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Information On Department Of Energy's Management Of The Strategic Petroleum Reserve

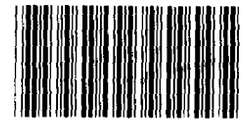
Senator Max Baucus and Congressman Donald Pease raised a series of questions regarding the Department of Energy's management of the strategic petroleum reserve program. This report answers their questions on

--alternative oil sources for the reserve,

--oil purchases for the reserve,

--salt cavern storage suitability, and

--oil storage alternatives.



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

ENERGY AND MINERALS
DIVISION

B-178205

The Honorable Max S. Baucus
United States Senate
The Honorable Donald J. Pease
House of Representatives

Your joint letter of December 14, 1978 (see appendix II), raised a series of questions regarding the Department of Energy's (DOE's) management and implementation of the strategic petroleum reserve program, and requested that we review and respond to you on these matters. Appendix I contains our responses to these questions. The responses are presented under seven subject areas and are keyed to the questions raised in the request letter.

We discussed these issues with officials in DOE and the Department of Defense's Defense Fuel Supply Center--the purchasing agent for the reserve oil. We examined pertinent agency program documents and files, including 26 out of the 29 oil procurement contracts for which crude oil has been acquired as of December 31, 1978. Regarding your questions on salt cavern feasibility, we were able to draw much of the information from two past reports--"Need to Minimize the Risk of Using Salt Caverns for the Strategic Petroleum Reserve" (EMD-78-25, Jan. 9, 1978) and "Questionable Suitability of Certain Salt Caverns and Mines for the Strategic Petroleum Reserve" (EMD-78-65, Aug. 14, 1978)--and from our ongoing review on the management controls over the reserve.

The oil procurement portion of this report was discussed informally with Defense Fuel Supply Center officials and their comments were incorporated as appropriate. We plan no further distribution of this report until 30 days from the date of its issuance. At that time, we will send copies to interested parties and make copies available to others upon request.

J. Dexter Peach
Director

BACKGROUND

The Energy Policy and Conservation Act (Public Law 94-163), dated December 22, 1975, requires DOE to create a strategic petroleum reserve to reduce the nation's vulnerability to interruptions of foreign petroleum supplies. This act required DOE to establish a reserve of at least 150 barrels of petroleum products by December 1978, and provided for the storage of up to 1 billion barrels of petroleum products in the reserve, subject to Congressional approval.

In December 1976, DOE submitted a Strategic Petroleum Reserve Plan that stated, in accordance with the act, that the reserve would contain 150 million barrels of oil by December 1978 and 500 million barrels by December 1982. DOE subsequently submitted plan amendments to establish new reserve storage targets of 250 million barrels by December 1978, 500 million barrels by December 1980, and 1 billion barrels by 1985.

Despite the strong emphasis DOE has placed on accelerating the storage time frame for the reserve, DOE officials have stated that the 1978 target of having 250 million barrels of oil in storage is not expected to be achieved until about December 1980, and the 1980 target of having 500 million barrels in storage will probably not be achieved until 1982 or 1985. A firm target date for a billion barrels no longer exists, and may never be reached, since the Congress and the Office of Management and Budget are reconsidering the need for a reserve of such size.

By mid-February 1979, 74 million barrels of oil were stored in three salt cavern sites near the Gulf Coast, which have been acquired for the reserve. The sites include West Hackberry and Bayou Choctaw in Louisiana, and Bryan Mound in Texas.

SOURCES OF CRUDE OIL PURCHASED FOR THE RESERVE (QUESTIONS 1, 2, AND 7)

All crude oil for the reserve was purchased from foreign countries, and purchases from Mexico were higher than those from any other country. Mexican oil purchases represent one-third of all reserve crude oil and almost 60 percent of all sour crude oil purchased as of January 19, 1979. The source countries, volumes, and types of crude oil awarded for the reserve, as of January 19, 1979, are shown in the following table.

TABLE 1

Sources of Oil Purchased for the Reserve

Source Country	Volumes (barrels)	Type of Crude
Norway (North Sea)	1,861,000	a/Sweet
United Kingdom (North Sea)	22,686,000	Sweet
Libya	20,410,000	Sweet
Algeria	160,000	Sweet
Venezuela	949,000	b/Sour
Ecuador	347,000	Sour
Saudi Arabia	3,734,000	Sour
Iran	18,358,000	Sour
Mexico	34,371,000	Sour
TOTAL	102,876,000	

a/Sweet crude is defined as having less than 0.5 percent sulfur content. Sweet crude purchased for the reserve had an American Petroleum Institute (API) gravity of between 35 degrees and 42 degrees. API gravity is the measure of mass of the fluid relative to water that ranges from about 10 degrees for heavy crude oils to 45 degrees for light crude oils.

b/Sour crude is defined as having more than 0.5 percent sulfur content. Sour crude purchased for the reserve had an API gravity of 32 degrees to 36 degrees.

According to Defense Fuel Supply Center officials, the policy toward Petroleos Mexicanos (PEMEX) and Mexico is the same as for other potential bidders. They are on the solicitation listing for all oil procurements for the reserve and thus have been sent requests to bid on all procurements. In response to these solicitations, PEMEX has bid four times, three of which resulted in contracts. These awards to PEMEX, as with the other awards, were based on low price, according to Defense Fuel Supply Center officials. They did point out, however, that there are other advantages to purchasing Mexican

oil, such as the low transportation costs and the flexibility in terms of scheduling deliveries.

RELATIONSHIP BETWEEN THE INTEGRITY OF SALT CAVERN STORAGE AND THE SEPTEMBER 1978 FIRE AT THE WEST HACKBERRY STORAGE SITE (QUESTION 3)

Salt cavern storage of crude oil is a proven technology if used with proper procedures. In the United States, salt caverns have been used for over 20 years to store petroleum products, including fuel oil and natural gas, but they have not been used to store crude oil. In France and West Germany, however, crude oil has been stored in salt caverns for several years.

The fire at the West Hackberry salt cavern, in itself, has no relationship to the integrity of salt cavern storage. It was the result of an equipment failure and poor management, not from the unfeasibility of storing crude oil in salt caverns. As a string of pipe was being pulled out of well 6 of cavern 6, drilling mud and a plug previously set in the lowest section of the pipe were forced out, causing oil in the cavern to flow out, forming fumes. The fumes were drawn into the air manifold intakes of nearby diesel engines, and before contractor personnel could turn off all the engines, an explosion occurred causing the fire.

The "Report on the Explosion, Fire, and Oil Spill Resulting in One Fatality and Injury on September 21, 1978," submitted to DOE in November 1978 by an accident investigation committee concluded that the fire would not have occurred if the plug had held. The committee concluded that this plug was not designed to be used in an environment present at the West Hackberry storage site, and that use of a different type of plug could have prevented the accident.

The committee also concluded that deficiencies on the part of DOE management may have contributed at least indirectly to the accident. These included: (1) a policy of giving predominant priority to getting "oil-in-the-ground", which was allowed to override prudent safety and contingency planning and implementation; (2) lack of established standards, review approval and monitoring procedures, and oil field expertise; and (3) an organizational lineup that split onsite responsibility, and was weak in attention to safety, quality assurance, and technical inputs.

We believe that oil can be stored in salt caverns successfully if adequate safety and technical standards are maintained. However, if these standards are not upheld, as was the case at West Hackberry, the potential exists for serious problems to develop.

EFFECTS OF CONTINUED BRINING OPERATIONS ON CAVERN SUITABILITY (QUESTION 4)

Our prior review of the cost and feasibility of salt cavern storage raised questions concerning the need for better information to reduce risks and uncertainties regarding the suitability of specific caverns for storage. One such issue concerned continued brining in caverns approved for oil storage.

DOE permitted the chemical companies who formerly operated the caverns to continue brine production at two of the storage sites after the caverns were tested and certified as suitable for oil storage. DOE agreed to allow the chemical companies to continue brine production in order to avoid further litigation and damage claims which were likely to result had DOE deprived the chemical companies of continued brine production.

During our prior review, DOE, while acknowledging the possibility that brining can cause cavern damage, believed the risk of such damage occurring was extremely low. In line with this belief, DOE was not planning to monitor the brining operations, nor retest the caverns after brining was completed before filling the caverns with crude oil.

In a January 1978 report to the Secretary of Energy on "Need To Minimize Risks of Using Salt Caverns for the Strategic Petroleum Reserve (EMD-78-25, Jan. 9, 1978), we recommended that DOE

--institute a formal control system during brining operations to assure that brine is not being produced in excess of safe rates of production and operating pressures, and

--retest the caverns after brining has been completed.

As a result of our report, DOE did set up a formal procedure for controlling brining operations at the two storage sites. DOE continues to believe, however, that retesting, after completion of brining operations, is unnecessary. Although a DOE official acknowledged that one cavern

was retested after brining, he stated that retesting would not have been performed if a new entry well had not been drilled into the cavern.

RISKS ASSOCIATED WITH OIL STORAGE (QUESTIONS 5 AND 9)

The Federal Energy Administration (FEA) 1/ began pumping crude oil in caverns 2 and 4 at Bryan Mound before testing an adjacent cavern--cavern 3.

As stated in our January 9, 1978, letter to the Secretary of Energy, although cavern 3 was not selected for storage, its suitability for storage is important because of its location in relation to caverns selected for storage. A cavern's exact location and distance are considered in cavern design analysis to determine (1) if caverns will grow together and (2) the impact of such growth resulting from crude oil displacement cycles. FEA used five such cycles for planning purposes and assumed the storage sites may have to be emptied as many as five times because of major supply interruptions. Cavern enlargement is expected to occur during each displacement cycle. Although its contractor recommended further testing of cavern 3, FEA determined from a previous analysis that there was adequate distance between cavern 3 and the two other caverns and concluded risks associated with oil fill were nonexistent. We believe that the information used by FEA to make this initial analysis was inadequate to indicate that the risks were nonexistent and, consequently, FEA should have delayed oil fill until the subsequent tests were completed and results analyzed.

The initial analysis performed to determine the distances between cavern 3 and the storage caverns was inadequate due to lack of information to verify the location of cavern 3. This is further supported by the results of subsequent tests performed on cavern 3 indicating that the minimum distance between cavern 3 and caverns 2 and 4 is 300 feet--200 feet or 40 percent less than FEA's earlier analysis indicated. Furthermore, although it now appears that no structural damages or financial loss will result due to FEA's decision to begin oil fill before the tests on cavern 3 were performed and analyzed, we believe that FEA took an unnecessary risk in

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1/The functions of the Federal Energy Administration were assigned to DOE on Oct. 1, 1977, pursuant to the Department of Energy Organization Act (P.L. 95-91).

view of the structural damages and financial loss that could have occurred.

Effects of long-term storage of crude oil in salt caverns

In our report to the Congress on "Questionable Suitability of Certain Salt Caverns and Mines for the Strategic Petroleum Reserve" (EMD-78-65, Aug. 14, 1978), we stated that DOE and petroleum company officials maintain that, although the length of time crude oil can be stored in salt caverns or mines and remain suitable for refining is unknown, they believe long-term storage should not have any detrimental effects on crude oil. U.S. petroleum industry researchers have developed information concerning the effects of salt cavern storage on hydrocarbon stability, but this information is generally based on storage periods of less than 1 year.

The West German Government has stored crude oil in salt caverns for over 8 years--the longest period of time crude oil has ever been stored in salt caverns. DOE awarded a contract in mid-1978 to the West German company that constructed and is operating these caverns to obtain detailed information on the stability of the stored crude oil. The contract will be completed in fall 1979 at a cost of about $300,000. To date, about 60 percent of the oil samples drawn out of three West German caverns has been analyzed. Preliminary results indicate no detrimental effect on the crude oil.

One DOE official stated that after the caverns have been filled a year or so, DOE plans to sample the oil in the caverns and test periodically the chemical composition of the crude oil. This information will then be given to refiners to make the necessary preparations to maximize product efficiency during any supply interruptions.

Potential crude oil losses in salt caverns

In our August 14, 1978, report, we stated that we discussed the potential for crude oil losses in salt caverns with DOE officials and with companies having experience in design, construction, and operation of salt caverns for crude oil storage--American petroleum companies, a West German company, and the Louisiana Offshore Oil Port. All of these sources considered the potential for losses to be minimal, although some oil could be lost during storage (1) by leakage through

cracks in the cavern, (2) suspension of oil in brine, or (3) during oil withdrawal.

If caverns remain structurally stable and do not crack, crude oil should not leak out of the caverns. Officials of the American petroleum companies, the West German company, and the Louisiana Offshore Oil Port, told us that because salt is impervious to petroleum, crude oil should not be lost due to absorption.

In commenting on the environmental impact statement that DOE prepared for one of the storage sites, Environmental Protection Agency (EPA) officials stated that when oil is removed from the storage caverns, some oil will adhere to the cavern walls and will subsequently be suspended in the brine. EPA further stated that when oil is pumped back into the caverns, the displaced brine will carry the oil with it. According to DOE, the maximum amount of crude oil mixing with the brine during crude oil displacement would be about 18 parts per million. Applying the 18 parts per million estimate to a 1 billion barrel reserve, DOE can expect to lose about 18,000 barrels of oil (0.0018 percent) during withdrawal operations.

DOE also stated that some oil will be suspended in brine near the oil-brine interface and concluded that the amount of suspended crude oil, commonly known as an emulsion, cannot be predicted. The emulsion amount can be minimized, however, by insuring that the oil-brine interface is not withdrawn from the cavern. The contractor who performed the engineering feasibility studies on new caverns for DOE suggested that the emulsified interface could be held in the cavern until its volume warranted treatment. As part of the German contract concerning the effects of long-term storage, studies are being conducted to determine if (1) unacceptable oil emulsions will be encountered and (2) treatment facilities are necessary for breaking the emulsion and recovering the oil. Preliminary indications are that the amount of emulsion is minimal.

COST OF VARIOUS CRUDE OILS PURCHASED FOR THE RESERVE AND THEIR COMPARISON TO ALASKAN OIL (QUESTIONS 6, 11, AND 12)

Table 2 compares by source country the average contract costs per barrel and types of crude oil taken title to by DOE as of December 31, 1978.

TABLE 2

SPR Contract Price Comparisons Excluding

Impact of Cargo Preference Act 1/

Date of contract award 2/	Origin of oil	Oil name	Quality of oil	Amount of barrels purchased	Average Contract cost ($ per barrel)	Transportation cost 3/ ($ per barrel)	Cost to Gulf Coast ($ per barrel)
7-08-77	Mexico	Isthmus	Sour	327,526	13.590		13.590
8-05-77	Saudi Arabia	Light	Sour	421,134	13.560		13.560
8-17-77	Mexico	Isthmus	Sour	3,685,921	13.448	.265	13.713
	Saudi Arabia	Light	Sour	314,080	13.870		13.870
8-17-77	Saudi Arabia	Light	Sour	1,591,682	13.650		13.650
	Iran	Light	Sour	1,146,894	13.650		13.650
	Venezuela	Lagomedio	Sour	948,723	13.628		13.628
	Mexico	Isthmus	Sour	720,069	13.650		13.650
8-17-77	Iran	Light	Sour	5,508,524	12.730	1.059	13.789
	Iran	Light	Sour	605,108	13.869		13.869
	Mexico	Isthmus	Sour	1,426,058	13.345	.265	13.610
9-02-77	United Kingdom	Forties	Sweet	9,103,930	14.000	.836	14.836
9-02-77	Norway	Ekofisk	Sweet	1,086,493	15.125		15.125
	Norway	Ekofisk	Sweet	776,060	14.052	.955	15.007
3-28-78	United Kingdom	Forties	Sweet	7,650,000	13.560	.925	14.485
3-28-78	Libya	Sirtica	Sweet	559,324	13.925	.290	14.215
	Libya	Sirtica	Sweet	282,116	13.925		13.925
	Libya	Es Sider	Sweet	291,103	13.925	.470	14.395
	Mexico	Isthmus	Sour	232,163	13.500		13.500
3-28-78	Libya	Es Sider	Sweet	1,958,391	14.474		14.474*

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Date of contract award 2/	Origin of oil	Oil name	Quality of oil	Amount of barrels purchased	Average Contract cost ($ per barrel)	Transportation cost 3/ ($ per barrel)	Cost to Gulf Coast ($ per barrel)
3-30-78	Saudi Arabia	Light	Sour	251,175	13.240	.308	13.548
4-27-78	Iran	Light	Sour	500,000	12.452	1.177	13.629
5-26-78	Mexico	Isthmus	Sour	700,000	13.474		13.474
	Libya	Es Sider	Sweet	297.321	14.570		14.570
5-31-78	Mexico	Isthmus	Sour	1,293,030	13.589		13.589
6-01-78	Mexico	Isthmus	Sour	4,528,401	13.113	.268	13.381
6-01-78	Mexico	Isthmus	Sour	1,276,844	13.167	.268	13.435
6-01-78	Iran	Light	Sour	638,748	15.100		15.100*
6-01-78	Iran	Light	Sour	489,269	13.447		13.447
	Iran	Light	Sour	365,018	12.547	1.177	13.724
	Saudi Arabia	Light	Sour	756,967	13.447		13.447
	Mexico	Isthmus	Sour	70,471	13.147		13.147
6-01-78	Iran	Light	Sour	1,250,000	12.600	1.177	13.777
	Algeria	Sah. blend	Sweet	160,530	15.550		15.550*
6-09-78	Libya	Es Sider	Sweet	794,499	14.530		14.530
6-09-78	United Kingdom	Forties	Sweet	464,540	14.525		14.525
7-21-78	Mexico	Isthmus	Sour	255,104	13.100	.269	13.369
7-21-78	Mexico	Isthmus	Sour	291,769	13.510		13.510
7-21-78	Iran	Light	Sour	5,466,703	12.545	1.170	13.715
7-21-78	Mexico	Isthmus	Sour	2,504,484	13.066	.269	13.335

APPENDIX I

Date of contract award 2/	Origin of oil	Oil name	Quality of oil	Amount of barrels purchased	Average Contract cost ($ per barrel)	Transportation cost 3/ ($ per barrel)	Cost to Gulf Coast ($ per barrel)
8-04-78	United Kingdom	Forties	Sweet	3,477,083	13.598	.592	14.190
8-04-78	Libya	Es Sider	Sweet	600,000	13.578	.617	14.195
8-04-78	Libya	Es Sider	Sweet	1,972,237	13.670	.617	14.287
	Libya	Sirtica	Sweet	1,518,931	13.571	.618	14.189
9-15-78	Libya	Es Sider	Sweet	622,891	14.900		14.900

1/Transportation costs were estimated using foreign flag tanker rates except in three cases. These cases, denotated by an asterisk (*), used U.S. flag tanker rates because foreign flag rates were not available. To meet the requirements of the Cargo Preference Act, 50 percent of the oil was transported in U.S. flag tankers; however, foreign tanker rates were used in all possible cases for comparability purposes.
2/Contracts underlined are spot market contracts.
3/When a transportation cost is not shown, it indicates that the contract cost includes transportation.

APPENDIX I

Attractiveness of Mexican oil

As the chart indicates, Mexican sour crude oil, in most cases, was purchased for less than that of either Iran or Saudi Arabia. As of March 16, 1979, Mexican oil still maintained this advantage. As of that date market prices plus estimated transportion charges for Mexican, Iranian, and Saudi Arabian crude oil were about $14.902, $15.903, and $15.792 respectively. Because of the attractive price and close proximity to the United States, there would be a cost advantage of purchasing the reserve's sour crude requirements from Mexico. However, Mexico's present policy--setting aside only 100,000 barrels a day of its total production for the reserve--and matching this production rate with the planned fill for the reserve, will currently limit the possibility of using greater volumes of Mexican oil for the reserve.

Potential of purchasing Alaskan oil

To deliver Alaskan crude oil to the Gulf Coast, it would cost DOE about $13.96 a barrel. This amount represents the estimated weighted average cost of a barrel of Alaskan oil--$10.00--plus a transportation charge of $3.96. 1/ As indicated by table 2 on pages 8 to 10, the average cost per barrel of Alaskan oil delivered to the Gulf Coast falls midrange among the six foreign countries supplying sour crude. The price relationship between Alaskan and foreign oil, however, for future reserve purchases is likely to change because of the already announced or expected price hikes by foreign suppliers. For example, according to our report to the Senate Committee on Energy and Natural Resources on "Analyses of the Energy and Economic Effects of the Iranian Oil Shortfall" (EMD-78-38, Mar. 5, 1979), spot market prices are now around $23 a barrel.

It is important to recognize, however, that cost is only one of the factors to be considered in judging the merits of

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1/The transportation charge was computed as follows. According to the revised 1979 American Tanker Rate Schedule, the rate from Valdez, Alaska, to Houston, Texas is $2.26 a barrel. This amount increases or decreases daily according to market demand and ship availability. However, in most cases, the rate will be higher as was the case on Feb. 1, 1979, when oil brokers increased the rate by a factor of 1.75, setting the transportation rate at $3.96 a barrel.

purchasing Alaskan oil for the reserve. Given existing conditions and legislative requirements, two other considerations limit, if not eliminate, Alaskan oil purchases for the reserve.

--Alaskan crude oil does not meet DOE's current crude oil specifications for the reserve.

--The Merchant Marine Act requires that no oil shall be transported between points in the United States in any other tanker than a United States-owned and built tanker.

Comparison of Alaskan crude oil specifications

Table 3 presents API gravities, sulfur content, and the desired refining yields for each of the five specific types of crude planned for the reserve.

TABLE 3

Major Reserve Crude Oil Specifications

Characteristic	Type of Crude Oil				
	I	II	III	IV	V
API Gravity (°API)	30-36	40-45	30-36	34-40	36-41
Total Sulfur (Weight %) Maximum	1.99	0.25	0.50	0.25	0.50
Yields (Volume %)					
Naphtha	24-30	35-42	21-29	20-36	30-38
Distillate	17-31	31-35	23-37	31-45	19-33
Gas Oil	26-38	20-34	28-42	20-34	23-37
Residuum	10-19	4-9	7-14	0-5	7-14

According to a DOE official, an early 1978 test of an Alaskan North Slope oil sample determined that although the sulfur content--1.18 percent--was comparable to the five types; the API gravity--26 degrees--and the expected refinery yields--18 percent naphtha, 25 percent distillate, 42 percent gas oil, and 15 percent residuum--were not.

The reserve official would not comment as to whether or not the specifications would ever be changed to accommodate Alaskan oil. He states, however, that because ongoing reserve planning and implementation activities are using these specifications, a decision at the directorate level of the program would be necessary to change them. We plan to follow-up on this matter with appropriate DOE officials.

Merchant Marine requirements

The Merchant Marine Act of 1920 (Public Law 66-261), requires that no oil shall be transported between points in the United States, either directly or via a foreign port or for any part of the transportation, in any other tanker than a tanker built in and documented under the laws of the United States and owned by persons who are citizens of the United States. DOE officials maintain that there will not be enough small (80,000 dead weight tons or less) United States tankers 1/ available for transporting Alaskan oil to the reserve to meet this requirement. Also, our October 18, 1978, report on "Transportation Planning for the Strategic Petroleum Reserve Should Be Improved" (LCD-78-211), questions United States tanker availability for the reserve without even addressing the additional needs for transporting Alaskan oil to the reserve.

COMPETITIVENESS OF STRATEGIC PETROLEUM RESERVE OIL PROCUREMENT (QUESTION 8)

Based on our review of 26 out of 29 oil procurement contracts for the strategic petroleum reserve, we believe that the contracts are being competitively bid.

The procurement process can be summarized as follows. The policy of the Department of Defense's Defense Fuel Supply Center, which has been handling reserve oil purchases for DOE, is to award oil contracts on a competitive basis. The Defense Fuel Supply Center sends out over 200 copies of each request

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1/Although large U.S. tankers are currently available to transport oil from Alaska to the West Coast, small tankers would be necessary to transport the oil through the Panama Canal to the Gulf Coast.

for proposal to prospective crude oil suppliers. Once offers 1/ are received, they are evaluated in terms of price, and whether their quality of oil offered and delivery schedule can meet the specifications of the proposal. Once those unable to meet the quality of oil or delivery schedule requirements are eliminated, price is negotiated. After best and final offers are called for, contracts are awarded based on lowest price and the requirements of the Cargo Preference Act (Public Law 83-664). 2/

Spot market purchases

There have been nine instances where, at the request of DOE, the Defense Fuel Supply Center has awarded contracts on the spot market. As of March 9, 1979, this represented only 5 percent of all crude purchased for the reserve.

Each of these contracts was awarded at a cost-per-barrel amount within the current market price range determined, using United States Customs Service figures and other data by the Defense Fuel Supply Center's Office of Market Research. These spot contract award amounts are also in the range of other reserve procurement contracts awarded for similar oil during comparable time periods. For example, the first two spot contracts in July and August 1977 were for Mexican sour crude at $13.59 a barrel and Arabian crude at $13.56 a barrel; Mexican and Arabian crudes under the first long-term contract in August 1977 were $13.71 and $13.87 a barrel, respectively.

According to the contract files, the reasons given by DOE for necessitating spot market procurements were the following:

1/Based on our review of 26 out of the 29 oil procurement contracts, the number of offers per contract ranged between 2 and 23.

2/To comply with the Cargo Preference Act, the Defense Fuel Supply Center, as DOE's purchasing agent, is required to take whatever steps are necessary and practicable to acquire 50 percent of the oil on United States flag tankers. Therefore, there are instances where it is not possible to acquire all the oil offered by the lowest bidder since that bid is based on transportation by foreign flag.

--Oil was needed to begin oil fill operations before the first cargo of oil purchased under the first long-term contract arrived.

--Oil was needed to fill up a tanker so as to preclude dead freight expense.

--Oil was needed to increase maximum use of terminal facilities since the Government is subject to throughput charges, regardless of whether or not the terminals are utilized.

--Oil was needed to increase fill rate at sites.

--Oil was needed to afford DOE flexibility to react to changes in fill schedules.

It is possible that with better long range planning by DOE, some of these spot procurements would not have been necessary. For example, it would seem that deliveries from long-term contracts could be scheduled in a manner that terminal use would be optimized. Because the price-per-barrel amounts were comparable to other long-term contracts awarded at that time, it appears that the Government may not have incurred unreasonable costs. However, if DOE's planning is not improved, much higher costs to the Government will result if contracts are awarded at the higher current spot market prices.

COMPARISON OF STORAGE ALTERNATIVES (QUESTION 10)

The Federal Energy Administration (FEA) determined that underground storage, both in salt caverns and in mines, is best suited to reserve requirements. Table 5 which appears in the January 1977 Strategic Petroleum Reserve Plan, lists the criteria used to make this determination and a comparison, using this criteria, of each of the storage modes considered.

In mid-1976, we analyzed the advantages and disadvantages of the various storage alternatives and reached the same conclusion as FEA; underground storage was the most viable alternative. Officials in private industry told us, however, that although technically and environmentally feasible, FEA's costs per barrel for underground storage were extremely conservative. This conservatism was illustrated in recent hearings before the Subcommittee on Energy and Power, House Committee on Interstate and Foreign Commerce, when it was stated that underground storage costs have ballooned from approximately $1.50 a barrel to $3.39 a barrel. But, even the $3.39 a barrel is less than the other storage alternatives.

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TABLE 5

Storage Facilities Considered For The Reserve

	Solution mined caverns	Conventionally mined caverns	Surface tanks	Tankers	Lagoons/ rubber bags	Depleted oil wells	Shut-in oil
Technical feasibility and suitability for storage	Yes	Yes	Yes	Uncertain	Uncertain	No	Yes
Adequate storage capability available on a timely basis	Yes	a/Yes	Partially	Uncertain	Uncertain	No	Partially
Proximity to existing petroleum distribution system	Yes	a/Yes	a/Yes	a/Yes	Uncertain	No	Uncertain
Environmental impact	Low	Low	High	High	High	Low	Low
Security	Good	Good	Poor	Very poor	Poor	Good	Good
Cost per barrel:							
Existing	$1.10-$1.75	$0.90-$1.50	$8-$12	Over $6	b/Over $15	c/Over $60	Over $100
New	$1.35-$2.15	$6-$9	$8-$12	Over $6	d/Uncertain	Over $60	Over $100

a/For at least a portion of the requirements.
b/Cost per barrel for rubber bag storage used by the military for fuel was approximately $15 (fiscal year 1968 data).
c/This assumes that only about 25 percent of the oil could be recovered in 6 months. On that basis, the cost would be about equal to the cost of the oil stored and not recovered, or about $45 per barrel.
d/There is no firm basis for estimating costs of large-scale lined lagoon storage.

SOURCE: Strategic Petroleum Reserve Plan, January 1977.

APPENDIX I

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Congress of the United States

House of Representatives

Washington, D.C. 20515

December 14, 1978

Mr. Elmer B. Staats
Comptroller General of the United States
General Accounting Office
441 G Street, Northwest
Washington, D.C. 20548

Dear Comptroller General:

It now appears very likely that Mexico will become a major oil exporter in the years ahead. Certainly it is prudent that the U. S. re-examine certain aspects of our national energy policy to take into account this development.

Under the Energy Policy and Conservation Act, the Department of Energy is required to create a Strategic Petroleum Reserve to provide protection against future disruptions in U. S. energy supplies. Certain actions have already been taken pursuant to this mandate. President Carter has also announced his intention to see the Reserve increased to 1 billion barrels. Accordingly, we have certain questions for which we seek specific answers from the General Accounting Office.

(1) Did Mexico or PEMEX offer to sell the U. S. any oil for the Strategic Petroleum Reserve?

(2) If so, what was our response and what is our present policy?

(3) Recently there was a fire at one of the storage sites which has raised some questions as to the safety of the storage plan. In light of recent experience and the haste with which the Reserve is being developed, is it still sound public policy to assume that large quantities of oil can be stored in caverns within salt domes?

(4) In a GAO report issued on January 9, 1978, it states: "FEA and its testing contractor have acknowledged that brining can cause cavern damage. This would appear to be substantiated by the failure of five other caverns at Bayou Choctaw, previously used for brine production, to pass casing and cavern pressure testing." Despite these findings, has the Department of Energy permitted continued brining operations in caverns selected for crude oil storage and has the department re-examined these sites to determine whether they are still suitable for storage before oil fill began?

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(5) The GAO report of January 9, 1978, raises some concerns on our part as to the usability of crude oil stored in salt caverns. After all, your report did contain a finding that FEA decided not to wait for test results before beginning oil fill even though it was not certain of the continued suitability of these caverns for storage. Is there any danger that the crude oil stored in the salt caverns could be contaminated? Have there been any conclusive findings to the effect that co-mingling of oil and brine will not occur?

(6) Recent press accounts and industry claims suggest there is a glut of oil on the West Coast, prompted in part by delivery of Alaskan oil. Does it makes sense in terms of the Strategic Petroleum Reserve to keep purchasing expensive foreign oil for storage?

(7) With respect to the Strategic Petroleum Reserve, what percentage of the oil are we getting from foreign sources and what percentage are we getting from domestic sources?

(8) Are the supply contracts for the Strategic Petroleum Reserve being competitively bid?

(9) In view of the GAO report detailing some of the risks associated with the current storage plan, how would you evaluate the possibility or the probability that the oil stored in the caverns might become unusable for its intended purpose?

(10) Are there other storage methods that could be used other than salt caverns for creation of a Strategic Petroleum Reserve? Have feasibility studies been done?

(11) In view of the back-up of surplus North Slope oil on the West Coast, would it not make sense to use North Slope oil primarily if not exclusively for the Strategic Petroleum Reserve?

(12) Please estimate potential savings to the U. S. government of using Mexican oil as opposed to using Middle Eastern or Nigerian oil for storage in the Stragetic Petroleum Reserve.

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Mr. Comptroller General, perhaps some of these questions can be answered on the basis of earlier work the GAO did in compiling its previous report on the Strategic Petroleum Reserve. However, a substantial number of our questions are new. Your cooperation in supplying answers to these inquiries which take into account new developments will be most appreciated.

Sincerely yours,

DON J. PEASE
Member of Congress

MAX BAUCUS
Member of Congress

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