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Fact Sheet for the Chairman, Subcommittee on Environment, Energy, and Natural Resources, Committee on Government Operations, House of Representatives

June 1988

OIL RESERVES

Status of Strategic Petroleum Reserves as of March 31, 1988

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Resources, Community, and
Economic Development Division

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June 24, 1988

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

Dear Mr. Chairman:

In your December 9, 1985, letter, and in subsequent discussions between my staff and your office, you requested that we continue to report on the Department of Energy's (DOE) progress in developing, operating, and filling the Strategic Petroleum Reserve (SPR) and in complying with the requirements of applicable law. These reports are now made on a semiannual basis.

This fact sheet covers events and activities related to DOE's progress in developing, operating, and filling the SPR during the first half of fiscal year 1988. These events and activities are highlighted below. Details are provided in sections 1 and 2 of the fact sheet.

-- As of March 31, 1988, the SPR inventory totaled 544.9 million barrels of oil. During the past 6 months DOE added 11.0 million barrels of crude oil to the SPR at an average fill rate of about 60,000 barrels per day.

-- During this period, DOE disbursed $208 million from the SPR Petroleum Account. All of the oil was purchased from PEMEX--the Mexican national oil company.

-- Public Law 100-202 (December 22, 1987) appropriated $164 million in fiscal year 1988 for facilities development and management and $439 million for oil purchases. According to the law, cash outlays from 1988 appropriations for oil purchases in fiscal year 1988 are limited to $257 million. This funding, plus fiscal year 1987 carryover, is adequate to fill the SPR at an average rate of 50,000 barrels per day for fiscal year 1988.

-- For fiscal year 1989, DOE proposes to obligate $173 million for facilities development and management and $236 million for oil purchases. DOE expects that these funds will be adequate to continue to fill the SPR at an average rate of 50,000 barrels per day.

-- Tests of the instrumentation and control systems installed at West Hackberry, Louisiana, by Coggins Systems, Inc., indicate over 550 possible software deficiencies. Boeing is analyzing these deficiencies in order to determine their significance and the corrective action needed.

-- DOE plans to postpone all further drawdown exercises involving crude oil movements until their effects on cavern integrity are evaluated by a Technical Evaluation Committee.

-- DOE and the Military Sealift Command have made significant progress in resolving the questions surrounding nearly $500,000 in payments to shippers for demurrage charges.

OBJECTIVES, SCOPE, AND METHODOLOGY

By agreement, we limited our review to providing primarily statistical information and highlights of major activities that occurred during the period October 1, 1987, to March 31, 1988. 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. We did not verify the volume or quality of oil that DOE received or the available capacity of SPR storage facilities. We discussed the information provided in this fact sheet with DOE program officials, who verified its factual accuracy. Their comments have been incorporated into the fact sheet as appropriate.

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As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this fact sheet 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. If you would like further information on this fact sheet, please contact me at (202) 376-9715. Major contributors to this fact sheet are listed in appendix I.

Sincerely yours,

Keith O. Fultz
Associate Director

CONTENTS

ABBREVIATIONS

ARCO	Atlantic Richfield Company
DCAA	Defense Contract Audit Agency
DOE	Department of Energy
GAO	General Accounting Office
I&C	Instrumentation and Control
MSC	Military Sealift Command
PEMEX	Petroleos Mexicanos
RCED	Resources, Community, and Economic Development Division
RWIS	raw water intake structure
SPR	Strategic Petroleum Reserve
WHA	Walk, Haydel, and Associates, Inc.

SECTION 1

STATUS OF STRATEGIC PETROLEUM RESERVE

ACTIVITIES AS OF MARCH 31, 1988

The Energy Policy and Conservation Act (P.L. 94-163, Dec. 22, 1975), as amended, authorized the creation of the Strategic Petroleum Reserve (SPR) to store up to 1 billion barrels of crude 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 develop capacity to store 750 million barrels of oil. The schedule for completing this capacity depends upon budgetary decisions now before the Congress and the administration. However, under proposed budget requests DOE expects to have all storage capacity developed and available for oil fill by 1992.

Initially, DOE developed the SPR by 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. Subsequently, DOE developed additional storage capacity at these sites; a new site at Big Hill, Texas; and constructed a marine terminal at St. James, Louisiana. The additional storage capacity was developed through a leaching program that entails pumping fresh water into salt deposits and removing the resultant brine.

The various SPR storage sites are connected by pipeline to the following 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 the Phillips Petroleum Company's terminal in Freeport, Texas, and to the ARCO terminal in Texas City, 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 will also be connected to the Sun Oil terminal when the final oil pipeline tie-in is completed.

-- 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 in Oak Ridge, Tennessee. These

activities, as delegated by the Operations Office, are carried out through the Project Management Office in New Orleans, Louisiana. Under a 5-year management, operation, 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 technical direction, while Boeing is responsible for SPR's day-to-day management.

This fact sheet discusses activities affecting the SPR that occurred during the 6-month period ending March 31, 1988. It includes (1) oil-fill activities, (2) the status of the SPR Petroleum Account, (3) SPR funding, (4) storage site development activities, (5) oil distribution improvement and enhancement activities, (6) progress on various SPR contracts, (7) drawdown exercises, and (8) the resolution of issues related to demurrage charges on oil deliveries to the SPR.

SPR OIL-FILL ACTIVITIES

DOE reported that 11 million barrels of crude oil were added to the SPR inventory during the period ending March 31, 1988, increasing it to 544.9 million barrels. The crude oil received during this period was purchased from Petroleos Mexicanos, the Mexican national oil company (PEMEX).

Crude oil purchases for October and November 1987 completed the 1-year PEMEX III contract. In November, DOE executed a new crude oil purchase agreement with PEMEX. This contract (PEMEX IV) is for a 2-year period beginning December 1987 and running through November 1989. Terms and conditions are similar to previous agreements. The price is determined cargo by cargo on the basis of a formula, which is standard for all U.S. imports of Mexican crude. DOE plans to continue purchases under this contract for the remainder of the fiscal year. No other sources of oil procurement are anticipated.

The average fill rate for the period was about 60,000 barrels per day. (See sec. 2, fig. 2.1, for further information on SPR oil acquisition and fill activities.) Of the 544.9 million barrels of oil in storage, 35 percent is sweet (low sulfur) crude, 54 percent is sour (high sulfur) crude, and about 11 percent is a combination of lower quality (sulphur and gravity) crude oils.

STATUS OF SPR PETROLEUM ACCOUNT

According to DOE, its SPR Petroleum Account (oil acquisition and transportation) provides funds for (1) SPR oil procurement; (2) associated transportation costs, such as pipeline, tanker, and marine terminal activities; (3) U.S. Customs duties; (4) Superfund taxes; and (5) miscellaneous costs, such as administrative expenses associated with acquiring and transporting the oil. The Omnibus

Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) provides that if an SPR oil drawdown occurred, this account would also 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 go into this account.

During the 6 months ending March 31, 1988, DOE disbursed $208 million from the SPR Petroleum Account. This included outlays against the $96 million in unpaid obligations as of September 30, 1987. Unpaid obligations at the end of this period were $70 million, and the unobligated balance of funds was $257 million.

FISCAL YEARS 1988 AND 1989 SPR FUNDING

In Public Law 100-202 (Dec. 22, 1987), the Congress appropriated $164 million in fiscal year 1988 for the development and management of the SPR and $439 million to purchase oil. Outlays (payments) in fiscal year 1988 that result from the use of this $439 million cannot exceed $257 million. According to a DOE official, the constraint on outlays from the fiscal year 1988 appropriation will not be an obstacle to filling the SPR at a rate of 50,000 barrels per day in fiscal year 1988.[1]

For fiscal year 1989 DOE has requested budget authority of about $173 million for facilities development and management and $334 million to continue filling the SPR at an average rate of 50,000 barrels per day.

In fiscal year 1988 DOE plans to obligate about $232 million for facilities development and management and $296 million for SPR oil to be delivered in fiscal year 1988 at an estimated average acquisition cost of $19.97 per barrel. In addition, during the last quarter of the fiscal year, DOE plans to obligate about $143 million to acquire oil for delivery in fiscal year 1989.

For fiscal year 1989, DOE plans obligations of $173 million for facilities development and management and $236 million to purchase oil for delivery in fiscal year 1989 at an average rate of

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[1]The Energy Policy and Conservation Act (P.L. 94-163), as amended by the Omnibus Budget Reconciliation Act of 1986 (P.L. 99-509), links the sale of oil from the Naval Petroleum Reserve in Elk Hills, California, to filling the SPR at an average annual rate of 75,000 barrels per day until at least 750 million barrels are in storage. However, the appropriation language in P.L. 100-202 waived this linkage for fiscal year 1988. In its current budget request, DOE proposes that the linkage again be waived for fiscal year 1989.

50,000 barrels per day.[2] DOE estimates that the average oil acquisition cost will be $20.75 per barrel. DOE also plans to obligate about $98 million to purchase oil for delivery in fiscal year 1990 at an estimated average acquisition cost of $21.51 per barrel.

SPR SITE DEVELOPMENT ACTIVITIES

During the reporting period, DOE continued to make progress in completing the last of the planned storage caverns at the Bayou Choctaw and West Hackberry sites and increased the number of caverns being leached at Big Hill. Pipeline tests and repairs were undertaken, and oil movement capabilities were tested. At the Weeks Island site, water concerns continue. Big Hill site officials are modifying cavern wellheads to overcome leakage problems and replacing some well casings that have experienced excessive corrosion. A Sulphur Mines system test did not fully meet its basic objective.

Bayou Choctaw

Leaching of cavern 101, which began on July 31, 1987, is continuing and is scheduled for completion in 1990. The instrumentation and control (I&C) work to integrate caverns 101 and 17 into the site control room under the Coggins System, Inc., contract is also ongoing and scheduled to be completed by September 13, 1988.

As we discussed in our previous report, Boeing plans to investigate a crude oil pipeline anomaly (possibly resulting from corrosion/erosion) between the site and the St. James terminal.[3] The work will involve excavating about 200 feet of the pipeline and examining its condition. The contract package is with DOE for review and approval. Work is expected to be finished about 90 days after its commencement.

Weeks Island

The presence of water at the Weeks Island mine has been a continuing area of concern for DOE. Our previous report discussed recent water leak and/or seepage investigations and Boeing's monitoring program to observe water level changes over time.

The source of the accumulation of water is not known. In the upper areas of the mine, the water may be the result of atmospheric

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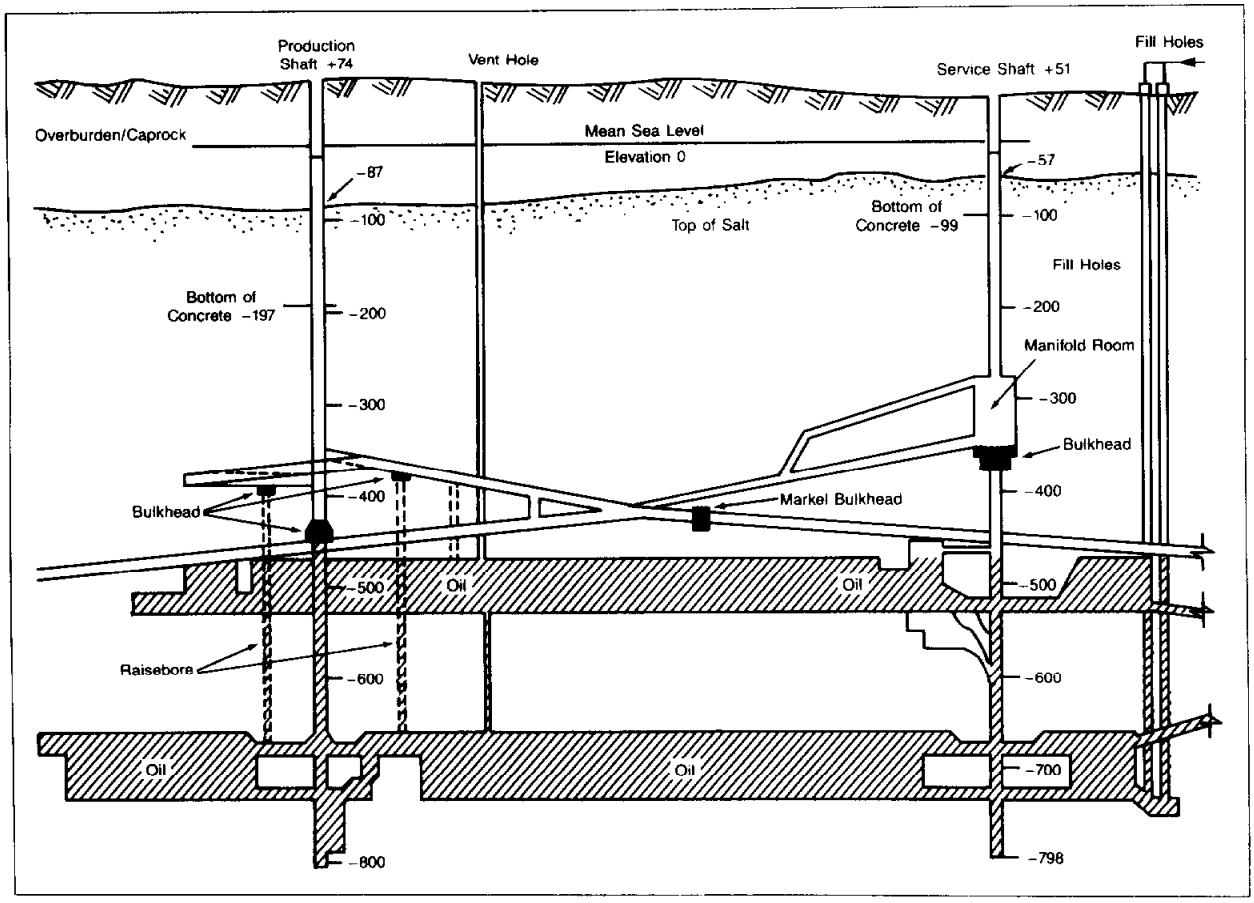
[2]This rate may be increased if the Congress approves legislation to sell portions of the Naval Petroleum Reserve.

[3]Oil Reserve: Status of Strategic Petroleum Reserve Activities as of September 30, 1987, GAO/RCED-88-59FS.

condensation. In the lower sections, it may represent condensation from the gas cap, water injected during construction or testing, or residual water in the oil which has settled in the sump areas. According to a Boeing cavern engineer, on February 4, 1988, Boeing completed removing about 30,000 barrels of brine from the mine's fill hole sump. Figure 1.1 shows the relative location of relevant features of the mine. After the brine removal, monitoring was increased to twice daily. Sump water level has continued to rise at the rate of about 114 gallons per hour. Nevertheless, the cavern engineering staff continues to believe that no new water is entering the mine, but that water is moving from other parts of the mine to the sump. Boeing plans to have a private laboratory carry out an isotope analysis to determine the age and other characteristics of the brine. This analysis may determine whether the brine is primarily mine water that has settled or is water that has seeped in from an outside source.

Figure 1.1: Schematic Drawing of Weeks Island SPR Storage Site



Boeing considers the presence of water in the Weeks Island mine to be a long-term concern and is exploring options to reduce or stabilize it. Other risk abatement measures under consideration include an early warning system in the mine's manifold room, which is critical for oil withdrawal, and a backup oil withdrawal system in the event that the manifold room becomes inaccessible. At the present time, the water level in the service shaft and in the fill hole sump is being monitored.

Although initially planned for May 1988, the Weeks Island/St. James terminal crude oil pipeline was surveyed by an electronic instrumental tool ("smart pig") on November 5 and 6, 1987. An area of possible severe erosion was identified. Boeing's review and evaluation of the report results were submitted to DOE on May 31, 1988. Plans for a reliability, availability, and maintainability test of the equipment on site have been suspended until a special drawdown study is completed. (See p. 19.)

Sulphur Mines

In September 1987, Boeing held a system test and exercise at Sulphur Mines to move oil between two caverns and to test for gases dissolved in the oil. One cavern has a nitrogen blanket to prevent leakage or loss. Dissolved gases may result in damage to operating equipment such as crude oil pumps and meters and may require the use of a gas/oil separator when the oil is withdrawn for use. The Boeing report published on January 29, 1988, described the test as successful and indicated that pressurized dynamic samples and composite samples were taken without incident. No problems that would affect pumps and metering equipment were observed. There were no major equipment failures, and the exercise verified that operating procedures are in place and that site personnel are well trained.

Although Boeing considered the test to be a success, the basic objective of the test--to determine the gas concentration and composition of the oil--was not achieved. A contractor, Southwestern Laboratory, took 72 pressurized samples under dynamic conditions throughout the exercises under varying pressures, temperatures, and flow rates. The contractor was to deliver the results to Boeing within 10 days, keeping backup samples until the results were accepted by Boeing. The report, however, was delayed by laboratory equipment breakdown. Further, laboratory tests of samples were not run in accordance with contract requirements, and the laboratory did not keep backup samples that could have been retested. As a consequence, sample results cannot be compared to findings of previous Sulphur Mine oil analyses and were not useful in determining the composition and concentration of gases in the oil and the need for an oil/gas separator.

Boeing was unable to resolve these deficiencies. Southwestern Laboratory agreed to retake and analyze samples at another exercise completed in late April.

West Hackberry

During the past 6 months, West Hackberry received about 3 million barrels of crude oil. As of March 31, 1988, following remedial leaching and changes in oil inventory, 10 of the 16 phase II caverns were full, with about 103.3 million barrels; 5 were in final-fill status, currently containing 36.2 million barrels; and 1 was in the development leaching stage (cavern 111), as was the single phase III cavern (117). Remedial leaching also occurred at four of the phase II caverns (107, 110, 112, and 114).

P.D.Q. Contractors, Inc., investigated anomalies at four points on the crude oil pipeline between the site and the Sun Oil Company terminal at Nederland, Texas, in October and November 1987, according to a Boeing pipeline engineer. At three locations the anomalies involved defects in the external protective coating. The pipeline sections involved were cleaned and recoated. The anomaly at the other location, near the Sun Oil Company terminal, required that the pipe be repaired. According to another Boeing engineer, further ultrasonic testing, followed by analysis of a sample of the pipe wall, confirmed that the pipeline will be able to perform at full capacity for years.

The 4.2-mile West Hackberry raw water line was surveyed on October 22, 1987. According to Boeing's Semi-Annual Pipeline Integrity Report, dated December 31, 1987, pipeline surfaces had not been adequately cleaned, resulting in incomplete survey information. However, the survey log indicated excessive corrosion for a distance of 2 miles, after which the instrumentation failed. The pipeline was subsequently inspected by a diver who examined the first 400 feet of the raw water line from the intake with the aid of ultrasonic measurements. This inspection found average wall losses of 10 percent, with a maximum loss of 20 percent. DOE does not consider these losses to be significant. Boeing uses cleaning pigs to scour this line periodically, and tests indicate that flow rates are at or near normal levels.

The brine line was surveyed in February 1988 using a smart pig with advanced technology. The report of this survey is not yet available, but preliminary results indicate that the line is severely eroded in a number of places. In the worst place, 70 percent of the original thickness of the pipe has been lost. This line will be needed only until September 1988, when leaching is expected to be finished. Later, the line may be used for cavern depressurization and, after a complete drawdown, for a refill of the site.

Bryan Mound

During the reporting period, about 8.3 million barrels of crude oil were delivered to the Atlantic Richfield Company (ARCO) and Seaway terminals for the Bryan Mound site. This oil was injected into cavern 5. As mentioned in our last report, this cavern was emptied of sweet crude oil so that it could be refilled with sour oil. When this occurred, less oil was removed than site records indicated should have been in the cavern. According to DOE, this difference did not represent a loss of oil, but resulted from the fact that several caverns were filled simultaneously without individual cavern metering. A final adjustment to the cavern's sweet inventory by the Crude Oil Accountability Review Board is expected by July 1988.

Crude oil deliveries across the Phillips dock have been limited to about 300,000 barrels of oil per day because the channel depth of the harbor at Freeport, Texas, limited the size of ships coming to the loading terminal. The channel has been dredged to allow larger vessels to use the terminal. In addition, DOE recently completed installing a piping system to use the terminal meters for custody transfer during drawdown. On October 21, 1987, Boeing conducted a drawdown exercise to test the recently completed meter bank enhancement and repiping system. This test demonstrated the site's capability to deliver crude oil to the Phillips docks at a 480,000 barrels per day rate and Phillips' capability to load a ship at the same rate. A DOE chartered ship was used to provide temporary oil storage at the dock.

The Boeing report, Bryan Mound to Phillips Pipeline Drawdown Exercise Report, December 31, 1987, called the test a success. The planned flow rate of 20,000 barrels per hour, equivalent to 480,000 per day, was sustained through 2 meter banks for 30 minutes each. Since the flow rate was achieved by using only associated cavern pressures from three caverns, the exercise did not test the site's ability to use oil booster pumps to achieve maximum rates.

Another exercise at Bryan Mound was designed to demonstrate the site's capacity to deliver oil through the pipeline to ARCO at Texas City, Texas, at a sustained average rate of 1 million barrels per day for at least 2 hours and ARCO's ability to receive crude oil at this rate. The test was also designed to gather meter-proving data and to move oil for pigging operations. Shortly before the exercise, DOE asked Boeing to test the site's maximum drawdown rate through this pipeline and requested that cavern pressure, not oil booster pumps, be used.

According to Boeing's February 8, 1988, report, the original objectives of the test were met but the site's maximum drawdown rate was not achieved because of equipment problems and limited

tank space at ARCO. DOE considers that additional tests are needed to refine its knowledge of operational characteristic of the site.

According to a Boeing cavern engineer, in late 1987 an integrity test took place on cavern 106, the site of a slow leak discussed in our prior report. The results of this test proved that the cavern's walls were in satisfactory condition. The rate of leakage was less than 20 barrels per year, a small amount that approaches the limits of the sensitivity of the testing instruments. This engineer indicated that any amount less than 100 barrels per year would require no corrective action.

Big Hill

As we reported previously, cavern leaching began at Big Hill as scheduled on October 1, 1987, and by the end of October 10 caverns were in leaching status. A gross cumulative volume of storage capacity equivalent to about 9.5 million barrels has been created, but this has not yet created cavern capacity ready to receive crude oil. DOE plans to begin negotiations in May 1988 with the Sun Pipeline Co., to tie in the Big Hill oil pipeline to the Sun terminal facilities by August 1, 1988.

The contract for surface construction on nine caverns, including pipeline tie-ins to connect the caverns to the oil, brine, and water systems, was 93 percent complete as of March 31, 1988. Under terms of the contract, work was supposed to be completed on March 14, 1988, but DOE did not consider the contract work to be substantially completed until May 1988. As of May 31, 1988, some civil engineering tasks, such as paving site roads, remain to be completed. The remaining four caverns are scheduled to begin leaching in June 1988.

When Boeing began making preparations for site leaching in early 1987, leaks were discovered involving the wellhead component part called a 10-3/4-inch hanger. This hanger is the part of the wellhead that holds the 10-3/4-inch casing string that extends from the surface down into the cavern and conducts the brine that is produced by the leaching process out of the cavern into the brine disposal system. Each of the hangers on the 28 wellheads was installed as government-furnished equipment by the well drilling contractors and had passed the required acceptance tests when the casing and wellhead installations were completed.

DOE attributes the leaks primarily to a design flaw discovered during a shop test of the hangers. Furthermore, according to a DOE geologist, the proposed moratoriums on SPR development in 1985 and 1986 delayed the awarding of the contract to tie the wellhead into the oil, brine, and water piping systems so that leaching could be started. Consequently, the hanger sealing surfaces may have deteriorated.

As a result of these leaks, DOE asked its architect/engineer contractor, Walk, Haydel, and Associates, Inc., (WHA) to develop repair specifications and then prepare designs for reworking the units. As of March 31, 1988, 7 hangers had been reconditioned and 10 new hangers manufactured and installed. This work is continuing, and other hangers will be installed during various stages of the leaching process.

Boeing has reported severe corrosion on the reconditioned 10-3/4-inch well casing in two wells. This casing was installed when the wells were drilled. Boeing is changing from uncoated to coated 10-3/4-inch well casing to overcome this problem and to achieve greater operational efficiencies. According to a contract cavern specialist, as a result of using coated pipe in all Big Hill wells, about $4.2 million in electric power savings would accrue to DOE over the life of the Big Hill site.

SPR OIL DISTRIBUTION IMPROVEMENTS AND ENHANCEMENTS

As previously reported, DOE has planned a number of distribution enhancements to increase the SPR oil distribution capacity to match projected drawdown capability. This drawdown capability is expected to reach 4.5 million barrels per day as the SPR approaches 750 million barrels. These projects include the following:

-- A 12-mile long, 36-inch pipeline to connect the West Hackberry site to the Texas 22-inch pipeline in the Lake Charles area. This pipeline, when completed, will provide a flow rate of 864,000 barrels per day. In January 1988, the Texas Pipeline Company and DOE signed a tie-in agreement to connect the West Hackberry to the Texas 22-inch line and Lake Charles spur. The invitations to bid on the project were issued on May 20, 1988.

-- On November 3, 1987, DOE and the Shell Oil Company concluded the Capline tie-in connection agreement, and on December 1, 1987, they accepted the design package. The construction contract for $861,701, with a 90-day performance period, was awarded to Firth Construction Company on December 30, 1987. The work was completed in April 1988.

DOE is also adding to its marine terminal shipping capability at St. James and for the West Hackberry site. DOE solicited bids for the use of private terminal facilities near St. James. However, only one offer was received for a private marine terminal services contract to supplement the government-owned terminal in the St. James area. On March 26, 1988, DOE issued a request for proposals for marine terminal distribution capability in the Lake

Charles, Louisiana, area to serve the West Hackberry site. DOE received proposals as of April 25, 1988, and is evaluating them.

COGGINS INSTRUMENTATION AND CONTROL CONTRACTS

A recent Boeing test of the I&C system installed by Coggins Systems, Inc., at the West Hackberry site disclosed 663 discrepancies--104 hardware items, which Boeing is correcting, and 559 software items. This test, after several delays, was conducted in January and February 1988. The test results highlight our longstanding concern with I&C systems installed at SPR sites.

Instrumentation and control systems at SPR sites are used to monitor and control the flow of crude oil, water, and brine, and to operate and protect critical field equipment from a central location at each site. While other contractors were involved in the initial construction of the systems, for the last several years responsibility for completing the systems has rested primarily on Coggins. In 1983 a contract was awarded to Coggins to complete the I&C system at West Hackberry. Subsequent contracts were awarded to Coggins for I&C work at Big Hill, Bryan Mound, and Bayou Choctaw.

Work is continuing on the latter three contracts, but at West Hackberry, DOE took use and possession of the Coggins installation in July 1985. In the past we have reported a number of difficulties such as computer software error and inadequate design, quality assurance and testing, and software changes on one system adversely affecting another. When Coggins completed its work on the I&C system used to monitor crude oil, water, and brine flow, WHA witnessed the 30-day acceptance test and reported that the system had been demonstrated to fulfill the functional requirements of the contract. The contract was modified in July 1985 to incorporate the raw water intake structure (RWIS) at West Hackberry into the overall site I&C system.

When Coggins made changes in the computer software for the site distribution control system in order to incorporate the RWIS system, WHA, Boeing, and Boeing Aerospace all recommended that the entire system be retested. In the absence of such a retest WHA advised DOE in April 1986 about the possible adverse effects of software changes and recommended implementing software configuration control (to document changes to software programs in place to accommodate the RWIS control system). According to DOE, adding a requirement for configuration control would delay the contractor's work and cause claims for delay; however, DOE did direct Coggins to comply with WHA's "punch list" items to assure that software changes would not affect the rest of the control system. At the end of April, Boeing stated that it would not accept the control system as part of its site operations responsibility unless the entire system was satisfactorily

retested, particularly in view of the software changes that had been made.

At a July 1986 design review meeting, a decision was reached that Boeing would perform a complete retest of the control room after contract close-out (the last punch list item was cleared in January 1987). Boeing System Engineering began the complete system retest on April 6, 1987, but shut down after 1 day because of software problems. The test was rescheduled for July and August, 1987, but postponed as a result of the need for staff to be involved in the special effort to bring Big Hill to leaching status by October 1, 1987. Boeing finally retested the Coggins I&C system in January and February, 1988. This system retest was the only means to check completed system software, including the impact of Coggins' revisions on previously installed material.

As indicated above, the Boeing test disclosed 663 discrepancies, including 559 software items. These software items included problems such as excessive screen update time, system lockup as a result of alarm traffic, and inconsistent alarm annunciation. These discrepancies require extensive analysis, and Boeing's reports on the test were not completed until late May 1988.

Boeing Aerospace Operations in Houston, Texas, also performed a software "sneak" analysis of a portion of the Coggins software. This type of analysis can only be carried out when source codes for the software programs are available, as they were for part of the West Hackberry I&C system. The primary objective of this analysis was to examine the software of the control room HP-1000 computer to identify potential design errors or faults that might lead to unsafe operation. Results showed 88 discrepancies. Boeing concluded that software errors or faults could affect West Hackberry's operational efficiency and complicate the process of program maintenance. The central control system, however, can be bypassed and the site operated by using subsystems and components. On the other hand, a Boeing control room operator commented that under emergency drawdown conditions, he feared a total system failure. Boeing recommended that a software sneak analysis be performed on the system software at the other sites.

DOE is awaiting Boeing System Engineering's final report of the complete systems retest analyzing the 559 software items. If the discrepancies are found to be latent defects, Coggins has agreed to correct them. If not, DOE may have to issue another contract to correct these problems.

With regard to the ongoing Coggins contracts at other sites, a portion of the Big Hill I&C system was tested in September 1987. Test results generated a significant number of possible deficiencies and omissions. At that time, Boeing concluded that the site would not be able to operate in the automatic mode for

leaching activity. According to the DOE SPR Director, however, the deficiencies are minor and do not inhibit leaching in an environmentally sound and efficient manner. Boeing and DOE conditionally accepted the Big Hill leaching control system, subject to resolving any remaining discrepancies and omissions, and established a Readiness Review Board to review Coggins' work. Boeing planned a 30-day, full site test at Big Hill in May 1988, but this has been delayed. The Coggins work at Bryan Mound and Bayou Choctaw will not be ready for testing until later in 1988.

OTHER SPR CONTRACT NEGOTIATIONS

Our last report discussed the disagreement between DOE and PEMEX over a DOE claim of $287,104 related to the basic sediment and water factor for crude oil delivered under the PEMEX I contract. PEMEX had offered to settle the claim at substantially less than half of the amount sought by DOE, and DOE countered in June 1987 with an offer of $237,000. According to a DOE contract specialist, PEMEX responded to DOE's settlement offer on August 19, 1987, by reiterating its previous settlement offer of $103,616.76. On October 30, 1987, DOE and PEMEX settled this dispute for $149,080. By accepting this settlement DOE avoided the disputes process.

As of March 31, 1988, DOE and Fruin-Colnon Corporation still had not reached a final settlement on DOE's liquidated damages claim for late completion of the Big Hill I-A construction contract or on claims submitted by Fruin-Colnon. This contract covered site surface construction for the first five caverns. The contract work has been completed, but Fruin-Colnon contends that $9,134,724 in claims is still due from DOE. The Defense Contract Audit Agency (DCAA) has audited the Fruin-Colnon claim documentation, and DOE is making a technical evaluation of this report. The target close-out date is July 1988.

On February 12, 1988, DOE notified WHA to submit a proposal for the final option year of its participation in the Capital Improvement Program, to begin on May 31, 1988. DOE received the WHA proposal on March 21, 1988, and DCAA has reviewed the proposal package. The contract is expected to be awarded in the second quarter of 1988.

On February 25, 1988, DOE awarded a cost reimbursable contract valued at $1,238,768.88 for the Weeks Island Risk Abatement Program to the Jacobs Engineering Group. This contract has a 1-year period with four unpriced 1-year options.

DRAWDOWN EXERCISE EVALUATION

DOE has conducted drawdown exercises and tests for a variety of purposes. These include testing equipment and personnel readiness, including the ability to meet and sustain performance

targets, as well as the regular use of equipment and systems that are normally in a standby status. Study is currently being given, however, to the advisability of continuing exercises and tests involving oil movement.

Evaluation of 1987 Exercise

In a previous report we discussed the SPR drawdown readiness exercise (SPREX-87) that began June 1, 1987.[4] SPREX-87 was an informal SPR training exercise, limited to the SPR organization and designed to ascertain the readiness of existing SPR drawdown systems and contractor personnel to execute a drawdown and sale with a minimum of advance notification. Physical drawdown from three sites occurred: Bryan Mound on June 16-17, 1987, for about 500,000 barrels, and West Hackberry and Sulphur Mines simultaneously on June 20, 1987, for about 625,000 barrels. The SPREX-87 exercise ended July 10, 1987.

The SPR SPREX-87 exercise was generally successful, according to an October 5, 1987, letter report from the DOE Director, Operations and Readiness Division, Office of Strategic Petroleum Reserve. Of the items mentioned as requiring corrective attention, eight dealt with administrative aspects such as lack of copies of manuals, changes and clarifications to Standard Sales Provisions, unnecessary paperwork, difficulty in gaining access to the Sales Evaluation Model and insufficient staff resources. Two items reflected operations problems--not properly notifying all possible parties associated with an SPR drawdown and vagueness of terminal contractual provisions. Another item dealt with uncertainties about requirements to discharge oily bilge water, another with technical problems in the Sales Evaluation Model. These items are still under review.

Policy for Future Drawdowns

According to a DOE industrial specialist, as of January 1, 1988, all drawdown exercises involving oil movement at the SPR were postponed until a special study by a Technical Evaluation Committee composed of DOE, Boeing, and Sandia Laboratory personnel is completed and its recommendations considered. No drawdowns have been held in fiscal year 1988, and with one exception, no drawdowns are scheduled. (The exception is Sulphur Mines. The planned exercise is entirely between two caverns on site, using brine only, and is a repeat to fulfill a contractor's requirements not accomplished at an earlier exercise. See Sulphur Mines discussion on p. 12.)

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[4]Oil Reserve: Status of Strategic Petroleum Reserve Activities as of June 30, 1987, GAO/RCED-87-194FS.

According to DOE, potential problems and concerns about drawdown exercises include

-- effects on cavern integrity,

-- effects on cavern shape, and

-- interruptions in collection of long-term data on cavern behavior.

The committee will evaluate

-- the potential effect of oil transferred offsite (oil spill, clean-up cost, environmental impact, potential contamination);

-- effects on caverns (monitoring, salt falls, creep rate, leaching, integrity);

-- the effect on systems (pumps, motors, pipelines, instrumentation, control systems, wear on components, lubrication, corrosion);

-- the exercise of equipment and systems (better availability, personnel training, personnel proficiency, limited test time);

-- alternatives (no tests, bypass caverns, recirculate fluids, use brine, special cavern or tank); and

-- the cost of exercises (man-hours, overtime, power).

The deliberations of the Technical Evaluation Committee led to recommendations which were submitted in May 1988.

PROGRESS TOWARD SETTLEMENT OF DEMURRAGE OVERCHARGE ISSUES

In our last SPR status report we reported on differences between Boeing and the Military Sealift Command (MSC) on the subject of possible demurrage overcharges. According to MSC, demurrage is the agreed-on liquidated damage if a chartered vessel is delayed more than a specified period of time, usually 72 hours, while loading or unloading. MSC is responsible for chartering tankers for the delivery of SPR oil and is therefore responsible for evaluating and paying shipowners' claims for demurrage, which are ultimately paid from the SPR oil acquisition and transportation account. On the basis of a review of MSC demurrage invoices for the period June 1980 through September 1985, Boeing concluded that for 27 cases a total of $453,057.23 of MSC payments were in excess of calculated liability and required additional clarification and/or substantiation. This sum represented possible overpayment

to shipowners. At the time of our last report MSC did not agree with this position.

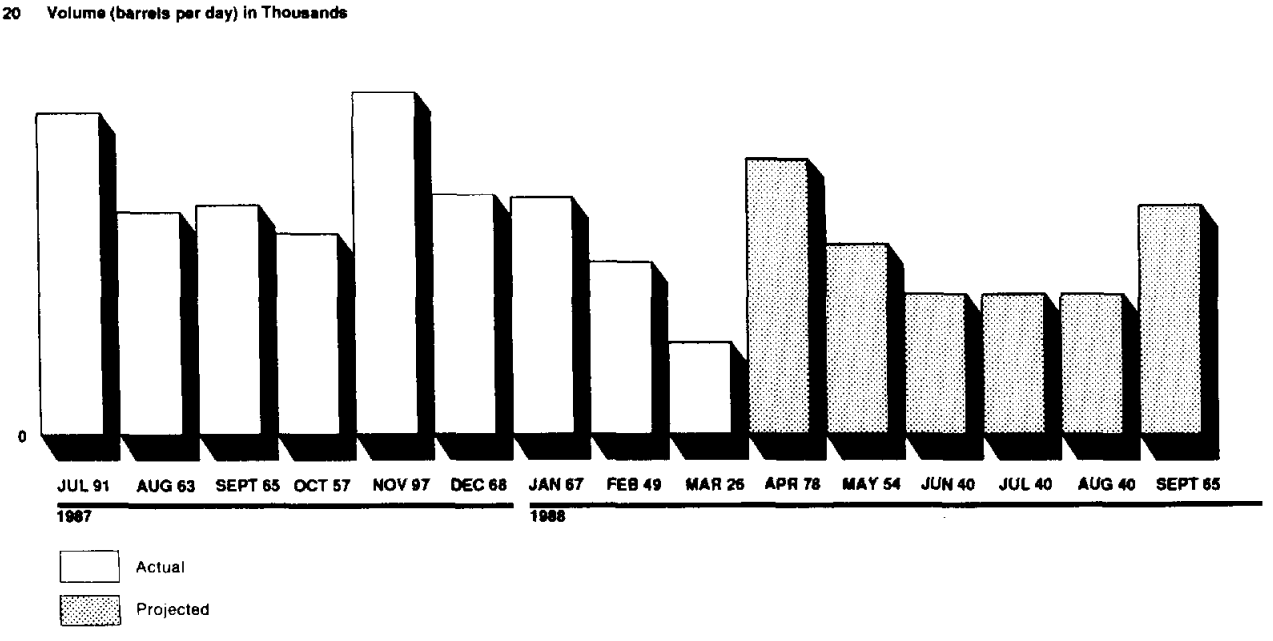
This dispute between DOE and MSC over the appropriate demurrage charges has been going on for several years with no resolution of the claims. Since we formally surfaced the potential overpayments in our last report and held several meetings with DOE, Boeing, and MSC officials, significant progress has been made toward the resolution of the demurrage issue. Representatives of all three parties have examined documents and new information on these cases and as of April 1988 have agreed that in 15 cases totaling $263,175 the demurrage claims were correct and no further action is required. In six cases totaling $92,904 it was agreed that overpayment had occurred and that MSC would take steps to recover this amount. The remaining six cases, with questionable payment amounting to $96,977, remain unresolved and require additional research.

For several reasons, future cases of this sort should arise less frequently and should be resolved more quickly. First, MSC is in the process of revising the form of its standard charter contract and has circulated a draft for comment from interested parties. This new charter will have more explicit language regarding demurrage. In addition, the MSC review process has been improved. The MSC accounts department responsible for paying demurrage claims is being collocated with other headquarters offices and will have better access to the expertise of the legal and contracting staffs.

SECTION 2

DATA ON THE STATUS OF THE STRATEGIC PETROLEUM RESERVE

Figure 2.1: Average Daily SPR Oil Receiving Ratea



[a]*Daily receiving rate for April through September 1988 based on DOE projection of future* deliveries. All of these rates are subject to change.

Source: DOE

Table 2.1: Status of SPR Petroleum Account (Oil Acquisition and Transportation) Funds as of March 31, 1988[a]

Funds made available	Amount (millions)
Fiscal year 1977 to 1981 appropriations[b]	$ 6,665
Fiscal year 1982 appropriations	3,684
Fiscal year 1983 appropriations	2,074
Fiscal year 1984 appropriations	650
Fiscal year 1985 appropriations	2,050
Fiscal year 1988 appropriations	439
Total	$15,562
Funds used or committed	
Fiscal year 1977 to 1981 payments	$ 4,859
Fiscal year 1982 payments	3,687
Fiscal year 1983 payments	1,641
Fiscal year 1984 payments	2,329
Fiscal year 1985 payments	1,621
Fiscal year 1986 payments	397
Fiscal year 1987 payments	490
Estimated fiscal year 1988 payments[c]	208
Estimated DOE unpaid obligations as of March 31, 1988[d]	70
Total	$15,302
Estimated unobligated funds at DOE	$ 257

[a]The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) established the SPR Petroleum Account, effective October 1981, to pay for petroleum acquisition and transportation.

[b]Includes lapsed funds of $2.97 million. As a result of this inclusion, total funds made available are greater than total funds used or committed and unobligated funds.

[c]Amount consists of DOE's actual reported payments through February 1988 and DOE's estimated payments for March 1988.

[d]Unpaid obligations primarily represent funds that have been obligated for oil deliveries or are obligated to Defense Fuel Supply Center for PEMEX oil transportation costs.

Source: DOE.

Table 2.2: Status of SPR Underground Capacity for Crude Oil Storage as of March 31, 1988

Storage facilities	Gross volume planned	Gross volume completed	Permanent capacity planned[a]	Capacity available	Capacity filled[b]
	(millions of barrels)				
Phase I sites:					
Bayou Choctaw	54.6	48.6	52.0	46.0	45.8
Bryan Mound	74.0	74.0	69.7	69.7	43.1
Sulphur Mines	-	27.3	-	26.0	25.4
Weeks Island	73.0	73.0	73.0	73.0	71.8
West Hackberry	50.4	50.4	47.6	47.6	47.2
Total	252.0	273.3	242.3	262.3	233.3
Phase II sites:					
Bayou Choctaw	11.3	11.3	10.0	10.0	6.5
Bryan Mound	139.4	139.4	124.5	124.5	130.7
West Hackberry	180.8	178.5	160.8	151.0[c]	140.2
Total	331.5	329.2	295.3	285.5	277.4
Phase III sites:					
Bayou Choctaw	11.2	2.2	10.0	-	-
Bryan Mound	36.6	36.6	31.8	31.8	30.4
West Hackberry	11.8	8.1	10.6	.4	.1
Big Hill	180.6	9.5	160.0	-	-
Total	240.2	56.4	212.4	32.2	30.5
Tank and pipelines	-	-	-	-	3.7
Total	823.7	658.9	750.0	580.0	544.9

[a]Permanent capacity for oil storage is less than gross volume because a certain volume of unoccupied capacity must be provided for brine. Data shown is from DOE's Facilities Development Plan, October, 1986.

[b]Differences with previous reports reflect the affect of remedial leaching and the movement of oil.

[c]The total capacity available is currently reduced by 2.4 million barrels pending the completion of remedial leaching (sump enlargement) at 3 West Hackberry sweet crude oil caverns.

Source: DOE.

APPENDIX I

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