,677
Estimated unobligated funds at DOE	\$ 590

^aThe Omnibus Budget Reconciliation Act of 1981 (Public Law 97-35, Aug. 13, 1981) established the SPR Petroleum Account, effective October 1981, to pay for petroleum acquisition and transportation. This is an off-budget account.

^bAmount consists of DOE's actual reported payments through May 1986 and DOE's estimated payments for June 1986. Amount through May 1986 is net of \$27.9 million of receipts from SPR test sale of about 1 million barrels of crude oil delivered in December 1985 and January 1986.

^cUnpaid obligations represent funds that have been committed to pay for fiscal year 1986 oil deliveries under the first PEMEX contract, or are obligated to Defense Fuel Supply Center for PEMEX oil transportation costs. The Supply Center estimates that of the funds obligated to it, about \$2.2 million is available as of June 30, 1986, for future costs.

Source: DOE and Defense Fuel Supply Center.

Appendix II
Figure and Tables on the Status of the
Strategic Petroleum Reserve

Table II.3: Status of SPR Underground Capacity for Crude Oil Storage as of June 30, 1986

Millions of Barrels					
Storage facilities	Gross volume planned	Gross volume completed	Permanent capacity planned ^a	Capacity available	Capacity filled
Phase I sites:					
Bayou Choctaw	48.3	48.3	46.0	46.0	45.0
Bryan Mound	74.5	74.5	66.0	66.0	64.2
Sulphur Mines	27.4	27.4	26.0	26.0	26.2
Weeks Island	73.1	73.1	73.0	73.0	72.9
West Hackberry	51.1	51.1	49.0	49.0	47.8
Total	274.4	274.4^b	260.0	260.0	256.1
Phase II sites:					
Bayou Choctaw	12.2	11.3	10.0	0	0 ^c
Bryan Mound	134.4	139.2	120.0	121.2	116.2
West Hackberry	179.2	159.6	160.0	117.0	114.2
Total	325.8	310.1	290.0	238.2	230.4
Phase III sites:					
Bayou Choctaw	11.2	0	10.0	•	•
Bryan Mound	44.8	34.8	40.0	12.0	12.1
West Hackberry	11.2	1.5	10.0	•	•
Big Hill	156.8	0	140.0	•	•
Total	224.0	36.3	200.0	12.0	12.1
Tanks and pipelines	•	•	•	•	3.2
Total for SPR	824.2	620.8	750.0	510.2	501.8

^aCapacity for oil storage is less than gross cavern capacity completed because a certain volume of unoccupied capacity must be provided for water, sediment, and anhydrites that settle out of the oil and brine.

^bDOE acquired and modified existing caverns and a mine containing this gross volume. No leaching was required.

^cA newly leached cavern with 4.5 million barrels of usable capacity has been exchanged for an existing 10-million-barrel cavern owned by Allied Chemical Corp. at the Bayou Choctaw site.
Source: DOE.

Listing of Prior GAO SPR Quarterly Reports

1. Progress in Filling the Strategic Petroleum Reserve Continues, but Capacity Concerns Remain (GAO/EMD-82-112, July 15, 1982).
2. Status of Strategic Petroleum Reserve Activities as of September 30, 1982 (GAO/RCED-83-29, Oct. 15, 1982).
3. Status of Strategic Petroleum Reserve Activities as of December 31, 1982 (GAO/RCED-83-93, Jan. 14, 1983).
4. Status of Strategic Petroleum Reserve Activities as of March 31, 1983 (GAO/RCED-83-136, Apr. 15, 1983).
5. Status of Strategic Petroleum Reserve Activities as of June 30, 1983 (GAO/RCED-83-203, July 13, 1983).
6. Status of Strategic Petroleum Reserve Activities as of September 30, 1983 (GAO/RCED-84-11, Oct. 14, 1983).
7. Status of Strategic Petroleum Reserve Activities as of December 31, 1983 (GAO/RCED-84-92, Jan. 13, 1984).
8. Status of Strategic Petroleum Reserve Activities as of March 31, 1984 (GAO/RCED-84-148, Apr. 13, 1984).
9. Status of Strategic Petroleum Reserve Activities as of June 30, 1984 (GAO/RCED-84-182, July 13, 1984).
10. Status of Strategic Petroleum Reserve Activities as of September 30, 1984 (GAO/RCED-85-40, Oct. 15, 1984).
11. Status of Strategic Petroleum Reserve Activities as of December 31, 1984 (GAO/RCED-85-58, Jan. 22, 1985).
12. Status of Strategic Petroleum Reserve Activities as of March 31, 1985 (GAO/RCED-85-111, Apr. 15, 1985).
13. Status of Strategic Petroleum Reserve Activities as of June 30, 1985 (GAO/RCED-85-149, July 15, 1985).
14. Status of Strategic Petroleum Reserve Activities as of September 30, 1985 (GAO/RCED-86-37, Oct. 15, 1985).

15. Status of Strategic Petroleum Reserve Activities as of December 31, 1985 (GAO/RCED-86-84, Jan. 29, 1986).

16. Status of Strategic Petroleum Reserve Activities as of March 31, 1986 (GAO/RCED-86-151, April 18, 1986).



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