BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Chairman, Subcommittee On Environment, Energy, And Natural Resources Committee On Government Operations House Of Representatives

Analysis Of Oil Withdrawal And Distribution Tests For The Strategic Petroleum Reserve

Periodic tests of the oil withdrawal and distribution capabilities of the Strategic Petroleum Reserve (SPR) would help demonstrate that the system will work in a crisis. GAO assessed the feasibility, cost, effectiveness, and oil market impact of several suggested SPR test scenarios involving either oil sales or storage and examined factors that should be considered in designing a cost-effective test.

GAO noted that the suggested tests are generally feasible. However, to provide the most confidence in total SPR system reliability, a test should involve a drawdown and distribution at maximum sustainable capacities. Test costs could be minimized by storing a maximum of withdrawn oil at SPR terminal sites and by simulating oil sales.

GAO also noted that a combined sales/storage test could be (1) designed to stress the SPR system by maximizing both oil withdrawal and distribution and (2) sustained as long as desired but would likely cost more than either a sales or storage test.

GAO/RCED-85-115
MAY 8, 1985

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-208196

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

Dear Mr. Chairman:

Your December 27, 1984, letter (see app. I) expressed the subcommittee's concern that the Department of Energy (DOE) periodically test actual drawdown and sales of oil from all Strategic Petroleum Reserve (SPR) sites to help demonstrate that the system will work in a crisis. You requested that we analyze the feasibility, cost, effectiveness of testing actual SPR operations, and possible impacts on oil markets of the following suggested scenarios:

--withdrawal and sale of 1.1 million barrels (MMB) of oil over a 30-day period,

--withdrawal and sale of 2.1 million barrels per day (MMB/D) for periods of 7 and 14 days, and

--withdrawal and storage of 2.1 MMB/D for periods of 7 and 14 days.

In addition, you asked that we provide our views on factors that should be considered in designing a cost-effective SPR test and on the utility of oil exchange arrangements between DOE and private firms to facilitate an SPR test.

The results of our analyses with regard to our withdrawal/sales and withdrawal/storage scenarios are summarized below. The objectives, scope, and methodology (including assumptions used in our analyses) are given in appendix II. Additional details on the test scenarios and on oil exchange arrangements are given in appendixes III and IV, respectively.

SPR OIL WITHDRAWAL/SALES TEST SCENARIOS

All of the sales-oriented scenarios in your letter are feasible and within the system's current drawdown/distribution

capabilities. At the present time oil can be withdrawn from the SPR at the rate of about 2.9 MMB/D. In addition, the present distribution capability of the three marine terminal complexes--Capline, Texoma, and Seaway--that are connected by pipeline to the five operating SPR sites is limited to 2.3 MMB/D.

DOE officials did point out some potentially disruptive effects of a sustained SPR test at the higher withdrawal rates with a duration of 5 to 7 days. Unlike expected conditions during an actual oil supply disruption, local marine terminal facilities would handle a normal volume of oil while the SPR tests were being conducted. These officials cited possible adverse side effects, such as terminal congestion and commercial oil pipeline capacity tie-ups. Marine terminal officials, on the other hand, told us that, with appropriate planning and advance notification, they did not see any particular problems in meshing an SPR test with normal commercial operations.

DOE officials also expect that a 5- to 7-day test would disrupt normal SPR storage development and oil fill operations. Depending on the length of the tests, DOE would have to adjust its SPR site development and oil delivery schedules. Information obtained from DOE officials on site development activities indicates that DOE should be able to accommodate a withdrawal test for 5 to 7 days. Beyond that time, however, schedule adjustments would likely be required.

Costs--electrical, administrative, operations/maintenance, terminal, and oil replacement--of the proposed tests increase with test size and duration. In addition, offsetting revenues from the proposed oil sales would likely not cover oil replacement costs because buyers would probably require discounts from market prices to cover their cost of complying with (1) certain restrictive terms in DOE's Standard Sales Provisions and (2) the Jones Act (46 U.S.C. 883) requirement that cargo moving between U.S. ports--such as oil transported between SPR marine terminals and U.S. refineries--be carried on U.S.-flag ships as opposed to the lower cost foreign-flag ships normally employed by U.S. refiners to import oil.[1]

DOE has estimated that the expected discount resulting from compliance with its Standard Sales Provisions would range from $0.30 to $0.60 per barrel. To the extent that U.S.-flag ships were required to transport SPR test oil, DOE has estimated that buyers of SPR oil under nonemergency conditions would seek additional discounts of between $0.43 and $1.68 per barrel, depending

---

[1]If an oil disruption were to occur, buyers would be actively bidding for SPR oil and neither of these two discounts would apply to oil sales.

upon the destination of the SPR oil. This discount would not apply to any test oil delivered via pipeline to refineries. Further, the discount likely to be required by buyers for compliance with the Jones Act could be avoided or reduced if, for test purposes, the Jones Act requirement were waived so that buyers could use any source of water transport.

Regarding your concern about the impact of a test on oil markets, the market most likely to be affected by selling SPR oil under test conditions would be the spot market. This is an informal, world-wide network of oil companies, traders, and brokers who buy and sell oil in an open and unregulated market compared to the more formal, long-term contract market. Because of the lack of data on spot market price relationships with supply and demand, we could not determine the impact of selling test SPR oil. We did, however, determine the estimated amount of crude oil currently being sold in the spot market on a daily basis and calculated what percentage of that amount would likely be the result of selling various volumes of SPR oil. Current free-world crude oil production is about 40 MMB/D. Based on discussions with several market traders and observers, about 50 percent of total oil production, or about 20 MMB/D, currently moves in the spot market. The volume of SPR test oil that would be added to the spot market under the three sales scenarios could range as high as 10.5 percent on a daily basis. The duration of each test would affect the overall impact of each sales scenario.

A summary of each test sale is given below.

A 1.1 MMB drawdown and sale over 30 days

A 1.1 MMB SPR drawdown test and sale conducted over a 30-day period lies well within the system's current drawdown and distribution capability. In our view, this test should pose no problem for terminal operators or materially affect continued SPR site operations.

We estimate that this test would cost between $1.1 and $2.9 million, with most of the cost incurred reflected in the differential between the revenues received for the oil and the cost to replace an equal volume after the test is completed.

The actual oil sale envisioned in this test could provide some indication of the efficiency of DOE's sales procedures, and some lessons might be learned. A full test of these procedures will be limited, however, because of the inability to replicate an emergency situation. For example, the relatively small volume of oil offered for sale could limit the number of bidders, which would not reflect the bid evaluation and contract preparation procedures expected during an actual oil disruption. In addition,

drawing down such a small oil volume over a 30-day period does not make sufficient demands on the system to stress SPR drawdown and distribution capabilities.

This test would likely have the least impact on oil markets. It reflects only about 5.5 percent of estimated daily spot market sales if all 1.1 MMB were offered in one day and much less if the oil were offered for sale over a longer time period.

A 2.1 MMB/D drawdown and sale for 7 and 14 days

Test drawdowns and sales at a rate of 2.1 MMB/D for either 7 or 14 days appear to be feasible, although DOE's concerns about terminal, pipeline, and SPR site development problems would be more applicable in these tests than in the preceding scenario. These tests would require distribution of the oil to buyers both through terminal-connected pipelines and by pumping the oil across the marine terminal docks into ships or barges for water transport. Both distribution methods are within stated terminal capabilities.

We estimate the test costs at up to $30.1 million for a 7-day test and $60.2 million for a 14-day test if Jones Act shipping is employed. Not requiring Jones Act shipping would reduce these costs to about $14.2 million and $28.4 million, respectively.

Tests of this magnitude would come much closer than the smaller 1.1 MMB test to assessing DOE's sales procedures and its ability to manage an actual sale. From an operational standpoint, the 2.1 MMB/D oil withdrawal rate is well below the system drawdown capability of 2.9 MMB/D but only about 10 percent below the current 2.3 MMB/D distribution capability. Since the greatest amount of stress is likely to occur as the system approaches its maximum capability, this test is a better indication of distribution than drawdown capability.

A 2.1 MMB/D sale of SPR oil would constitute about 10.5 percent of current spot market oil transactions. Because of the lack of data on spot market activity, we could not determine the likely effect of this quantity of oil on spot market prices.

SPR OIL WITHDRAWAL/STORAGE TESTS

The availability of terminal storage and the current marine terminal distribution capability limit the maximum size and duration of storage-oriented tests to 2.3 MMB/D for about 7 days. To achieve this test level, offshore storage, such as ships or barges, would be required to supplement the available terminal storage. The unidirectional nature of pipelines between the terminals and refineries would limit their use as a means of returning the oil to the storage sites after the test.

Since no sales are involved, the costs of the tests would be significantly lower than comparable sales-oriented tests. Under the withdrawal/storage scenario, there would be no market impact. Neither would there be a basis to measure the effectiveness of SPR sales procedures under actual conditions.

Details of the specific scenarios are given below.

A 2.1 MMB/D withdrawal/storage test for 7 and 14 days

A 2.1 MMB/D test--in which the oil is withdrawn for 7 days, temporarily stored, and returned to the SPR sites--appears to be feasible under current conditions. Because of storage and terminal ship-loading limitations, however, a similar test conducted over a 14-day period could not be accomplished.

Terminal facilities can presently transfer oil from the SPR sites to water-borne storage at the rate of about 1.55 MMB/D. In a 2.1 MMB/D test, this leaves about 0.55 MMB/D to be stored at the terminals since, as mentioned earlier, the oil probably could not be effectively transported through pipelines from the terminals to refiners and subsequently returned to the SPR sites. In addition, some terminal storage will be needed as surge capacity between the incoming SPR oil and the oil flow over the docks into ships or barges. Therefore, based on the limited storage/transfer capacities of specific terminals, this test is effectively limited to about 8 days.

We estimated that a storage-oriented, 2.1 MMB/D test for 7 days would cost approximately $7 million. Maximum use of terminal storage would reduce costs for terminal operations and floating storage.

ALTERNATIVE TEST DESIGN CONSIDERATIONS

As you requested in your letter, we have also looked at the question of what amount of oil should be moved, and over what time period, to adequately test the SPR in a cost-effective manner. We developed our response in a format similar to that used in the preceding scenario analyses.

To provide maximum confidence in total SPR system reliability, we believe the system should operate either at design capacity or at the maximum capacity permitted by the conditions existing at the time the test is conducted. Although there is no defined time period that the SPR should run to test system reliability, engineers familiar with the SPR, or with equipment comparable to that used by the SPR, believe that a reasonable time period for a test is 5 to 7 days.

In addition to these considerations, we used the following conditions in formulating our assessment:

--The current total drawdown capability of the 5 SPR sites is about 2.9 MMB/D; and although this is expected to increase as site development and oil fill increase, the rate will probably remain constant over the next 1 to 2 years.

--The stated distribution capability of the 3 marine terminals is 2.3 MMB/D (pipeline and ship/barge loading capacity). This is supported by about 9.0 MMB of storage tank capacity at the terminal complexes and Bryan Mound site.

--In addition to total SPR drawdown and terminal distribution capabilities, each SPR site has its own drawdown rate, and each terminal complex associated with a particular site has its own distribution capability and storage capacity.

Feasibility and effectiveness of test options vary

Within the above conditions, several test options are feasible, each with its own degree of effectiveness in testing the full operational capability of the system. The first option would involve the withdrawal and sale of SPR oil. This would allow DOE to fully test the 2.3 MMB/D distribution capability of the three marine terminals. Although not utilizing the full 2.9 MMB/D drawdown capability, the test could be structured so that the maximum drawdown rate of one or more of the individual sites could be achieved without exceeding the distribution capability. This would allow the test to run for as long as it was considered practical. Further, a test with oil sales would provide the opportunity for DOE to test the effectiveness of its sales procedures.

A storage-oriented test could also be devised that would test the full 2.9 MMB/D drawdown capability of the SPR sites. This test, however, would not utilize the maximum distribution capability of the marine terminals because much of the oil would likely be retained in storage tanks at the terminals instead of being sent through pipelines or loaded into ships or barges. The 2.9 MMB/D drawdown rate could be sustained for only 2 to 3 days, however, because of the limited storage capacity and ship-loading capability for SPR oil at the Capline complex. A storage-oriented test also would not provide the opportunity to test actual sales procedures although a simulated sale of SPR oil could be run in conjunction with this test. DOE has previously conducted simulated sales exercises to test its procedures. The National Petroleum Council has also recommended that such simulated SPR oil sales be conducted but with industry participation.

A third feasible option, not included in any of our previous analyses, is a combination oil sale and storage test. From our analyses of available data on terminal distribution and storage, it appears that such a combined test would make maximum use of both the 2.9 MMB/D SPR drawdown rate and the 2.3 MMB/D terminal distribution capabilities. Furthermore, such a test would provide the opportunity to test DOE's sales procedures and could be continued for the suggested 5- to 7-day test duration.

A combined sales/storage test would probably require extensive planning because of the complex task of coordinating oil withdrawal from 5 sites and merging that task with a cost-effective mix of on-site storage, floating storage, and the distribution of oil sold through pipelines and tankers/barges. This test would require the full cooperation of the oil industry and terminal operators, but it would appear to be the most representative of an emergency situation.

Test costs vary by option selected

SPR tests that include oil sales would be more costly than tests that moved the oil from the sites into temporary storage facilities and returned it to the sites when the test was completed. Additionally, the cost of the tests would increase in direct proportion to the quantity of oil moved.

The relatively high cost of sales-oriented tests results primarily from the expected discount from market prices for SPR oil because of the Jones Act requirement that U.S.-flag ships be used in any intra-coastal transportation. If a sales-oriented test were deemed advisable to test sales procedures and distribution capabilities, test costs could be reduced by a congressional waiver of the Jones Act requirement for SPR test purposes.

While storage-oriented tests are less costly than those with accompanying oil sales, they do not provide an opportunity to assess the effectiveness of DOE's sales procedures. At least one option exists that may partially compensate for this shortcoming. As discussed previously, a storage-oriented test can be accompanied by a simulated sale to test emergency procedures as much as possible. Some additional administrative costs would be incurred for running the simulation exercise; however, we have not attempted to determine this amount.

Although the costs of a combined sales/storage test would probably be higher than either a sales or storage test, cost effectiveness could be achieved by increasing the quantity of oil stored and decreasing the amount sold. A cost analysis for this action would require detailed information on marine terminal operations and costs that was neither readily available to us nor could it be developed in our time frame.

Oil market impact of SPR sales is uncertain

Possible impacts on oil markets would have to be factored into a test design only if it included oil sales. Because of current distribution limitations, 2.3 MMB/D of oil is the most that could be sold under the options. This equates to about 11.5 percent of current estimated spot market transactions. As mentioned previously in our scenario analyses, we could not determine how this would affect oil market prices.

EXCHANGE OPTION

Some oil industry officials have advocated the idea of conducting SPR and private oil exchanges as part of a possible test methodology.

Oil exchanges are arrangements in which oil owned by one party is "exchanged" for a like kind and amount of oil owned, or to be acquired, by another party. Industry officials we contacted told us that these exchanges are not uncommon among private sector firms and that they typically involve payment of some cash differentials to compensate for marginal differences in the characteristics of the crude oil exchanged.

Oil exchanges would allow for longer, sustained-capability system testing than some other scenarios analyzed. That is, by transferring withdrawn SPR test oil to a private exchange party, the limited, available marine terminal storage facilities can remain unfilled and will support operational surge requirements for a longer period. This could allow a longer, sustained-test duration. Also, exchange-oriented test methodologies could probably be used in connection with other test methodologies, such as storage-oriented testing, to enhance test flexibility, duration, and demonstration value.

However, DOE officials we contacted noted that, while they had not thoroughly evaluated the possibility of SPR oil exchange options, they did not believe that DOE could conduct such arrangements in the same manner as private industry. They pointed out that DOE would most likely require extensive, formal guarantees and assurances (similar to the Standard Sales Provisions) regarding the private-sector exchange party's oil replacement performance requirements. Similar to SPR sales arrangements, any exchange agreements would likely have to be effected on some competitive basis. Further, oil exchanges would not provide DOE a basis for evaluating its existing sales procedures.

Unlike private-sector oil exchange arrangements, many uncertainties exist regarding SPR oil exchanges. The uncertainties involve legal, procedural, and cost issues. We believe,

therefore, that SPR oil exchange test methodologies should be further analyzed prior to any proposed implementation.

- - - - -

This review is based on information obtained in the first quarter of 1985 and was performed in accordance with generally accepted government auditing standards. The views of directly responsible officials were sought during the course of our work and are incorporated in the report where appropriate. In accordance with your wishes, we did not request DOE to review and comment officially on a draft of this report.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 3 days from the date of its issuance.

Sincerely yours,

J. Dexter Peach
Director

Contents

ILLUSTRATIONS

ABBREVIATIONS

B/D	Barrels per day
DFSC	Defense Fuel Supply Center
DOE	Department of Energy
GAO	General Accounting Office
LOOP	Louisiana Offshore Oil Port
MMB	Millions of barrels
MMB/D	Millions of barrels per day
MSC	Military Sealift Command
SPR	Strategic Petroleum Reserve

APPENDIX I

NINETY-EIGHTH CONGRESS

Congress of the United States

House of Representatives

ENVIRONMENT, ENERGY, AND NATURAL RESOURCES
SUBCOMMITTEE
OF THE
COMMITTEE ON GOVERNMENT OPERATIONS
RAYBURN HOUSE OFFICE BUILDING, ROOM B-371-B-C
WASHINGTON, D.C. 20515

December 27, 1984

Honorable Charles A. Bowsher
Comptroller General
U.S. General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Bowsher:

As you know, the Subcommittee on Environment, Energy and Natural Resources has been reviewing the Strategic Petroleum Reserve program on an ongoing basis.

One specific concern of the Subcommittee has been that the Department of Energy periodically test actual drawdown and sales of oil from all SPR sites to help demonstrate that the Reserve system will work as planned in a crisis. In fact, the full Government Operations Committee recommended periodic SPR tests in a May 17, 1984 report called: "Preparing for the Next Energy Crisis: DOE's Management of the International Oil Sharing Test." The report followed a Subcommittee investigation and hearings on the international oil crisis response test, AST-4.

Legislative proposals for SPR tests were considered in 1984 and appear certain to be considered again in the 99th Congress. Therefore, I would like the General Accounting Office to provide the Subcommittee with the following information on issues related to SPR tests:

* To what extent would SPR drawdown, distribution and sales capability be demonstrated by a test withdrawal and sale of 1.1 million barrels of SPR over a 30 day period? Approximately how much would it cost the government to conduct such a test? What revenues could be expected to result from the test sale of the oil (if the oil sold in the test was priced at a level at least 90% of the price of oil in the Gulf sold on the market at the time of the test)? How would these revenues compare with the expected costs of the test and the cost of replacing the test oil within one year of the test? What would be the likely effect of such a test on domestic and world oil markets in terms of price and supply?

APPENDIX I

* To what extent would SPR drawdown, distribution and sales capability be demonstrated by a test withdrawal and sale of 2.1 million barrels/day over a 1 week or 2 week period? Approximately how much would it cost the government to conduct such a test? What revenues could be expected to result from sale of the oil (if the price of the oil sold in the test was at least 90% of the price of oil in the Gulf sold in the market at the time of the test)? How would these revenues compare with the expected costs of the test and costs of replacement of the test oil within one year of the test? What would be the likely effect of such a test on domestic and world oil markets in terms of price and supply?

* Suppose the sales aspect of the test was dropped and DOE simply withdrew 2.1 million b/d over a 1 week or 2 week period, distributed the oil to some type of temporary storage or holding tanks and then after the test brought the oil back into SPR sites. Would this type of test be feasible? Does temporary storage on- or off-shore for SPR oil exist or could it be obtained. Approximately how much would it cost the government to conduct this type of test?

* What amount of oil should be withdrawn from the reserve, and over what period of time to adequately test SPR drawdown, distribution and sales capability on a cost-effective basis (given DOE statements that current SPR drawdown capability is more than 2.1 million b/d)?

* Some oil industry officials have advocated the idea of exchanging SPR oil for private oil instead of competitively selling the SPR oil in a test. How would such an "exchange program" work? Would this type of program test the adequacy of the SPR distribution system and SPR sales procedures?

GAO should be prepared to provide briefings as its work proceeds and, if necessary, to provide testimony and/or a report to the Subcommittee. If you have any questions regarding this request, please have your staff contact Lynn Stevens of the Subcommittee staff at 225-6427.

Sincerely,

MIKE SYNAR
Chairman

MS/ls

OBJECTIVES, SCOPE, AND METHODOLOGY

The objective of our review was to analyze several optional scenarios for testing the SPR capability to move oil from the storage sites into the commercial distribution system or storage facilities. The five scenarios are related to two primary test methodologies: (1) SPR oil withdrawal and sale with replacement purchases and (2) SPR oil withdrawal, temporary storage, and return of the oil to the storage sites for reinjection into the caverns. Our analysis included the five SPR sites that contain oil inventories: Weeks Island, Bayou Choctaw, West Hackberry, Sulphur Mines, and Bryan Mound. We also included the marine terminal complexes--Capline, Texoma, and Seaway--that serve as the focal points for distributing the oil stored at the five sites (see fig. 1).

In analyzing the scenarios posed in the request letter (see app. I), we assessed the tests on the basis of the following elements:

--Are the tests feasible, i.e., can they be done?

--What are the costs?

--Are the tests effective in utilizing the system components to the maximum extent possible?

--What is the impact on the spot oil market of SPR oil sales?

During our review we obtained information from officials of the Department of Energy (DOE), the Defense Fuel Supply Center (DFSC), the Military Sealift Command (MSC), the Louisiana Offshore Oil Port (LOOP), and SPR-connected marine terminals in Nederland and Freeport, Texas. In addition, we reviewed publications, studies, and DOE program documents related to SPR.

As a measure of feasibility, we compared the amount of oil to be withdrawn and sold/stored in each scenario with (1) the current stated capability of the SPR sites to withdraw oil at the rate of 2.9 million barrels per day (MMB/D); (2) the total 2.3 MMB/D capability of the three marine terminals to move oil from temporary storage tanks over the docks for loading onto tankers and/or barges at a rate of 1.55 MMB/D and into pipelines for transfer to refineries at a rate of 0.75 MMB/D; and (3) the total 9.0 MMB storage capacity at the Bryan Mound site and the three marine terminal complexes.

We assumed that the full terminal capacity to move 2.3 MMB/D of SPR oil would be available for test purposes. This includes ship-loading capacity of about 320,000 B/D at the Seaway marine terminal complex, which handles oil from the Bryan Mound site.

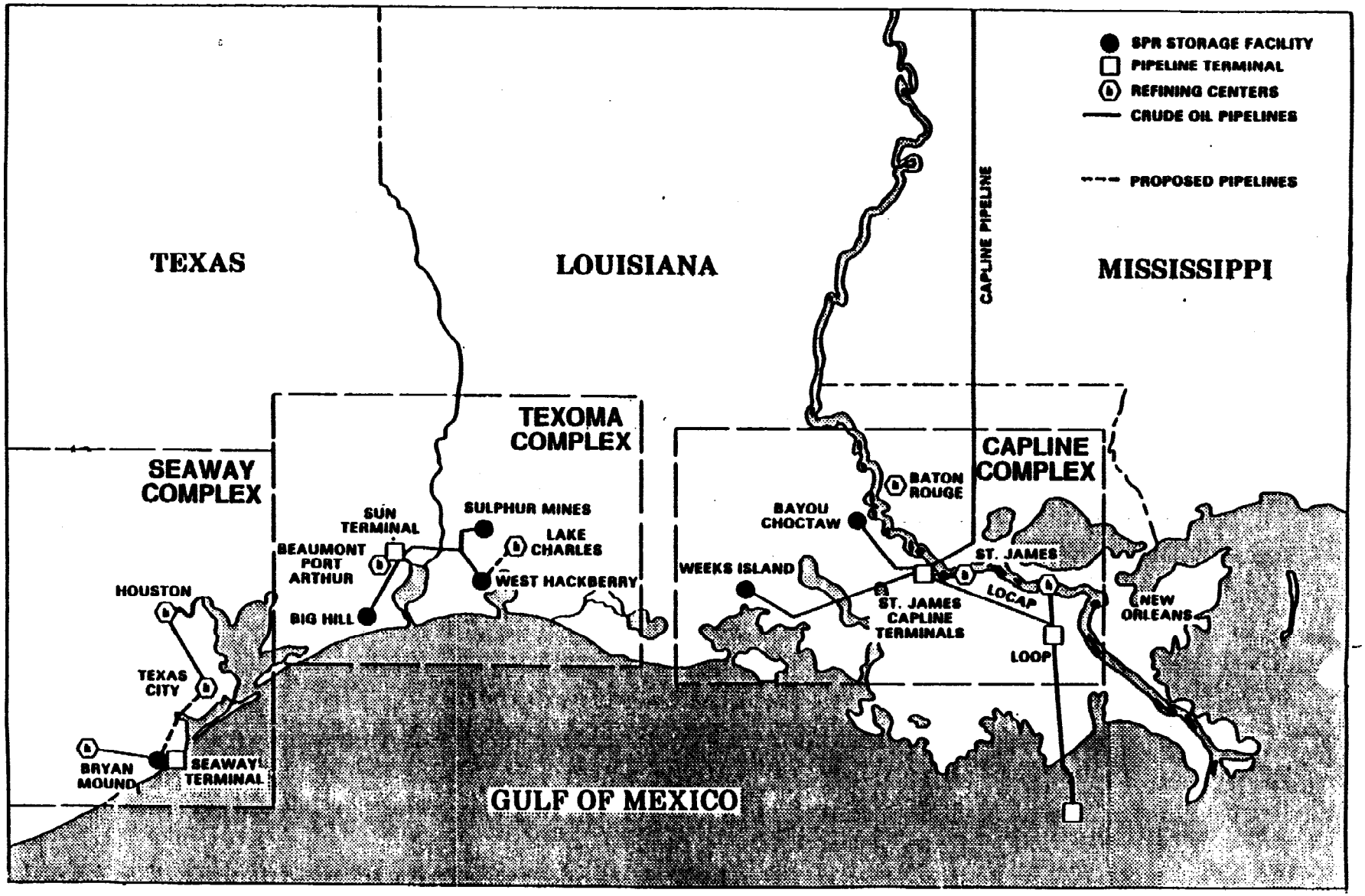

Figure 1. The Strategic Petroleum Reserve.

APPENDIX II

Seaway terminal officials told us that the terminal needs metering capability for custody transfer of oil moved over the dock to comply with DOE requirements and better control/communication linkage with the Bryan Mound site before they would be willing to participate in a test. Because these improvements are not difficult to make, we have assumed for the purpose of our analysis that they would be made. We have, therefore, included this terminal capacity in our analysis. Without this assumption, all of the tests using a 2.1 MMB/D withdrawal rate would exceed the available distribution capacity.

DOE officials managing the SPR program stated that successful tests could increase confidence in the system but expressed concerns regarding the potentially disruptive effects of conducting tests in which large quantitites of oil would be withdrawn over a sustained period of time under nonemergency conditions. Unlike conditions expected to occur during an emergency, terminals would be handling a normal volume of oil during an SPR test. The officials cited possible adverse side effects of this situation, including marine terminal congestion, disrupted SPR operations, and commercial oil pipeline capacity tie-ups.

Marine terminal officials, however, told us that with appropriate planning and advance notification, they did not see any particular problems in merging an SPR test with normal commercial operations. Therefore, our scenario analyses have not considered the effect of DOE officials' concerns in assessing the feasibility of the tests.

The cost data used in our analyses are based on estimates provided by DOE and others. We verified major cost components; but because of time constraints, we did not verify all of the routine costs involved in SPR operations. In estimating the cost of conducting the test scenarios, we separated the costs into two categories: (1) costs for site operations/maintenance, electricity, terminal operations, and overall administration that were assumed to be directly proportional to the quantity of oil involved in each of the five scenarios and (2) the cost differential between selling the oil at a discount from prevailing market prices and replacing the oil after the test at full market price. We assumed a single $30 per barrel market value for both oil sold and oil purchased for replacement after the test. In actuality, the cost of replacement oil would include additional, but unknown, transportation and customs costs. However, since these additional costs would remain constant across all scenarios, we have not included estimates of them in our analyses.

In estimating the costs of the tests that included oil sales, we assumed that the pipeline capacity would be utilized first because (1) no incremental costs exist because of nonemergency conditions and (2) it represents the lowest cost transportation method. In addition, a number of Gulf Coast refineries are

accessible by pipeline from the terminals. The remaining volumes of oil would then be transported either by U.S.-flag ships because of the Jones Act requirements or by foreign-flag tankers in the event a Jones Act waiver could be obtained for test shipments. We assumed that no incremental costs would be incurred for oil shipped via foreign-flag tankers since they reflect the lowest cost shipping normally used. As a result the oil sales revenues used in our cost analyses are reduced in direct proportion to the volumes of oil sold during the test scenario.

The cost differential between the sales price and replacement cost referred to previously results from two factors. Sales under DOE's Standard Sales Provisions would be based on contractual arrangements between DOE and buyers that would be used in any oil sale and require that the buyer post both offer and payment/ performance guarantees. Because these requirements impose costs on the buyer, DOE estimates that potential buyers would require discounts of $0.30 to $0.60 per barrel from the basic market price of $30 to participate in a sale under nonemergency conditions.

The Jones Act legislation requires that cargoes transported between U.S. ports be carried on U.S.-flag vessels. This requirement increases the purchasers' costs because U.S.-flag vessels typically cost more than foreign-flag vessels providing similar transportation. Thus, purchasers of SPR oil who must transport it from the marine terminals by ship could be expected to discount their bids for nonemergency SPR test oil because of the Jones Act requirement. DOE has estimated this expected discount at between $0.43 per barrel to $1.68 per barrel depending upon the destination of the SPR test oil. This discount would not apply to any test oil delivered via pipeline, nor would it apply to any SPR oil transported on foreign-flag vessels. In our scenario analyses, we have used the higher discount rate in each of the above costs. Under actual emergency conditions, however, buyers would be actively bidding for SPR oil, and these discounts would not be required.

We assessed the effectiveness of each test by determining whether it maximized the overall drawdown and distribution capability of the SPR sites and the marine terminals as well as the individual SPR site and marine terminal capabilities.

To assess the potential market impact of selling the SPR oil withdrawn during each test, we determined the estimated amount of crude oil currently sold in the spot market[1] on a daily basis and

---

[1]The spot market is an informal, world-wide network of oil companies, traders, and brokers who buy and sell oil in an open and unregulated market on a daily basis. This is in contrast to the more regulated, long-term contract market where oil supplies and prices are more stable.

calculated what percentage of that amount would likely result by selling various volumes of SPR oil. Current free-world crude oil production is about 40 MMB/D. On the basis of discussions with several market experts, traders, and observers, about 50 percent of the 40 MMB/D production, or about 20 MMB/D, moves in the spot market. However, because of the nature of spot oil market transactions and the lack of data on the relationships of price with supply and demand, we could not measure the price impact of offering SPR oil for sale.

GAO ANALYSES OF ALTERNATIVE SPR TEST SCENARIOS

In accordance with a December 27, 1984, request from the Chairman, Subcommittee on Environment, Energy, and Natural Resources, House Committee on Government Operations, we analyzed the following SPR test drawdown scenarios:

--1.1 MMB of oil withdrawn and sold over a 30-day period;

--2.1 MMB/D of oil withdrawn and sold for 7 days;

--2.1 MMB/D of oil withdrawn and sold for 14 days;

--2.1 MMB/D of oil withdrawn for 7 days, stored, and returned to the SPR storage sites; and

--2.1 MMB/D of oil withdrawn for 14 days, stored, and returned to the SPR storage sites.

We analyzed each test in terms of feasibility, cost, effectiveness in testing system capability, and possible impact on oil markets. At the subcommittee's request, we also assessed both the amount of oil that would need to be moved, and over what time period, to adequately test the SPR system in the most cost-effective way and the potential for using oil exchanges. The results of our work follow.

A 1.1 MMB SALE OF SPR OIL OVER A 30-DAY PERIOD

A 30-day, 1.1 MMB drawdown test and sale of SPR oil is feasible since it is well within the current drawdown capability of 2.9 MMB/D and the distribution capability of 2.3 MMB/D. Furthermore, the size of the withdrawal and the allowed time period for distribution provide DOE a number of options as to site(s) to be used and methods of distribution to buyers--pipelines, water-borne transport (tankers or barges), or a combination of these two. In practical terms any one of the five SPR sites that have oil stored could provide 1.1 MMB of oil over a 30-day period, or each of the sites covered could provide some share of the oil.

Distribution of SPR oil to buyers could be made through pipelines associated with the Seaway, Texoma, and Capline complexes or through oil tankers or barges that can be loaded at the three complexes. The pipelines have a maximum capacity of 750,000 B/D, and the combined loading capability of the three complexes is about 1.55 MMB/D.

Using DOE cost figures, we estimate that a 1.1 MMB/D test would cost about $400,000 for site operations/maintenance,

electrical, administrative, and terminal costs. Using the DOE high estimates for bid discounts related to both Jones Act shipping and Standard Sales Provisions guarantees, we project sales revenues of from $30.5 million to $32.3 million, depending upon oil destination and delivery mode. A comparison of projected test revenues, test costs, and the cost of oil replacement follows.

Table 1

Comparative Costs for a 1.1 MMB, 30-Day Sales Test

	High cost[a]	Low cost[b]
	(millions)	
Test revenues	$30.5	$32.3
Test costs	.4	.4
Net revenues	30.1	31.9
Refill costs	33.0	33.0
Unrecovered costs	$(2.9)	$(1.1)

[a]Applies to water-borne shipments requiring U.S.-flag tankers.
[b]Applies to pipeline shipments and waivers of Jones Act requirements for water-borne shipments.

A 1.1 MMB oil withdrawal and sale would provide some measure of DOE's ability to initiate and evaluate actual bids for SPR oil sales, write contracts, and arrange for delivery of the oil to the terminals for transfer to the buyers. However, to the extent that (1) an emergency environment could not be effectively replicated, (2) certain adjustments would have to be made to the Standard Sales Provisions and other features of the test demonstration (such as the bidding process and bond-posting verification), and (3) the relatively small volume of oil offered for sale limits the number of bidders, it appears that the conclusions reached about DOE's sales procedures and performance and the demonstration value of the test would be limited. Further, from an operational perspective, the small volume of oil withdrawn from SPR sites and distributed through the terminals--in relation to actual capability--would not provide sufficient stress to test the system's capability to deliver oil at maximum rates for a sustained period of time.

The impact of this SPR test sale/distribution on the spot oil market could not be readily identified, both because of the nature of the spot market and because of the time period allowed in this scenario for actually selling the oil. On the basis of the estimated 20 MMB/D of oil that moves in the spot market, the 1.1 MMB would represent about 5.5 percent of the total--if it were all sold in one day. If sales were spread over several days or weeks, the impact would be much less.

A 2.1 MMB/D SALE FOR 7 DAYS

A 7-day, 2.1 MMB/D SPR drawdown test and sale (14.7 MMB of oil) could be accomplished. However, combined pipeline and over-the-dock marine terminal distribution capabilities would be required to move the oil. Unlike the smaller 1.1 MMB test that allowed a choice of distribution methods, the combined distribution capability would be required because current over-the-dock capability is limited to 1.55 MMB/D. The 750,000 B/D pipeline capacity would, therefore, be required to supplement the tanker/barge-loading capability.

A 7-day withdrawal of 2.1 MMB/D would increase the basic operation/maintenance, electricity, administrative, and terminal costs over those of the smaller test. We assumed that the maximum pipeline capacity would be used since there would be no transportation discount from market price required by buyers who could use this mode of transporting the oil. This would leave about 1.35 MMB/D to be pumped over the terminal docks into tankers or barges. We computed the test costs with and without the Jones Act requirements for U.S.-flag transportation to show the differences.

As in the preceding scenario, we used the DOE high estimate for bid discounts in computing the estimated cost differential between the sales price and subsequent replacement costs. These estimates are shown in table 2.

Table 2

Comparative Costs for a
2.1 MMB/D, 7-Day Sales Test

	High cost[a]	Low cost[b]
	--------(millions)--------	
Test revenues	$415.8	$431.7
Test costs	4.9	4.9
Net revenues	410.9	426.8
Refill costs	441.0	441.0
Unrecovered costs	$(30.1)	$(14.2)

[a]With Jones Act shipping.
[b]Without Jones Act shipping.

Although a 7-day, 2.1 MMB/D test would come closer to demonstrating the current capability of the SPR than the 1.1 MMB scenario, it still would not provide maximum stress to the overall drawdown or distribution capability of the system. A test of this size, however, could be used to test the current drawdown capability of specific sites if the appropriate types of oil could be sold. For example, oil could be withdrawn from the West Hackberry, Sulphur Mines, Weeks Island, and Bayou Choctaw sites at current capacity and sent to the marine terminals for distribution. The one exception could be the Bryan Mound site, which has a daily drawdown capability greater than the 387,000 barrels of oil that can be distributed over the docks at the associated Seaway terminal and sent by pipeline to a local refinery. Because of this limitation, no sales test could currently put maximum stress on Bryan Mound's drawdown capability.

As with drawdown the stress on terminal distribution capability is uncertain. The extent to which maximum capability would be utilized depends on which site DOE would use to provide the oil. The Seaway terminal, for example, could be used to its maximum capability if Bryan Mound oil were sold. If both Weeks Island and Bayou Choctaw sites were drawn down together at design capacity, the 830,000 B/D rate would nearly meet the St. James terminal capacity of 880,000 B/D. A 1.1 MMB/D drawdown at the West Hackberry site, however, would not test the maximum capability of the Texoma complex.

In our opinion this test of DOE's sales procedures would generally have the same benefits and limitations as the 1.1 MMB test sale. However, it is possible that a larger sales volume compressed into a shorter time period would disclose some problems with the sales procedures (bid evaluations, contract preparation, delivery schedules) that a 1.1 MMB test with sales spread over a 30-day period would not show. Therefore, in this respect, this test may be a better indicator of how effective DOE's sales procedures would be in an emergency situation.

The impact on oil markets of offering 2.1 MMB/D of SPR oil for 7 days would likely be much greater than a single 1.1 MMB offering. It would not only constitute a larger percentage of total spot oil market transactions (10.5 percent versus 5.5 percent or less for 1.1 MMB) but would also continue to offer this amount of oil for 7 days.

A 2.1 MMB/D Sale for 14 days

Extending the previous test scenario by an additional 7 days also appears to be feasible. A test of this length would probably require a greater degree of planning as it could more readily interfere with the oil fill operations at the storage sites than would a 7-day test. DOE would probably have to change its cavern development schedule if the oil pipelines between the marine terminals and the storage sites were not available for incoming oil for a 14-day period.

When the same cost component estimates and assumptions about buyer discounts are used, doubling the time period at the 2.1 MMB/D rate is expected to double the costs of the preceding test scenario. These are shown in table 3.

Table 3

Comparative Costs for a 2.1 MMB/D, 14-Day Sales Test

	High cost[a]	Low cost[b]
	(millions)	
Test revenues	$831.6	$863.4
Test costs	9.8	9.8
Net revenues	821.8	853.6
Refill Costs	882.0	882.0
Unrecovered costs	$(60.2)	$(28.4)

[a]With Jones Act shipping.
[b]Without Jones Act shipping.

A 14-day test at 2.1 MMB/D would have about the same effectiveness in testing drawdown and distribution capabilities and DOE's sales procedures as the 7-day test at the same daily rate. It would, however, put more stress on SPR site personnel and their ability to keep the equipment operating over a longer sustained time period. In this respect it would be a better test than the two preceding scenarios.

While the test would continue to provide an opportunity for continued evaluation of DOE's sales procedures, it is questionable whether a 14-day test period would elicit any more concerns about DOE's sales procedures than a 7-day test.

The impact on the oil market appears to be the same as the 7-day test's. Doubling the time period of this scenario from 7 to 14 days would not change the percentage of SPR oil going into the spot market on a daily basis. However, if the spot market participants look at the total amount of SPR oil being made available rather than view it on a daily basis, then a 14-day test could have more of an impact than the 7-day test.

A 2.1 MMB/D WITHDRAWAL FOR 7 DAYS WITHOUT SALES

A 7-day, 2.1 MMB/D withdrawal of SPR oil without selling any of the oil poses implementation problems that are not present with a sale, but it appears to be feasible when all three SPR complexes are considered together. The Capline complex has 1.4 MMB of

storage capacity; the Texoma complex, a 4.2 MMB capacity; and the Seaway complex, 2.4 MMB capacity. The Bryan Mound site also has on-site storage tanks for 0.6 MMB of oil.

The no-sale provisions of the scenario generally exclude the use of pipelines because of the difficulty and additional cost of returning the oil to the original storage sites after the test. Most commercial pipelines transfer oil in only one direction, and oil sent from the terminals to refineries through the pipeline would probably require a return to the SPR site(s) by some other routing.

The limited storage capacity at the Bryan Mound site and the three marine terminals requires that some of the 14.7 MMB of oil withdrawn from site storage during the test would have to be pumped over the docks and loaded into tankers or barges for transport to remote storage locations or held in floating storage for the test duration. The exact amount of oil stored in above-ground tanks at Bryan Mound and the terminals and the amount pumped over the docks can vary because the differing storage and loading capacities at the three complexes provide DOE some flexibility. The option exercised would dictate the quantities in each location. From a cost-minimization standpoint, DOE would likely maximize the above-ground storage capacity. If that option were followed, about 6.7 MMB of oil would probably have to be loaded into water-borne transportation with about 8.0 MMB stored at Bryan Mound and the terminal areas.

The cost of withdrawing and storing the 14.7 MMB of oil envisioned in the scenario is much less than for tests in which actual sale and replacement purchases are required. The costs associated with oil drawdown, reinjection, and terminal operations/enhancements are similar to those associated with the preceding sales-oriented tests. Test costs would also include leasing of floating storage and possibly some shipping (presumably Jones Act) if oil were sent from the Seaway complex to the Capline complex for interim onshore storage at the LOOP facility and returned to Seaway after the test. On the basis of DOE and Military Sealift Command cost data, we computed the following cost of conducting the proposed test.

Table 4

Comparative Costs for a
2.1 MMB/D, 7-Day Storage Test

Test cost element	Amount (millions)
Drawdown/refill costs	$4.9
Terminal enhancements	.3
Interim storage costs	1.8
Shipping costs	.12
Total	$7.12

On a total systems basis, a 2.1 MMB/D drawdown does not test the SPR's capability for achieving its current drawdown rate of 2.9 MMB/D. Depending on DOE's decision as to which sites would be used, the individual site drawdown rates could be realistically assessed, as was pointed out in the previous scenario discussions. Further, even with a limited overall drawdown rate, the 7-day test duration would provide some evidence that the drawdown operation can be sustained. As we also discussed, this test would come close to testing the stated distribution capability of the three marine terminals and would, in all likelihood, test the Seaway complex at maximum performance.

Since no sale of SPR oil is connected to this test, DOE's sales agreement and procedures are not involved. However, as opposed to a test sale in which buyers would arrange their own transportation, a storage-oriented test would require that DOE plan and coordinate the test parameters so that all test participants receive adequate notification. DOE will have to arrange for such items as ship/barge floating storage, tanker shipments between complexes if necessary, terminal and other onshore storage, and the return of the oil to each site after the test is completed.

The no-sale provision of this test also means that there would be no impact on oil markets of the test.

A 2.1 MMB/D WITHDRAWAL FOR
14 DAYS WITHOUT A SALE

A 14-day, 2.1 MMB/D test in which the oil is stored and not sold could not be accomplished under the current terminal storage and over-the-dock loading conditions. The 7-day test in the

preceding scenario would fully utilize the available storage capacity at the Capline complex. As the test continues for an additional 7 days, however, the daily withdrawal rate that could be accommodated by available storage continues to drop. For example, the 2.1 MMB/D rate could be fully sustained for about 8 days, with all sites participating, by increasing the drawdown rate at the Texoma complex and decreasing the Capline rate. From days 9 to 12, the sustainable drawdown rate would be only about 1.6 MMB/D; and after day 12, storage is available for only 1.0 MMB/D. These computations are based on maximum use of over-the-dock loading capacity and all available storage capacity at the Capline and Seaway complexes. The Texoma loading capability would be fully utilized, but some available terminal storage capacity would remain unused unless a better balance between terminal and floating storage could be arranged.

Since we determined that this test is not feasible at this time, we did not assess the estimated cost or the test's effectiveness in measuring system capability. As in the preceding scenario with no SPR sale, there was no market impact to assess.

OIL EXCHANGE PROGRAM ISSUES

Some oil industry officials have advocated the idea of conducting SPR and private oil exchanges as part of a possible test methodology.

Oil exchanges are arrangements in which oil owned by one party is "exchanged" for a like kind and amount of oil owned, or to be acquired, by another party. Industry officials we contacted told us that these exchanges are not uncommon among private sector firms and that they typically involve payment of some cash differentials to compensate for marginal differences in the crude characteristics of the exchanged oil. Further, among private-sector firms, these exchange arrangements are typically conducted on an informal basis without extensive contractual arrangements and provisions. Because of their prior experiences and familiarity with these types of arrangements, these industry officials foresaw no technical nor operational difficulty with participating in oil exchange arrangements with DOE.

However, DOE officials we contacted noted that, while they had not thoroughly evaluated the possibility of SPR oil exchange options, they did not believe that DOE could conduct such arrangements in the same manner as private industry. To illustrate, DOE would most likely require extensive, formal guarantees and assurances (similiar to the Standard Sales Provisions) regarding the private-sector exchange party's oil replacement performance requirements. Similar to SPR sales arrangements, any oil exchanges would likely have to be arranged on some type of competitive basis.

The DOE officials also noted that the inclusion of guarantees and assurances would likely produce the same offer (price) discounting that is associated with SPR oil sales since compliance with the guarantee provisions would cost exchange parties more than their routine manner of conducting business. They said that the offer discount would probably take the form of a cash differential premium above the normal amount and kind usually associated with exchanges.

The DOE officials noted that some legal issues would have to be studied regarding oil exchange arrangements. For example, Cargo Preference Act applicability could become an oil exchange issue since oil coming into the SPR as a replacement for oil transferred to a private firm would change from private to government ownership at some point. Government water-borne shipments are subject to Cargo Preference Act compliance while privately owned shipments are not.

Further, DOE officials noted that it is not clear whether SPR oil exchanges would be viewed as SPR sales. No present specific

authorization exists for a nonemergency SPR sale or exchange. Accordingly, SPR test sales/exchanges appear to require new legislation.

Finally, DOE officials pointed out that, particularly in the present excess-supply oil market, private-sector exchange participation may be dependent on profit opportunities. As a result an exchange test approach could prove more costly than storage- or sales-oriented test approaches.

We believe that oil exchanges would allow for longer, sustained-capability system testing than storage-only testing because they would allow the use of pipeline capacity to distribute additional quantities of available SPR oil. By transferring withdrawn SPR test oil to a private exchange party, the limited terminal storage facilities could remain unfilled and available for a longer period to support operational surge capacity requirements needed during ship/barge loading operations. This allows for a longer, sustained test duration. In addition, exchange-oriented tests could provide opportunities for SPR distribution/sales procedures' evaluation similiar to those previously described for sales-oriented tests and subject to the same general limitations.

Unlike private-sector oil exchange arrangements, however, many uncertainties exist regarding SPR oil exchanges. As discussed above, these include legal, procedural, and cost issues. We believe, therefore, that the use of oil exchanges during SPR tests should be further analyzed prior to any proposed implementatio

(001766)