

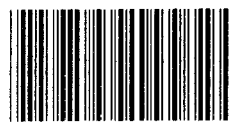
GAO

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

November 1986

OIL RESERVE

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



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Resources, Community, and
Economic Development Division

B-208196

November 17, 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, operating, and filling the Strategic Petroleum Reserve (SPR) and in complying with the requirements of applicable law. Appendix III contains a list of prior GAO SPR quarterly reports.

This report covers events and activities related to DOE's progress in developing, operating, and filling the SPR during the fourth quarter of fiscal year 1986. These events and activities are highlighted below.

- The funds apportioned in the oil account for fiscal year 1987 provide for a purchase level of 35,000 barrels of crude oil per day at an estimated cost of \$16.45 per barrel.¹
- Bids were invited for acquiring domestically produced crude oil for the SPR of up to 35,000 barrels per day for 1 year starting in fiscal year 1987. A final decision on the exact amount of domestically produced crude oil to be acquired for the SPR will be made in October.²
- Starting October 1, 1986, DOE plans to acquire 8,000 barrels of oil per day from the Naval Petroleum Reserve and transfer it by pipeline from Bakersfield, California, to the West Hackberry, Louisiana, SPR storage site. Total delivered costs are expected to be about \$16 per barrel.
- The decision whether to acquire additional crude oil from Mexico's Petroleos Mexicanos (PEMEX) beyond purchases to be made through October 31, 1986, has not been made.

¹On October 21, 1986, the President signed the Omnibus Budget Reconciliation Act of 1986 (Public Law 99-509) that requires DOE to fill the SPR for fiscal years 1987, 1988, and 1989 at the highest practicable fill rate achievable subject to the availability of appropriated funds. The act also tied the sale of Naval Petroleum Reserve oil to either having 750 million barrels of oil stored in the SPR or an average fill rate of 75,000 barrels per day. We are currently looking at the implications of various fill rates and purchase options to meet the oil fill requirement.

²On October 7, 1986, DOE awarded a contract to Transworld Oil U.S.A. for 10,000 barrels of oil per day from November 1, 1986, through October 31, 1987.

- As of September 30, 1986, the SPR inventory totaled 506.4 million barrels. During the quarter DOE added 4.6 million barrels of crude oil to the SPR. The oil fill rate during the quarter averaged about 50,000 barrels per day.
- Oil distribution enhancement and cavern improvement activities at the Bryan Mound site are continuing. On July 3, 1986, cavern leaching activities were resumed at the Bryan Mound and West Hackberry SPR sites.
- The contract for the construction of surface facilities to make the Big Hill site fully operational was awarded on August 29, 1986, at a cost of \$32 million. Leaching activities for cavern development at the site are tentatively scheduled to start in the period October to November 1987.

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

Objectives, Scope, and Methodology

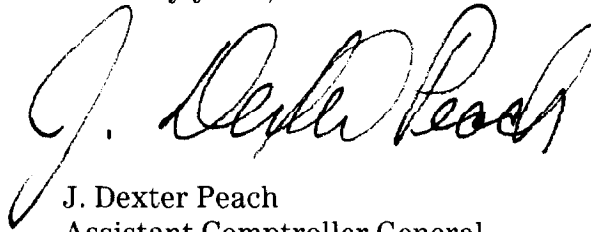
We limited our review, because of the time frame, to primarily providing statistical information and highlights of major activities that occurred during the period. To obtain this information, we reviewed DOE and contractor program documents, publications, and studies, and interviewed DOE managers and operations personnel responsible for planning and managing activities associated with developing and operating the SPR facilities.

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.

We provided DOE program officials with a draft of this report and discussed its factual accuracy with them. Their comments have been incorporated in the report where necessary. In accordance with your request, we did not obtain official agency comments.

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 others upon request.

Sincerely yours,

A handwritten signature in cursive script, reading "J. Dexter Peach". The signature is written in black ink and is positioned to the left of the typed name.

J. Dexter Peach
Assistant Comptroller General

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Abbreviations

API	American Petroleum Institute
ARCO	Atlantic Richfield Company
DOE	Department of Energy
GAO	General Accounting Office
NPR	Naval Petroleum Reserve
PEMEX	Petroleos Mexicanos
RCED	Resources, Community, and Economic Development Division
RWIS	raw water intake structure
SPR	Strategic Petroleum Reserve
WHA	Walk, Haydel, & Associates, Inc.

Status of Strategic Petroleum Reserve Activities as of September 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 if an oil supply disruption occurred. 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.

As we reported previously, Phase II leaching was stopped on December 31, 1985, in anticipation of an administration-proposed moratorium on further SPR development.¹ Also, the SPR oil fill level was to be terminated in July 1986 at the 500-million-barrel level. However, in accordance with requirements for filling the SPR in the Consolidated Omnibus Budget Reconciliation Act of 1985,² the July oil fill goal was raised to 502 million barrels. On July 3, 1986, cavern leaching activities were resumed. Completion of Phase II storage capacity development and ultimate oil fill is currently scheduled for August 1988.

Phase III, which was scheduled originally to be completed 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 at Big Hill, Texas, where site development activities were resumed in July 1986. Because of the time needed to develop capacity, activities associated with Phases II and III overlap. The administration's attempts at a moratorium on SPR development initially resulted in some slippage

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, April 7, 1986) 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.

in the planned completion schedule. The final completion date now depends on future decisions by the administration and the Congress.

The SPR storage sites are connected by pipeline to the following three marine terminal complexes 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., is responsible for overall program management and planning activities 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. Under a 5-year management, operations, and maintenance contract, Boeing Petroleum Services, Inc., provides the necessary qualified personnel and services to run the government-owned SPR facilities. DOE retains responsibility for overall project management and project technical direction, while Boeing is responsible for the SPR's day-to-day management.

This report discusses activities affecting the SPR that occurred during the quarter ending September 30, 1986, including (1) oil fill activities, (2) DOE actions underway to acquire additional crude oil for the SPR, (3) the status of the oil acquisition and transportation account, (4) storage site activities, and (5) contract changes during the period.

SPR Oil Fill Activities

DOE reported that 4.6 million barrels of crude oil were added to the SPR inventory during the quarter ending September 30, 1986, increasing it to 506.4 million barrels. All crude oil received this quarter was purchased

under DOE's 1981 contract with Petroleos Mexicanos (PEMEX), the Mexican national oil company. The contract expiration date was August 31, 1986, but deliveries were continued to September 30, 1986, by the SPR Program Office under the contract terms that 110 million barrels of oil would be supplied by PEMEX over the 5-year life of the contract. As of August 31, 1986, only about 106 million barrels had actually been purchased, and DOE and PEMEX agreed on the delivery extension.

The average fill rate for the quarter was about 50,000 barrels per day. The cumulative average fill rate for fiscal year 1986 was about 49,600 barrels per day. (See fig. II.1 and table II.1 for further information on SPR oil acquisition and fill activities.) Of the 506.4 million barrels of oil in storage, 38 percent is sweet (low sulfur) crude, 50 percent is sour (high sulfur) crude, and about 11 percent is a combination of lower quality (sulphur) crude oils. (See table II.1 for SPR oil quality specifications.)

Plans for Additional SPR Oil Purchases

During the past quarter, DOE has exhibited a great deal of uncertainty as to how it plans to provide additional oil for the SPR during fiscal year 1987. As of September 30, 1986, contracts to obtain SPR oil had only been made through October 31, 1986.

In our May 22, 1986, report to the Secretary of Energy, we informed the Secretary that we did not believe that DOE's proposed suspension of SPR oil fill in July 1986 at 502 million barrels was prudent given (1) the low oil prices, (2) \$580 million in unobligated funds, and (3) available storage capacity.³ We recommended that SPR oil fill be continued beyond July and that storage site development and leaching be resumed.

Following our report, the Secretary made several public statements that he favored continued oil fill at as much as 100,000 barrels per day and that he was seeking administration support for his position. On July 2, 1986, the President signed the 1986 Urgent Supplemental Appropriation Act (Public Law 99-349, July 2, 1986), which rejected the administration's deferral of \$41 million in construction funds and \$578 million in the oil account.⁴ Subsequently, cavern leaching activities were resumed and the Secretary said that because of lower-than-expected oil prices, DOE would use the remaining available oil money to add another 1 million barrels of oil to the SPR, for a total of 503 million barrels. This

³Low Oil Prices Favor Increased Purchases (GAO/RCED-86-158, May 22, 1986).

⁴Another \$156.8 million in construction funds that had been subject to deferral had been previously released by the Office of Management and Budget on April 11, 1986.

announcement was followed by a decision to continue buying oil under the PEMEX contract at 50,000 barrels per day through August 31, 1986.

On August 5, 1986, the President reaffirmed the administration's support for a 750-million-barrel SPR. The President announced that the administration would continue filling the reserve throughout fiscal year 1987 and gave the Secretary of Energy the discretion to exceed the current congressionally approved fill rate of 35,000 barrels per day should oil prices make such action an economically attractive choice. In a follow-up statement, the Secretary of Energy endorsed the President's actions and directed the SPR Program Office to develop options to enable the maximum purchase of oil in a fiscally responsible manner. On August 5, 1985, DOE and PEMEX officials agreed to continue oil deliveries to the SPR through September 30, 1986, at 50,000 barrels per day.

On August 27, 1986, DOE issued a preliminary notice of intent to acquire for the SPR up to 35,000 barrels per day of domestically produced crude oil for a 12-month period. Previously, invitations for bid on SPR oil were open to both domestic and foreign suppliers. The invitation for bids was issued on September 5, 1986. Bids from five potential suppliers for a total of about 10.4 million barrels (about 28,500 per day) were opened on September 19, 1986. The total amount of domestic oil to be purchased under the solicitation, and at what price, however, had not been decided as of September 30, 1986. DOE officials said that a major element in these considerations is whether domestically produced oil could be purchased for the SPR at a price competitive with imported oil.

On September 24, 1986, DOE and PEMEX officials agreed that deliveries of oil under the PEMEX contract that were to continue through September 30, 1986, would be extended through October 31, 1986, at the same 50,000-barrels-per-day rate.

On September 30, 1986, a memorandum of understanding was signed between the SPR and the Naval Petroleum Reserve (NPR) offices for acquiring NPR crude oil. Starting October 1, 1986, with the option to continue through December 31, 1986, 8,000 barrels of crude oil per day will be acquired and shipped by pipeline from the Elk Hills NPR near Bakersfield, California, to the SPR West Hackberry, Louisiana, storage site. The initial shipments are not expected to reach the SPR until sometime in December 1986. The base price to be paid for October deliveries of NPR oil will be \$13.42 per barrel, a price that DOE believes will reflect market

conditions in California where the Elk Hills NPR oil is sold in the commercial market. In addition, SPR will pay a tariff of \$2.62 per barrel for shipment of the oil. Near the end of October, the DOE Deputy Assistant Secretary for Petroleum Reserves will decide on whether additional purchases of NPR oil will be made during the month of November.⁵

On September 9, 1986, amidst the negotiations for SPR oil purchases for fiscal year 1987, the Secretary of Energy was reported as stating oil prices were too high to justify buying more oil for the SPR than the mandatory 35,000 barrels per day.⁶ The Secretary was reported as stating that prices would have to decline before additional oil would be purchased, but he did not say by how much the price would have to go down. While both PEMEX and NPR oil prices vary with market conditions, delivered prices as of September 30, 1986, were \$14.73 per barrel for PEMEX oil and \$16.04 per barrel for NPR oil.

As of September 30, 1986, according to Program Office officials, although about 900,000 barrels of oil will remain undelivered under the current PEMEX contract, no arrangements were being made for the SPR to acquire any of this oil from PEMEX after October 31, 1986, nor were arrangements being made for a new PEMEX contract in fiscal year 1987. Consequently, the domestic oil offered under the invitation for bids and the 8,000 barrels per day from the NPR represent the currently available source of SPR oil deliveries in November.

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. The Omnibus Budget Reconciliation Act of 1981 (Public Law 97-35, August 13, 1981) provides that if an SPR oil drawdown occurred, 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 would also go into this account. During the quarter, DOE made payments of \$64 million for oil acquisition and transportation. The Program Office reported that as of September 30, 1986,

⁵On October 16, 1986, the SPR Program Office decided not to buy any NPR oil in November for delivery to the SPR.

⁶At that time, DOE was paying \$14.70 per barrel for PEMEX oil delivered to the SPR.

DOE had unpaid obligations of about \$63 million and unobligated funds of about \$526 million.

Fiscal Years 1987 and 1988 Oil Account Apportionment of Funds

The DOE apportionment of unobligated funds in the oil account for fiscal years 1987 and 1988 provides about \$210 million for the purchase of 35,000 barrels of crude oil per day, or a total of 12,775,000 barrels for fiscal year 1987, at an estimated cost of \$16.45 per barrel. For fiscal year 1988, \$336.9 million in funding for crude oil purchases will remain in the account.

To meet the congressionally mandated 527-million-barrel minimum SPR oil storage level at the close of fiscal year 1988, DOE will need to buy about 7.8 million barrels of oil in fiscal year 1988. At \$16.45 per barrel, the fiscal year 1988 oil acquisition would cost about \$128.3 million, and about \$208 million would remain in the oil account at the close of the fiscal year. However, oil acquisition costs and funds remaining in the oil account at the close of each fiscal year could vary depending on oil market conditions.

SPR Site Development and Enhancement Activities

During the quarter, cleanup of the oil spill that occurred at West Hackberry when part of the wellhead on a Phase II cavern failed was completed. About 82 percent of the oil was recovered at a cost of about \$1.7 million. Phase III leaching at Bryan Mound was completed. Also at Bryan Mound, the project to improve cavern 5 drawdown capability continues. At Big Hill, the contract for surface development and improvement at the remaining nine planned caverns was signed.

West Hackberry

The West Hackberry site received 1.4 million barrels of crude oil, about 30 percent of all the oil added to the SPR during the quarter. Leaching was resumed at the site after the 1986 Urgent Supplemental Appropriation Act was passed. All caverns were removed from standby status. As of September 30, 1986, 15 of the 16 Phase II caverns contained oil: nine are full containing a total of 89.5 million barrels; two are in the final-fill stage, containing a total of 16.2 million barrels with an additional capacity of about 4.6 million barrels; four that contained 11.0 million barrels are in leaching status; and one cavern which was in a test status is now being prepared for leaching.

In our July 1986 report, we stated that a site drawdown was scheduled at West Hackberry for July 15 and 16, 1986.⁷ A DOE industrial specialist, responsible for drawdown plans, told us that drawdown was canceled because of the on-site cavern wellhead failure, and because of crude oil pipeline corrosion disclosed by an instrumented pig run (an electronic measuring tool) pipe inspection. According to the industrial specialist, a drawdown for West Hackberry has not been rescheduled.

In three previous reports, we discussed leak tests for a Phase II cavern in the leaching-only stage that was scheduled to be completed in August 1986.⁸ In our July 1986 report, we stated that on July 7, 1986, a blow out occurred at this cavern. The Oak Ridge Operations Office appointed an accident investigation board to investigate the circumstances surrounding the West Hackberry cavern failure.

On August 18, 1986, the board issued a report entitled Report of the Investigation of the Wellhead Failure and Oil Spill at the West Hackberry, Cameron Parish, Louisiana, Strategic Petroleum Reserve on July 7, 1986. According to the report, the probable cause of the incident was the failure of two 3/4-inch diameter socket head cap screws used to secure the packing retainer on a suspended tubing hanger. The component failure occurred on July 7, 1986, at 5:43 a.m. and allowed the uncontrolled escape of nitrogen gas employed as a test medium.

The ejection of gas brought-up about 7,500 barrels of crude oil and about 1,000 to 2,000 barrels of brine from the cavern in a spray plume that at one point reached an estimated 200 feet. The flow of nitrogen, oil, and brine continued for about 11 hours. A steady wind carried about half of the oil outside the wellpad containment dike, with some of the oil mist dispersed up to one-half mile from the wellpad, extending into marshlands in the area and into Black Lake, a brackish lake adjacent to the site. Cleanup operations began the same day and lasted for about 30 days, with about 82 percent of the oil recovered. Costs associated with the incident totaled about \$1.7 million.

⁷Status of Strategic Petroleum Reserve Activities as of June 30, 1986 (GAO/RCED-86-205, July 25, 1986).

⁸Status of Strategic Petroleum Reserve Activities as of December 31, 1986 (GAO/RCED-86-84, January 29, 1986); Status of Strategic Petroleum Reserve Activities as of March 31, 1986 (GAO/RCED-86-151, April 18, 1986); and (GAO/RCED-86-205, July 25, 1986).

Our July 1986 report also discussed an inspection of the crude oil pipeline—instrumented pig run—from the Sun Oil terminal to West Hackberry. A DOE industrial specialist and a Boeing engineer told us that the results disclosed five corrosion points in the West Hackberry line near the junction of the West Hackberry and Sulphur Mines crude oil lines. The results also indicated that 50 percent or more of the pipewall may have corroded at the five locations. Before repairs were completed, the oil pipeline, which would normally be rated at a maximum flow rate of 1.4 million barrels of crude oil per day at 600 pounds pressure, was derated to 970,000 barrels per day at 400 pounds pressure.

A Boeing engineer informed us that a contract was awarded, using emergency procurement procedures, on August 15, 1986, to WHC, Inc., for a fixed price of \$123,000 for investigation and repair work at the five locations. WHC, Inc., has excavated the pipeline and found that there had been external pipe coating failure at each of the five locations, the most severe involving a pipewall corrosion loss of .150 inch or about 34 percent of the original .438 inch wall thickness. The other corrosion losses were .120 inch (27 percent); .09 inch (21 percent); .06 inch (14 percent); and .05 inch (11 percent). The contractor welded metal sleeves on four of the five location points and a hot patch (called buffering) was applied to the other location. WHC, Inc., completed the work on September 15, 1986. A final report on the condition of the pipeline by C.E. Vetco—the company that originally investigated the extent of the corrosion—will be issued in late October or early November 1986. The pipeline has been returned to full operating capability.

Our last three reports discussed the West Hackberry brine disposal line rupture that occurred December 8, 1985, and shut down the site's leaching activities. The failure analysis report was issued May 5, 1986. Temporary repairs were completed on June 6, 1986, and work under the contract for permanent repair of the brine disposal line is underway.

A DOE quality assurance specialist and a Boeing contract specialist acknowledged that the contractor experienced problems that delayed the previously estimated August 1986 completion date. Shortly after the contractor placed his equipment at the work site a fire destroyed the planking, drilling rig, and trucks, which had to be replaced. The replacement pipeline, which was installed as a single unit through an underground directionally-drilled hole, initially became stuck in the hole at about the 1,100 foot point. Several joints of pipe had to be cut before the pipeline could be removed. A Boeing contract specialist told us that a

second hole was drilled on September 28, 1986, and the pipe successfully pulled through that day. The newly installed pipeline section will be tied into the original brine disposal line with a completion date now estimated at about mid-November 1986.

Our July 1986 report discussed the continuing work to convert the West Hackberry raw water intake structure (RWIS) from a manned (manual) to an unmanned (automatic mode) operation, and the establishment of a DOE readiness review board to evaluate the contractor's work. A DOE member of the review board told us that the board has met on two occasions but has not completed its evaluation of contractor compliance and performance because various documentation, such as approved and certified drawings and files related to construction and installation, are not available. Also, the RWIS program software when used on line appears to result in malfunctions and interfere with the entire instrumentation and control system. The DOE architect and engineering contractor, Walk, Haydel, & Associates, Inc. (WHA) is helping to complete the needed documentation, and the contractor and Boeing are working to resolve the software problem. Until the software problem is resolved, no full-scale test of the instrumentation and control system, to include the RWIS, can be done.

The West Hackberry site is scheduled for an annual maintenance shutdown in late October and early November 1986. These dates coincide with the tie-in date for completing the new section of brine disposal line. Preventive maintenance procedures are scheduled to be completed on site electrical systems, valves, pumps, motors, and on brine pond maintenance and cleaning.

Bryan Mound

The Bryan Mound site received 3.2 million barrels of crude oil during the quarter, about 70 percent of all oil added to the SPR during the quarter. Leaching resumed at the site on July 3, 1986, after the administration's SPR funding deferrals were overturned.

The DOE leach-fill manager told us that the cavern leaching program to achieve the planned 226 million barrel capacity at Bryan Mound was completed in August 1986. The project to improve cavern 5, and change the crude oil storage configuration to improve the site's drawdown capability, continues. Our July 1986 report discussed the Phase I cavern project that began June 6, 1986. Cavern 5 consists of two vertically aligned cavities or sections, separated by a web of salt, connected by a narrow opening similar to an hourglass that restricts oil flow during drawdown.

The project proposes to leach a specific area of the lower cavity (which now contains about 20 million barrels of sweet crude oil) while simultaneously continuing to leach the narrow opening to join the cavern's two sections into a more unified single-cavern configuration.

The Phase III caverns, which are an integral part of this project, will receive the sweet crude oil from cavern 5 in stages as the leaching progresses. Initially, the Phase III caverns were to contain sour crude oil but now with Phase III leaching complete, the sour crude oil in these caverns (8.4 million barrels) is being transferred to various Phase II caverns. The Phase III caverns will remain depositories for sweet crude oil following the conversion, and cavern 5 will be designated for sour crude oil storage when the project is completed. The crude oil transfer from cavern 5 to the Phase III caverns will begin next quarter. The overall project objective is to achieve a sweet crude oil drawdown capability at the site of 1.1 million barrels per day, which is not possible now because of the cavern 5 configuration.

Our July 1986 report discussed plans for a drawdown exercise at Bryan Mound in August 1986. A DOE industrial specialist told us that the drawdown was canceled because privately owned tanks at the nearby Jones Creek Tank Farm that DOE planned to use in the drawdown were filled by the owner with low price oil, leaving no space available for the drawdown exercise. The DOE industrial specialist told us that the drawdown exercise has not been rescheduled.

A DOE program analyst stated that the site's annual maintenance shutdown is scheduled for March 1987, which is more than 16 months following the last completed maintenance on November 9, 1985. The site's maintenance shutdown period was rescheduled for March 1987, so that it did not overlap the West Hackberry shutdown period. DOE also wanted to avoid site shutdown during the unpredictable winter weather months.

Weeks Island

Our July 1986 report discussed the Weeks Island site drawdown exercise held from April 22 to April 24, 1986. Boeing Petroleum Services, Inc., distributed its drawdown exercise report entitled Weeks Island FY 86 Drawdown Exercise Report on July 8, 1986. The report noted that a maximum drawdown rate of 693,000 barrels per day was achieved and that a total quantity of 1.1 million barrels of crude oil was drawn down and transferred from Weeks Island to the six storage tanks at the St. James Terminal.

The drawdown exercise demonstrated for the first time the capability of the power distribution system and electrical equipment to simultaneously operate the three main line pumps in the three possible pair combinations. Prior to the drawdown, two of the pumps had not been operated together because of concern for electrical overload. This had been resolved by changing the electrical configuration.

Also, in the past, start-up of a second mainline pump occasionally caused the first pump to shut down prior to completing the start sequence due to high discharge pressure. The problem was resolved by relocating a pressure sensor, and success was demonstrated during the drawdown exercise. The report stated that the drawdown exercise was an unqualified success.

Bayou Choctaw

Our July 1986 report discussed the Bayou Choctaw site drawdown exercise held from May 6 to May 8, 1986, the flow rates achieved, and various problems that occurred. Boeing Petroleum Services, Inc., issued a report on the drawdown entitled Bayou Choctaw - St. James FY 86 Drawdown Exercise Report on July 31, 1986. The report noted that a maximum drawdown rate of about 485,000 barrels per day was achieved and that a total of 909,500 barrels of crude oil was drawn down and transferred from Bayou Choctaw to five St. James terminal tanks. When the last two caverns are completed, the site's operational drawdown capability will be 480,000 barrels daily. The drawdown director-site manager's published comments concluded that the exercise was successful but not totally without problems. (See our July 1986 quarterly report, page 15 for discussion of the problems that occurred.) The most important problem noted was that the control room operator could not monitor and control the whole operation from the control room. The director-manager said this would be a major problem in the event of an extended drawdown.

According to a DOE contract specialist, a two-step procurement is in progress which would integrate instrumentation and control at the Bayou Choctaw control room. Unpriced proposals were solicited on August 25, 1986, and were due on October 24, 1986. DOE said that bids will be requested following an evaluation of the proposals.

Our July 1986 report discussed Phase III work at the Bayou Choctaw cavern 101 to construct surface piping at the cavern and to tie the cavern to the existing oil, water, and brine pipelines. The contract for the work was awarded on August 5, 1986, to Plaquemine Contracting

Co., for a fixed price of \$2,290,435. Notice to proceed was granted August 15, 1986. The contract is scheduled to be completed by May 17, 1987.

Our July 1986 report also discussed potential brine disposal line replacement work at Bayou Choctaw. According to a Boeing contract official, an invitation for bids was issued September 12, 1986, to replace about a 30-foot section of the brine disposal line at the site. Bids were expected by October 15, 1986.

Big Hill

At the Big Hill site, facility development activities continued during the quarter. The settlement of open punch-list items on the I-A and I-B construction contracts is underway, and construction work on the oil pipeline has been significantly accelerated. A contract for additional surface construction work at the caverns was also signed during the quarter.

On February 18, 1986, DOE began assessing the contractor \$20,500 per day in penalties for delays in completing the I-A and I-B contracts as scheduled. These penalties continue to accrue until DOE has accepted all work as substantially complete. As of September 18, 1986, 14 punch-list items remained open for substantial completion on the I-A contract, and two punch-list items remained open for substantial completion on the I-B contract. Various other punch-list items considered less significant also remained open. At a meeting with the contractor, Fruin-Colnon, held on September 23, 1986, all open punch-list items on the two contracts were reviewed in detail. The contractor agreed to offer a financial settlement on the two contracts for liquidated damages and to prescribe any additional corrective actions needed at a meeting scheduled for early November.

On May 6, 1986, DOE and the firms of Gregory & Cook and Reading & Bates signed a \$34.4-million stage I-C contract for constructing a 13.2-mile brine disposal line; a 5.3-mile raw water line; and an overhead power transmission line between the raw water intake structure and the Big Hill 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 from date of award. As of September 27, 1986, DOE estimated overall contract completion at over 35 percent.

The \$20,975,000 contract entered into on May 13, 1986, with Michael Curran Associates for the construction of a 24.2-mile crude oil pipeline from the Sunoco terminal in Nederland, Texas, to the Big Hill site, is

estimated by DOE to be 66 percent complete as of September 27, 1986. About 64 percent of the pipe has been laid out along the route with about 40 percent of the welding completed. A DOE contract specialist at the site told us that the contract is expected to be fully completed by December 1986.

On August 29, 1986, a third contract was entered into for surface construction work at nine caverns at the site, including pipeline tie-ins to enable the caverns at the site to be connected to the oil, brine, and water systems. The contract was awarded to Ebasco Services, Inc. Notice to proceed was provided on September 11, 1986, for completion within 545 days. The contract award was for \$32 million.

SPR Oil Distribution Enhancements

In our July 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 to achieve an intermediate 4.0 million-barrels-per-day distribution capability would cost \$97 million.

The 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 1.1 million barrels per day.

According to DOE contract personnel, the contract for the crude oil pipeline was awarded on July 1, 1986, to Kiewit/Tulsa-Houston, a joint venture. The contract includes two major line items. The first line item covers the structure used in placing the instrumented pig in the pipeline and constructing of 33 of the 46 miles of pipeline at a cost of \$17.5 million. The second item covered the remaining 13 miles of the pipeline at a cost of \$6 million. Separate acquisition items were stipulated because at the time of the award, rights-of-way acquisitions were in hand for only 33 miles, and were still pending for the remaining 13 miles. The contractor has been granted notice to proceed for all contracted work with the latest notice to proceed for work on the 13-mile pipeline granted on September 25, 1986. The contract calls for the Bryan Mound on-site work to be completed by December 1, 1986, and the remaining work on the crude oil pipeline to be completed by December 15, 1986. A contract

was also awarded on July 11, 1986, to L.S. Womack, Inc., for \$250,000 to tie in the crude oil pipeline to the on-site pipeline system at Bryan Mound.

Contract negotiations between DOE and Phillips for Seaway terminal enhancements and distribution services have continued through the quarter. Basic agreements have been reached, and contract signing is expected in the next quarter. The current contract with Phillips expires December 31, 1986. According to a DOE contract specialist, final agreements reached with Phillips provide for keeping the terminal on stand-by from January 1987 through September 1991, and for a fixed price of \$825,000 for Phillips to modify the meters at the terminal site to measure the quantity of SPR oil shipped by way of the Phillips docks. The meter modification work is scheduled to take 9 months. Stand-by charges of \$63,000 monthly will be credited against through-put charges for SPR shipments going through the Phillips docks to and from Bryan Mound. The total cost of the contract is estimated at \$4.4 million. The contract will have a 5-year base period with three 5-year options.

With regard to the Capline distribution system, DOE officials have proposed metering and pipeline 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, design work for the enhancements has been initiated and is scheduled to be completed by WHA in February 1987. DOE plans to award the contract for long lead-time equipment in April 1987, with delivery expected in October 1987. Construction is planned to begin in July 1987 and be completed about December 1987. Detailed cost estimates are being prepared.

Our July 1986 report discussed changes in process for various contracts including PEMEX (oil purchases); Aerospace Corporation (engineering support services); Walk, Haydel, & Associates, Inc., (architectural and engineering support services); and Wells Fargo (protection services).

As was discussed earlier, the PEMEX contract under which DOE has been buying oil since 1981, expired August 31, 1986, and the Program Office extended the contract initially to September 30, 1986, and then to October 31, 1986, for crude oil purchases at a rate of 50,000 barrels per day. As of September 30, 1986, DOE had not announced any decisions regarding further purchases of PEMEX crude oil for the SPR.

A DOE contract specialist also told us that as a result of the negotiations between PEMEX and DOE, which were held in July 1986, no changes in calculating quantity adjustments resulted, but that revisions are to be made in demurrage practices involving vessel layover time. In the future, rather than incurring demurrage charges after 36 hours of straight-line time, allowances are to be made for the hours the port is closed.

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. DOE advised Aerospace on June 2, 1986, by letter of intent that it planned to exercise the contract's final 1-year option. DOE requested and received from Aerospace in August 1986 the details of a proposal for the 1-year extension. 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. The proposal is currently being reviewed after which DOE will develop a pre-negotiation plan. DOE plans to complete the process and award the extension before the October 19, 1986, expiration date.

The Walk, Haydel, & Associates, Inc., contract for architectural and engineering services involving construction work for the Big Hill site was to have expired on July 31, 1986. On July 16, 1986, DOE extended the contract through September 19, 1986, for \$2,136,000. On September 19, 1986, DOE contracted for additional WHA services for Big Hill for the period from September 20, 1986, through July 1, 1988, for \$15,976,075.

The contract with Wells Fargo, which provided security services for the SPR, expired September 30, 1986. Boeing, the SPR management operations and maintenance contractor, assumed protection services responsibility for the SPR on October 1, 1986. In anticipation, Boeing subcontracted these services with Wackenhut Services, Inc., on August 29, 1986. The new protection services became effective September 3, 1986, and include a 1-month phase-in period. Wackenhut will provide protective services under Boeing's direction at all SPR sites including the protection of government-owned or leased property and equipment, protection of proprietary or classified documentation; government and contractor employees; and visitors within Boeing-controlled areas.

The estimated cost for the phase-in period, September 3 through September 30, 1986, is \$149,811. The basic contract is a cost-plus-award-fee type for 3 years beginning October 1, 1986. The estimated cost of the

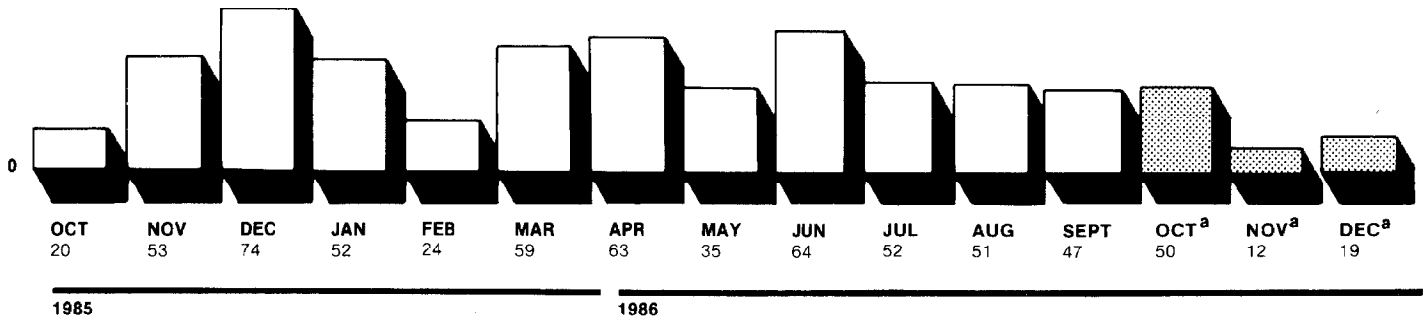
Appendix I
Status of Strategic Petroleum Reserve
Activities as of September 30, 1986

contract is \$25.5 million, which includes the phase-in period, a fixed-fee of \$172,749 for the first 6 months, and an award-fee not to exceed \$975,793 for the remainder of the base period. The contract includes two 1-year options to be exercised solely at Boeing's discretion. The first year option is estimated at \$9,069,372, with a maximum fee of \$434,357; and the second year option is estimated at \$9,597,978, with a maximum fee of \$459,673.

Figure and Tables on the Status of the Strategic Petroleum Reserve

Figure II.1: Average Daily SPR Oil Receiving Rate

100 Volume (barrels per day) in thousands



Actual
 Projected

^aDaily receiving rate for October, November and December 1986 based on DOE projection of future deliveries and is subject to change.

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

	Type I ^a	Types II-V ^b	Type VI ^c	Type VIa ^d	Maya ^e	Total
Volume delivered (millions of barrels)	254.6	192.2	31.4	16.6	11.6	506.4
Percentage of total oil delivered	50	38	6	3	2	99 ^f

^aHigh-sulfur crude (1.99 percent maximum sulfur content) with an API gravity range of 30 to 45 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 Sept. 30, 1986^a

Millions of dollars	
Funds made available	Amount
Carryover from fiscal year 1981	\$1,806
Fiscal year 1982 appropriations	3,684
Fiscal year 1983 appropriations	2,074
Fiscal year 1984 appropriations	650
Fiscal year 1985 appropriations	2,050
Total funds made available	\$10,264
Funds used or committed	
Fiscal year 1982 payments	\$3,687
Fiscal year 1983 payments	1,641
Fiscal year 1984 payments	2,329
Fiscal year 1985 payments	1,621
Estimated fiscal year 1986 payments ^b	397
Estimated DOE unpaid obligations as of Sept. 1986 ^c	63
Total funds used or committed	\$9,738
Estimated unobligated funds at DOE	\$526

^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 August 1986 and DOE's estimated payments for September 1986. Amount through 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 primarily represent funds that have been obligated to pay for September and October 1986 oil deliveries under the first PEMEX contract, or are obligated to Defense Fuel Supply Center for PEMEX oil transportation costs. The Supply Center estimated that \$1.5 million was obligated to it as of September 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 Sept. 30, 1986

Millions of barrels					
Storage facilities	Gross volume planned ^a	Gross volume completed	Permanent capacity planned ^b	Capacity available	Capacity filled
Phase I sites:					
Bayou Choctaw	48.5	48.5	46.0	46.0	45.0
Bryan Mound	75.0	73.4	69.5	69.5	64.4
Sulphur Mines	27.3	27.3	26.0	26.0	26.2
Weeks Island	73.0	73.0	73.0	73.0	72.8
West Hackberry	50.4	50.4	47.7	48.2	47.4
Total	274.2	272.6^c	262.2	262.7	255.8
Phase II sites:					
Bayou Choctaw	11.3	11.3	10.0	•	•
Bryan Mound	134.4	139.2	124.6	124.6	123.0
West Hackberry	179.2	159.2	161.2	121.8	116.7
Total	324.9	309.7	295.8	246.4	239.7
Phase III sites:					
Bayou Choctaw	11.2	•	10.0	•	•
Bryan Mound	36.8	36.8	31.9	31.9	8.4
West Hackberry	11.2	2.8	10.1	•	•
Big Hill	156.8	•	140.0	•	•
Total	216.0	39.6	192.0	31.9	8.4
Tanks and pipelines	•	•	•	•	2.5
Total for SPR	815.1	621.9	750.0	541.0^e	506.4

^aDOE's current policy is to not publish gross cavern volumes.

^bCapacity 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.

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

^dA 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.

^eBryan Mound capacity development was completed on August 26, 1986; however, the site's fill capacity is currently limited to 196 million barrels due to the cavern storage configuration enhancement project.

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).

17. Status of Strategic Petroleum Reserve Activities as of June 30, 1986 (GAO/RCED-86-205, July 25, 1986).

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