

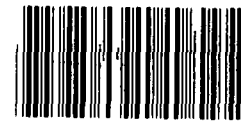
GAO

Briefing Report to Congressional Requesters

March 1987

NAVAL PETROLEUM RESERVE-1

Data Inaccuracies Complicate Production and Ownership Issues



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Resources, Community, and
Economic Development Division

B-215489

March 24, 1987

The Honorable Lloyd Bentsen
United States Senate

The Honorable Albert Gore, Jr.
United States Senate

This report is in response to your May 7, 1986, request that we examine whether the rate of oil production at the Naval Petroleum Reserve (NPR-1) located at Elk Hills in Kern County, California, meets the requirements of Public Law 94-258,¹ Congressional action opened NPR-1 to full production in 1976 and required that oil be produced at the maximum efficient rate (MER).²

On January 14, 1987, we briefed your staffs on the results of our work as of that date. We explained that inaccuracies and omissions in the production data and reports needed for determining MERs precluded us from reaching a definitive conclusion on the appropriateness of the production rates. In addition to these data problems, we also identified other problems that may adversely affect the amount of revenue received from selling NPR-1. As a result, we agreed to provide a briefing report on the effect of these problems on (1) the determination of appropriate MERs and (2) a final settlement of each owner's account if the government sells its share in the near future.

We found that as a result of inaccuracies in NPR-1 production data, the MER computations are probably incorrect. For example, in the two largest producing oil pools, we found that 87 wells, which have produced over 50 million barrels of oil (about 20 percent of total production

¹ NPR-1 is jointly owned by the federal government and Chevron, U.S.A., Inc., but the Department of Energy has overall management responsibility. The administration has proposed selling the government's share of NPR-1 in fiscal year 1988.

² MER is defined as "the maximum sustainable daily rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to the ultimate recovery." A reservoir and a pool are generally used synonymously.

from the two pools), need to be reviewed for production data errors. Further, the Department of Energy's (DOE's) ability to accurately compute each owner's actual share of production is also affected. Our analysis also shows that about 11.9 million barrels of oil could be lost to the federal government if NPR-1 were sold now. Until the data are corrected and the magnitude of the problems identified, DOE cannot provide assurance that (1) NPR-1 has been produced at an appropriate MER and (2) it can accurately determine how much of past NPR-1 production belongs to the federal government. This latter deficiency affects the calculation of the government's share of remaining recoverable reserves if NPR-1 is sold.

Underlying the inaccuracies found during our review was an absence of effective internal controls that could have prevented or would have limited the impact of these problems.

DOE officials agreed that production data problems exist but did not share our level of concern about the potential effect that these problems may have on selling the government's share of NPR-1 or their ability to produce at MER. The officials stated that corrective actions are being initiated but did not provide timetables for completing these actions or details on the scope of the actions proposed. We are not certain, therefore, that appropriate emphasis is being given to the corrective actions or that all of the problems we identified are included.

Therefore, we recommend that the Secretary of Energy

- give priority attention to correcting the data inaccuracies and other identified problems,
- establish an effective internal control program, and
- ensure that the federal government's interests concerning the allocation of past production and the remaining recoverable reserves are protected in any proposed sale of NPR-1.

To conduct our study, we reviewed DOE computer reports of cumulative production from the start of production until October 1986 and further analyzed this data by individual well, including allocation factors and production totals. We also reviewed and analyzed well histories and logs for the two major producing pools. In addition, we interviewed

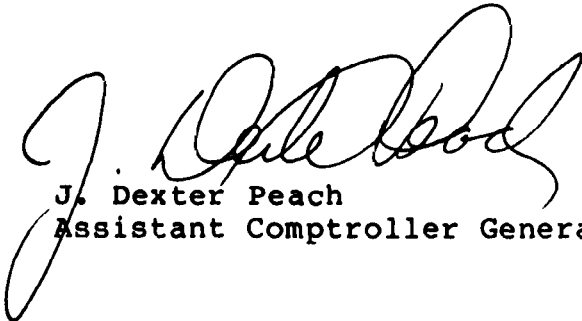
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DOE officials in Washington, D.C., and Elk Hills, California; Chevron and contractor officials at NPR-1, and consultants to DOE. A complete description of our methodology is in appendix I.

At the request of your offices, we did not obtain formal comments from DOE or Chevron on a draft of this report. We did, however, discuss its factual accuracy with responsible officials and incorporated their views into the report where appropriate.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time we will send copies to the Secretary, DOE, and interested congressional committees. We will also make copies available to others upon request.

This work was performed under the direction of Flora H. Milans, Associate Director. Other major contributors are included in appendix II.



J. Dexter Peach
Assistant Comptroller General

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FIGURE

- 2.1 Underground commingled well
- 2.2 Dual completion well

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ABBREVIATIONS

DOE Department of Energy
GAO General Accounting Office
MBB Main Body B/Western 31S pool
MER maximum efficient rate
NPR-1 Naval Petroleum Reserve-1
UPC unit plan contract

SECTION 1
BACKGROUND

NAVAL PETROLEUM RESERVE-1

-- WAS CREATED IN 1912,

**-- HAS BEEN MANAGED BY THE DEPARTMENT OF ENERGY (DOE) SINCE
OCTOBER 1, 1977, AND**

-- IS PART OF THE ADMINISTRATION'S PRIVATIZATION PROPOSAL.

RESPONSIBILITY FOR NAVAL PETROLEUM RESERVE-1

The Naval Petroleum Reserve (NPR-1) is located at Elk Hills in Kern County, California, and is jointly owned by Chevron, U.S.A., Inc., and the federal government. The federal government created NPR-1 in 1912 to provide a source of liquid fuel for the military during national emergencies. Later, in 1920, the Congress placed the Naval Petroleum Reserves under the authority of the Secretary of the Navy. However, in 1921, President Harding placed it under the Department of the Interior, but in March 1927, President Coolidge returned control to the Department of the Navy, which continued until September 30, 1977.

The Department of Energy (DOE) became responsible for NPR-1 when it was established on October 1, 1977. DOE has government personnel on site who have the overall responsibility for managing the reserve. However, DOE and Chevron (referred to jointly as the unit) share many management responsibilities for NPR-1. In addition, DOE has delegated the day-to-day maintenance, operations, and management of NPR-1 through a contract with Bechtel Petroleum Operations, Inc.³

PRIVATIZATION PROPOSAL

The administration has included the sale of NPR-1 in its proposed budget for fiscal year 1988. The administration believes that operating an oil field is an activity that the private sector is "well-equipped to undertake" and would operate "somewhat more effectively and efficiently than the government."

The administration expects to receive about \$2.5 billion in fiscal year 1988 from the sale of NPR-1 and NPR-3 in Wyoming, with an additional \$800 million in fiscal year 1989.⁴ Prior to the transfer of ownership, the administration expects to receive about another \$530 million in net operating revenues from NPR-1 in fiscal year 1988.

³ When management decisions are made that require concurrence by both owner parties (and indirectly by Bechtel), we have attributed these decisions to the unit in this report.

⁴ The majority of these revenues will come from the sale of NPR-1.

THE GEOLOGICAL FORMATIONS COMPRISING NPR-1 ARE COMPLEX

GEOLOGY OF NPR-1

NPR-1 is geologically complicated.⁵ Although the structure of the zones is understandable, the geology within the zones is complex and is not yet completely understood. DOE currently has an extensive effort underway to improve its understanding of NPR-1.

NPR-1 consists of four known, commercially productive, geologic zones in which petroleum has been trapped. These zones have been designated by DOE as the Dry Gas, Shallow Oil, Stevens, and Carneros. The Stevens Zone currently produces the most oil and has the largest remaining recoverable reserves. Within these four geologic zones, the unit has designated 15 oil pools of varying size and complexity. These pools are composed of one or more producing strata. (See table 1.1 for the 11 Stevens Zone pools and their producing strata.)

The oil-producing pools and strata are not all in separate and distinct areas. Some tend to overlap one another at different depths. DOE is also coming to the conclusion that there may be some oil and gas communicating (moving) between the pools and among the strata within the pools. This communication further complicates the development and production of the field.

⁵ Commercial deposits of crude oil and natural gas are always found underground and are contained in the water-coated pore spaces of various types of rock. The container is called a trap, and the portion of the trap that holds the oil or gas is called a reservoir. An underground feature capable of forming the reservoir is called a structure. A single such deposit of petroleum is a pool. At NPR-1, a zone is a layer of rock that roughly corresponds to a specific geologic time. Within each zone there are one or more pools that overlay each other and have been formed in geologic structures. The term "pool" as used at NPR-1 refers to one or more oil bearing strata (layers) that have been grouped together because of their geological linkage for purposes of development and production. The terms "pool" and "reservoir" are commonly used interchangeably by petroleum industry personnel. The terms are not, however, precisely the same.

Table 1.1: Stevens Zone Oil Pools and
Their Producing Strata

<u>Oil pool</u>	<u>Producing strata</u>
24Z Sand	24Z Sand
2B	2B Sand A Shale 24Z & 29R
26R	26R Sand
MBB/W 31S	MBB Sand W/31S Sand B-1, B-2, B-3 Shales 31S Upper Western Sand
31S N&A	N Shale 31S A Shale 31S
31S C&D	B-4, C Shale 31S D Shale 31S
29R	B Shale 29R C Shale 29R D Shale 29R A Shale 24Z & 29R N Shale 24Z & 29R
24Z Shale	N Shale 24Z & 29R A Shale 24Z & 29R
NWS A1-A3	NW A-1 Sand NW A-2 Sand NW A-3 Sand
NWS A4-A6	NW A-4 Sand NW A-5 Sand NW A-6 Sand
NWS T&N	NW T-3 Sand NW T-4 Sand NW T-4A Sand NW T-5 Sand NW N-2 Shale NW T-5A Shale NW D Shale

NPR-1

**-- IS JOINTLY OWNED BY THE FEDERAL GOVERNMENT AND CHEVRON,
U.S.A., INC., AND**

**-- IS MANAGED UNDER A UNIT PLAN CONTRACT BETWEEN THE FEDERAL
GOVERNMENT AND CHEVRON.**

JOINT OWNERSHIP

Chevron is included in the ownership of NPR-1 because it acquired privately held lands that were located within NPR-1 boundaries and became part of NPR-1 when the unit plan contract (UPC) was agreed to (see page 19). The ownership or equity shares of the government and Chevron have changed over time but currently approximate 78 percent and 22 percent, respectively, for NPR-1 as a whole. However, as shown in table 1.2 there are different ownership percentages for each of the four zones.

Table 1.2: NPR-1 Zone Ownership Percentages

<u>Zone</u>	<u>Federal government^a</u>	<u>Chevron U.S.A.</u>
Dry Gas	77.0492	22.9508
Shallow Oil	70.0119	29.9881
Stevens	79.6357	20.3643
Carneros	100.0000	0.0000

^a A small amount of additional NPR-1 production comes from the 100-percent-government-owned Tulare Zone and Asphalto Field, which are part of NPR-1 but are not included in the UPC.

Source: DOE.

There are also different ownership percentages for each individual producing strata and pool at NPR-1. For example, the government's share for the Stevens Zone ranges from 0 to 100 percent by producing strata and from 14 to 100 percent for pools. (See tables 1.3 and 1.4.)

**Table 1.3: Ownership Percentage by Producing Strata
and Estimated Recoverable Oil**

(Stevens Zone)

<u>Strata</u>	<u>Ownership percentage</u>		<u>Estimated recoverable oil</u>
	<u>Chevron</u>	<u>Federal government</u>	<u>Total^a</u>
	----- (percent) -----		
24Z Sand	7	93	65,443
2B Sand	0	100	8,586
26R Sand	0	100	211,866
MBB Sand	34	66	211,598
W/31S Sand	15	85	32,263
Upper Western Sand	100	0	274
NW A-1 Sand	82	18	17,165
NW A-2 Sand	95	5	9,401
NW A-3 Sand	84	16	8,138
NW A-4 Sand	67	33	14,486
NW A-5 Sand	58	42	14,239
NW A-6 Sand	31	69	26,836
NW T-3 Sand	5	95	6,101
NW T-4 Sand	0.1	99.9	13,543
NW T-4A Sand	0	100	17
NW T-5 Sand	0	100	294
N Shale 24Z & 29R	18	82	10,112
A Shale 24Z & 29R	2	98	29,146
A Shale 29R (2B pool)	0	100	175
B Shale 29R	1	99	24,151
C Shale 29R	0	100	868
D Shale 29R	0	100	11,080
N Shale 31S	12	88	12,449
A Shale 31S	22	78	85,016
B-1, B-2, B-3 Shales 31S	19	81	21,896
B-4, C Shale 31S	0	100	2,864
D Shale 31S	37	63	30,522
NW N-2 Shale	5	95	1,484
NW T-5A Shale	0	100	89
NW D Shale	0	100	190
Average total percent	<u>20.4</u>	<u>79.6</u>	<u>£70,292</u>

^a In thousands of barrels.

Source: DOE and Chevron, "Stevens Zone Estimated Recoverable Oil and Third Revision of Percentage Participation as of November 20, 1942," amended on November 20, 1980.

Table 1.4: Ownership Percentage by Producing Pools
and Estimated Recoverable Oil

(Stevens Zone)

<u>Pools</u>	<u>Ownership percentage</u>		<u>Estimated recoverable oil</u>
	<u>Chevron</u>	<u>Federal government</u>	<u>Total^a</u>
	----- (percent) -----		
24Z sand	7	93	65,443
2B sand	0	100	8,761
26R	0	100	211,866
MBB/W 31S	31	69	266,031 ^b
31S N&A	21	79	97,465
31S C&D	33	67	33,386
29R	.5	99.5	60,626
24Z shale	15	85	14,731
NWS A1-A3	86	14	34,704
NWS A4-A6	47	53	55,561
NWS T&N	<u>2</u>	<u>98</u>	<u>21,718</u>
Average total percent	<u>20.4</u>	<u>79.6</u>	<u>870,292</u>

^a In thousands of barrels.

^b Includes North Coles Levee.

Source: DOE and Chevron, "Stevens Zone Estimated Recoverable Oil and Third Revision of Percentage Participation as of November 20, 1942," amended on November 20, 1980.

Unit plan contract

Before the early 1940's, certain lands owned by the government and Chevron's predecessor, Standard Oil of California, had been developed to varying degrees. On November 20, 1942, the first agreement relating to NPR-1 operations was reached between the government and Standard Oil. This agreement was rescinded and a second temporary operating agreement was signed by the two parties on September 8, 1943. Under 1944 amendments to the Act of June 4, 1920 (41 Stat. 813), the Secretary of the Navy was authorized to enter into the current unit plan contract with Standard Oil for the cooperative development and operation of NPR-1 as a unit and to order production of the reserve for national defense purposes.⁶ The UPC was signed on June 19, 1944, and approved by the President on June 28, 1944.

Under the UPC, the federal government received, subject to the terms of the contract, exclusive control over reserve operations, including the time and rate of prospecting and development, and the quantity and rate of production at the reserve. In exchange for turning NPR-1 operations over to the government, Chevron was given a 50-percent participating vote on the two-member Operating Committee and the six-member Engineering Committee. The Operating Committee is responsible for setting the number of wells to be drilled to meet the production rate set by DOE; determining the location and depth of each well; determining the production rate for each well in accordance with sound oil field engineering practices; inspecting and supervising all exploration, development, and production operations at the field; requiring the use of sound oil field engineering practices to achieve maximum economic recovery of oil; and acting on other matters as elsewhere provided in the UPC or as may be referred to the Committee by both parties. The Engineering Committee, among other responsibilities, is responsible for re-determining ownership percentages. If the Engineering Committee cannot agree unanimously on the ownership percentages, the UPC provides the Secretary with the authority to make such determinations.

The terms of the contract stated the intent of the owners for distributing oil and gas production. Subject to certain provisions, the production is to be distributed between the government and Chevron on the basis of the ownership ratios of each zone. Further, DOE must keep complete and accurate records.

⁶ Unitization is the process whereby the owners of adjoining properties pool their reserves and form a single "unit" for the operation of the properties by only one of the owners. The production from the unit is then divided on the basis established in the "unit agreement." The purpose of such an agreement is to produce the reserves more efficiently, increasing the recovery for every participant.

CONGRESSIONAL ACTION IN 1976

- AUTHORIZED FULL PRODUCTION OF NPR-1, AND**
- ESTABLISHED A PRODUCTION RATE FOR NPR-1 OPERATIONS.**

FULL PRODUCTION FOR NPR-1

Until 1976, NPR-1 was not authorized for full production. Partial crude oil production for NPR-1 started in 1919 and continued at various levels, reaching a peak of 65,000 barrels per day in 1945. After World War II, NPR-1 was reduced to the minimum level necessary to prevent loss of recoverable oil and to provide Chevron with the amounts agreed upon in the UPC.⁷

Following the Arab oil embargo in 1973-74, the Congress passed the Naval Petroleum Reserves Production Act of 1976 (Public Law 94-258), which authorized the exploration and development of NPR-1 to its full economic and productive potential for a period of 6 years. At least every 3 years after this initial 6-year period, continued production was to be based on a presidential certification that it was in the national interest.

The act required that NPR-1 be produced at the maximum efficient rate (MER). MER is defined in the act as "the maximum sustainable daily oil or gas rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to the ultimate recovery." DOE has final responsibility for setting the MER for each pool. However, under DOE's current MER procedures, established in January 1985, Chevron also plays a part in the MER rate-setting process by commenting on DOE's MER proposals.

⁷ Loss of recoverable oil would occur if producible wells are not produced periodically. Without some production, oil could migrate out of the pool or beyond the reach of the well and/or the well casing will deteriorate.

SECTION 2
PRODUCTION OF NPR-1

ACCORDING TO DOE RECORDS, CRUDE OIL PRODUCTION

- HAS TOTALED 813 MILLION BARRELS OF OIL FROM THE TWO MAJOR PRODUCING ZONES,
- IN THE STEVENS ZONE HAS COME PRIMARILY FROM OIL POOLS WITH A HIGHER-THAN-AVERAGE PERCENTAGE OF GOVERNMENT OWNERSHIP, AND
- HAS COME FROM COMMINGLED WELLS THAT EXTRACT OIL SIMULTANEOUSLY FROM MORE THAN ONE POOL