
**Resources, Community, and
Economic Development Division**

B-215489

March 24, 1987

The Honorable Lloyd Bentsen
United States SenateThe 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

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.

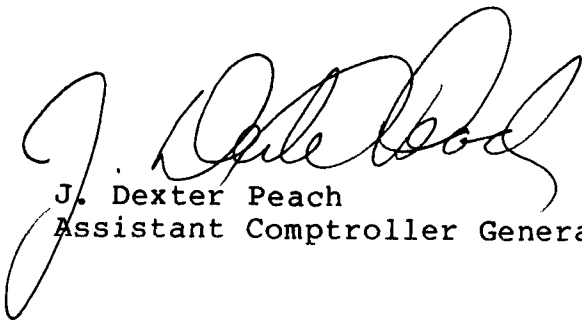
To conduct our study, we reviewed DOE computer reports of cumulative production from the start of production until October 1986 and further analyzed this data by individual well, including allocation factors and production totals. We also reviewed and analyzed well histories and logs for the two major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

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.

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.

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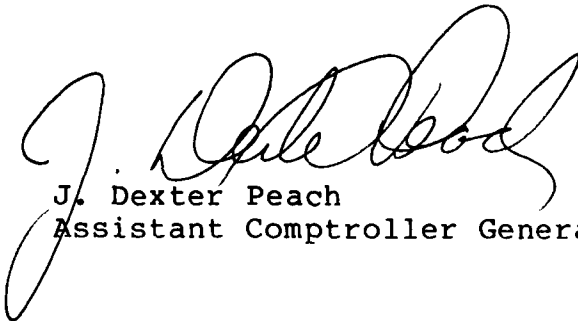
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THE GEOLOGICAL FORMATIONS COMPRISING NPR-1 ARE COMPLEX

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>870,292</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</u> ^a
	----- (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

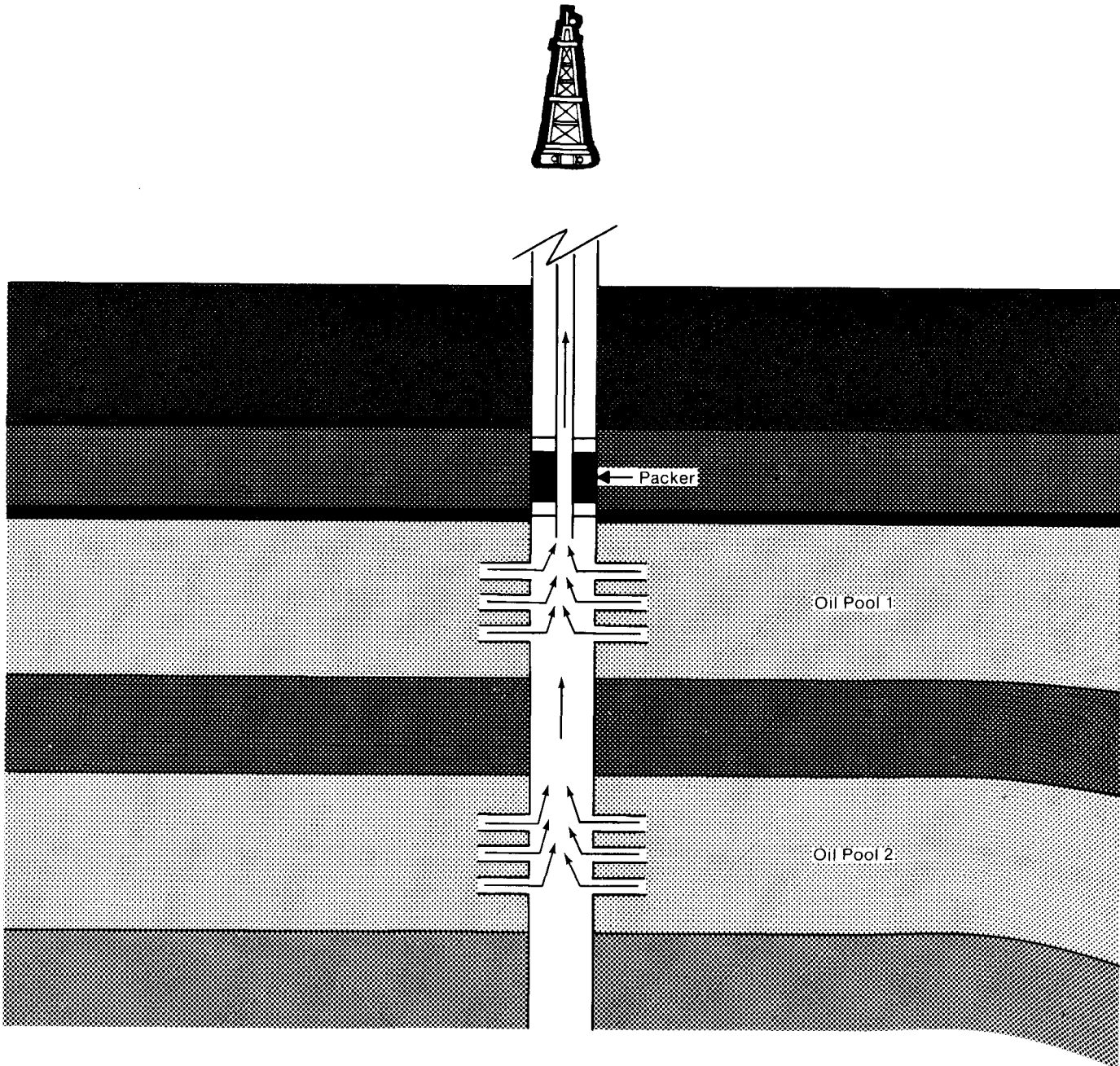
CRUDE OIL PRODUCTION

Total estimated original crude oil reserves for the two major producing zones (Stevens and Shallow Oil) at NPR-1 amount to about 1.47 billion barrels of oil. According to DOE, as of December 31, 1986, 813 million barrels of oil had been produced from these two zones--402.4 million barrels from the Stevens Zone and 410.6 million barrels from the Shallow Oil Zone. This leaves about 657 million barrels of oil remaining as recoverable reserves, most of which is in the Stevens Zone.⁸ The crude oil from the Stevens Zone is a light, high-quality crude oil. The oil from the Shallow Zone is a heavier, lower-quality crude, much of which has already been produced. These quality differences are reflected in their market value. In addition, the field produces natural gas and natural gas liquids. Oil production in fiscal year 1986 averaged 115,525 barrels per day.

There are 743 wells in the Stevens Zone at NPR-1, of which 647 are producers, 90 are injectors, and 6 are both producers and injectors. These wells tap 11 separate oil pools comprised of 30 individual producing strata and provide about 82 percent of current NPR-1 production. Although the government's ownership share of the Stevens Zone averages 79.6 percent, 6 of the 11 pools have government ownership ratios of 85 percent or higher. The second largest and most heavily produced pool, for example, has a 100-percent government ownership. Using DOE's production data, we analyzed the total Stevens Zone production by pool and ownership percentage and determined that, in contrast to the 79.6 percent ownership ratio used for distributing daily production, 82.6 percent of the production has come from the government's share of the zone on a pool basis.

⁸ In our report, Naval Petroleum Reserve No. 1: An Assessment of Production Alternatives (GAO/RCED-84-180, July 30, 1984), we stated that ultimate recovery would be lower because of overestimates of reserves in the Shallow Oil Zone and possible losses from overproduction in the Stevens Zone.

Figure 2.1: Underground Commingled Well



Note: Figure 2.1 shows how oil from the two pools enters into the single production tubing within the well casing. The packer is a mechanical device used to seal off the space between the well casing and production tubing, and to force the oil into the tubing.

COMMINGLED PRODUCTION

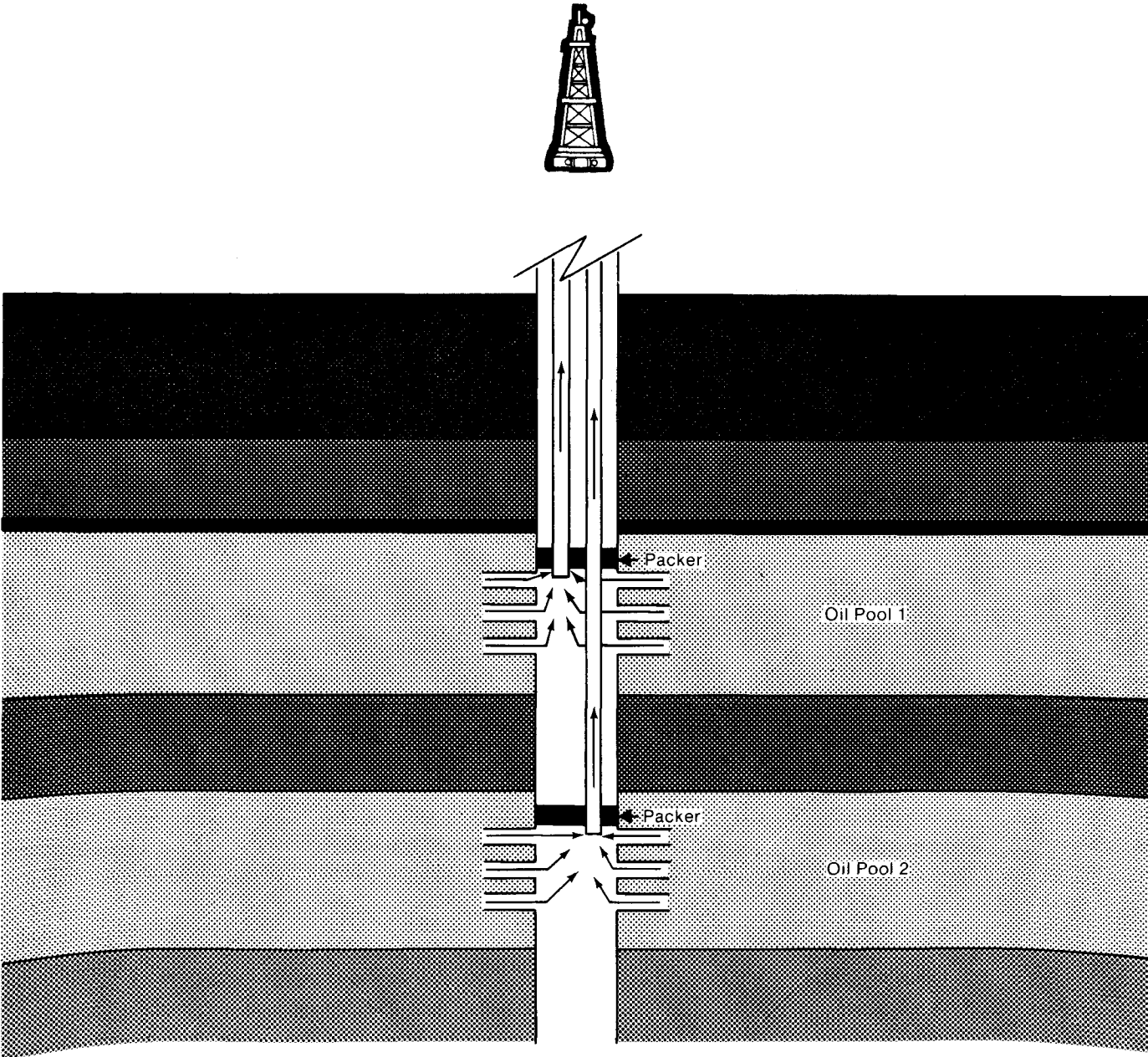
We identified 138 wells in the Stevens Zone that we believe have or have had commingled underground production from "rate-sensitive" and "non-rate-sensitive" pools or sometimes from more than one rate-sensitive pool.^{9,10} (See fig. 2.1.) Cumulative production for these wells was 71.5 million barrels of oil through September 1986. We also identified 58 wells that commingle production from more than one producing strata within a single pool. Cumulative production for these wells was 16.0 million barrels of oil through September 1986.

Underground commingled production causes several problems. For example, commingling makes it difficult to calculate the proper MER for each producing pool. It is also difficult to (1) monitor whether oil is being taken out too quickly from rate-sensitive pools or (2) control movement of oil, gas, and water between the pools by restricting movement when damage to the pools may occur.

9 Commingled production occurs when the casing for a well drilled through more than one pool is perforated in each pool, allowing fluids to flow into a common well-bore for production. We also consider commingling to have occurred when a well is drilled into a single pool but produces from multiple strata within the pool.

10 A rate-sensitive pool is one in which the rate of production affects the total amount of oil that can be recovered. Rate-sensitive pools generally have a driving mechanism such as gas or water that pressurizes the oil and forces it to move toward a well. A non-rate-sensitive pool is one in which the production rate does not affect the driving mechanism and, hence, ultimate recovery. Therefore, the oil can be produced at whatever rate the oil moves toward the well.

Figure 2.2: Dual Completion Well



Note: Figure 2.2 illustrates how packers are used to isolate the individual oil pools and limit the oil flow to the production tubing serving each pool.

To increase recovery of oil and gas from producing pools, it is industry practice to inject natural gas, water, or other fluids into pools through injection wells. These fluids maintain pressures and displace oil from one place to another in the pool. When the wells are used to put gas, water, or other fluids into more than one stratum without separate tubings for each in the wellbore, the wells are commingled injectors. With commingled injectors it is difficult to (1) control how much injected fluid is going into each stratum and (2) determine how much produced oil, gas, and water is being replaced or moved by injected fluids. Therefore, it is difficult to calculate the proper MER for each producing pool with recovery assisted by fluids injected through commingled wells. We identified 20 such injector wells in the Stevens Zone.

In the early 1940's, however, industry knew that, because of varying physical conditions of the fluids (oil, gas, and water) within each of the producing pools penetrated by a well, it might be advisable to inject fluids into and produce each pool separately. This provides for better pool pressure maintenance and prevents intercommunication of the fluids between the pools during both injection and production. With commingled production, there is no opportunity for exercising selective control to regulate production from different pools. Commingling production in a well that taps more than one pool can be prevented. For example, engineers can isolate the production from each pool by using a dual completion method. (See fig. 2.2.) Another method would involve limiting production from each commingled well to a single pool and drilling an additional well for each of the other pools.

Texas, Louisiana, Alaska, Oklahoma and the U.S. Minerals Management Service prohibit underground commingling of production in all new wells and fields unless it can be documented that loss of oil and gas will not occur. Alabama and Mississippi either discourage or disapprove the practice of commingled production. While California does not prohibit commingling, it does have the authority to control well completions to avoid loss of oil and gas. However, California's geology has provided few rate-sensitive oil pools; most of the fields in the state are older, contain heavy oil, and are, therefore, not rate-sensitive.¹¹

The unit started drilling these commingled wells in 1948 and has continued the practice. Such drilling is still a common practice in California. According to the government's member of the Operating Committee, this long-standing practice at NPR-1 stemmed from the field engineers' view that as long as a well was producing so as to minimize communication of fluids between strata of different pools it caused no harm. As early as 1977, however,

¹¹ Taken together, these seven states account for about 79 percent of all U.S. crude oil and natural gas liquids production.

consultants to DOE and Chevron, as well as Chevron, recommended that commingling production and/or injection of fluids at NPR-1 should be stopped. In 1979, Chevron provided a cost estimate for drilling separate wells into each producing pool at NPR-1 where commingled wells existed. Apparently, because of the high cost, the unit decided not to drill separate wells to correct problems with existing commingled wells. According to DOE's Engineering Division Chief at NPR-1, the unit has not changed its policy of producing individual pools from existing commingled wells. Further, DOE has continued to drill commingled wells at NPR-1.

SECTION 3

PRODUCTION DATA AND MANAGEMENT PROBLEMS

PRODUCTION DATA FOR NPR-1 SHOWED THAT

- THE ALLOCATION OF OIL, GAS, AND WATER PRODUCED FROM COMMINGLED WELLS IS INACCURATE;
- COMPUTER-GENERATED REPORTS ARE INACCURATE BECAUSE OF PROGRAMMING AND DATA-ENTRY ERRORS;
- UNEXPLAINED CHANGES TO INTRA-POOL WELL RECORDS WERE MADE;
- DOE CANNOT ACCOUNT FOR PRODUCTION ON THE BASIS OF OWNERSHIP; AND
- DOE HAS INEFFECTIVE INTERNAL CONTROLS.

INACCURATE PRODUCTION DATA

On the basis of our review of NPR-1 production data, we found that the computer-generated production reports by pool are inaccurate. These inaccuracies result from the unit's method of allocating petroleum production from commingled wells to the appropriate producing strata, flaws in computer programming, and errors in data entry. Furthermore, we found that there were unexplained changes relating to well locations in the records and that the computer system is unable to track ownership of production by producing strata.

Inaccurate production allocations

Under the commingled production conditions described in the previous section, each commingled well must have its production allocated to the appropriate pool or producing strata by some means to determine how much production comes from or how much fluid has been injected into each pool or strata. There are a number of ways that can be used at NPR-1 to allocate current and historical production of commingled wells. However, we believe the method generally used by the unit was inappropriate and resulted in inaccurate production allocations between pools.

According to staff petroleum engineers from state and federal agencies and private industry with whom we spoke, there are several acceptable methods for allocating production from underground commingled wells after an initial start-up period. The preferred method is to block off the flow of oil into the well from all but one source at a time and test the production from each strata on an individual basis. Another method suggested was to use a wire testing device on a cable drawn through the well to measure the fluid in each producing pool or strata.

A DOE consultant suggested in a 1986 report that production allocations at NPR-1 should be done using three factors to develop the appropriate allocation ratios.¹² The factors suggested were (1) the length of the pipe perforations that provide access to the oil in each pool or strata, (2) the permeability of the rocks in each pool or strata,¹³ and (3) the mobility of the oil, gas, and water. The consultant also stated that the production allocations done at NPR-1 have generally been based on the length of the perforated pipe in each producing interval (pool) and that the same

¹² H. J. Gruy and Associates, Inc., [Report to the Department of Energy], dated June 6, 1986.

¹³ Permeability is a measure of the ability of reservoir rock to allow fluids to move under the influence of pressure at various depths.

factor was used for oil, gas, and water. The consultant did not believe that this was the correct way to allocate this production.

DOE officials, however, said that an allocation factor based on the length of perforated pipe within a pool or strata is a generally accepted method when a well starts producing oil for a period of time. While the use of this factor makes calculations relatively simple and may have been acceptable for a newly opened well producing only or mostly oil, it may not properly account for oil production over the life of a commingled well or for wells that also produce gas and water. For example, Stevens Zone sands can produce oil much faster than Stevens Zone shales, and the shales may begin to produce high amounts of gas early in their productive cycle.

To assess the potential effect on allocation ratios by expanding DOE's methodology, we examined one well drilled into the Main Body B/Western 31S (MBB) pool, and the N and A Shale pool that had produced nearly 997,000 barrels of oil and 3 billion cubic feet of gas before it stopped producing. The unit had determined that the production allocation ratio for this well (based solely on perforation footage and applying the same factor to both oil and gas) was 69 percent to the MBB pool and 31 percent to the N and A Shale pool. Using available data, we recalculated the allocation by multiplying the average values for permeability of the pools' formations and the length of perforated pipe. The results of this calculation showed that when the additional permeability factor is considered, the allocation ratios for oil and gas would have been 91 percent to the MBB pool and 9 percent to the N and A Shale pool. The volume difference between the allocation ratio used by the unit and our calculation is that MBB would be credited with producing another 219,000 barrels of oil and an additional 660 million cubic feet of gas.

However, our calculation does not take into account the DOE consultant's third factor--the mobility of the oil, gas, and water through the producing strata. Oil, gas, and water move at different rates. Therefore, a separate allocation ratio must be developed for each of these substances in commingled wells if accurate production data are to be obtained. This requires detailed, complicated calculations.

We did not calculate the actual differences for the well above using all three factors recommended by H. J. Gruy and Associates, Inc., and separate allocation ratios for the oil and gas. However, we concluded that the 91/9 percent ratio for oil and gas coming from the MBB and N and A Shale pools would likely change. According to DOE, the N and A Shale pool production is derived from fractured shales and some minor sands. As naturally fractured reservoirs (pools) produce, there is generally a problem

of "drastic increases in gas-to-oil ratios."¹⁴ This means that fractured shales are likely to produce continually increasing amounts of gas in proportion to oil. Therefore, we concluded that if mobility of each of the fluids were considered in developing separate allocation ratios for the fluids in the well used in our example above, the production ratio for gas from the N and A Shale pool would probably be greater than the 9 percent that we calculated by using only two factors--permeability and length of perforated pipe. Conversely, gas production from MBB would likely be less than the 91 percent in our calculation. We would also expect the production ratio for oil in each pool to change.

Fluid mobility is also important for non-commingled wells. When a non-commingled well is completed in a single pool, the mobility of the separate fluids must be determined in order to (1) prepare an accurate MER and (2) determine how quickly oil should be produced or fluids injected.

Because production from commingled wells that tap multiple pools or strata changes over time, allocation ratios must also be changed. While we noted that DOE periodically changed some allocation factors, it did not do so on a routine basis and did not always use the same method. In the two largest producing pools in the Stevens Zone--MBB and 26R--we found 87 wells that either had been or currently are commingled producers. As of September 30, 1986, these 87 wells had produced about 51 million barrels of oil out of a total production for the two pools of about 225 million barrels. Consequently, over 20 percent of the production from these two pools alone needs to be reviewed for allocation errors.

Refiguring the actual well allocations for various points in time would not now be possible to do unless the unit has data from flow tests that were taken at regular intervals for each commingled well. Without such flow test data--and it is unclear from the records as to whether these tests were done--the unit will have to develop a computer simulation model to determine the production changes over time and correct historical allocations at NPR-1.

Errors in computer-generated reports

Each time the unit changes a well allocation factor, the computer program used to generate production histories of wells and pools changes the production history records. Rather than continuing to maintain a record of actual past production sources, the computer program credits all prior production according to the latest allocation factor. For example, a well producing in both a sand and a shale pool may start with 50 percent of production from

¹⁴ Aguilera, Roberto, Naturally Fractured Reservoirs (Tulsa, Okla.: PennWell Books, 1980), p. 415.

the sand pool and 50 percent from the shale pool. Several years later this allocation may be changed to 80 percent and 20 percent, respectively. When the change is entered, the computer would adjust all past production to the 80/20 ratio. This change in the production history records should not occur. We found this flaw in the computer program when we tried to get two production reports showing production from the 26R pool (generated from the unit's system in 1984 and 1986) to balance for a single date in 1982. After we asked unit staff why the pool production records did not balance, they suggested that the program was creating the problem. Other DOE officials verified that the program was indeed the problem and ordered the contractor to develop a new program to replace it.

We found that on June 22, 1984, DOE had directed the prior operating contractor to fix this problem with the computer program but that it had not been done. DOE expects that the new computer program will be ready by April 1987.

In addition, we found numerous data entry errors when we reconciled the two production reports mentioned previously. For example, we found 66 wells in the MBB pool that the records showed as commingled between pools but actually were not. In another case, we found data entry errors for well number 322-36R that resulted in an erroneous production history for the well and several pools. In a memorandum dated January 20, 1984, the Director of NPR-1 stated that this well should be allocated 100 percent to the 26R pool. As shown on a subsequent listing of allocation factors, however, an entry was made crediting the production to the 29R pool. Our analysis of the well log, however, showed that the initial determination was in error because the well had no perforations in the 26R pool and thus could not even produce from this pool. Instead, it was producing from the A and B-1 Shales.¹⁵ In May 1984, NPR-1 officials reallocated 100 percent of the production from the 29R pool to the N, A, and B Shales. Since the B shales are not a pool, and the computer only accepts data on a pool basis, B Shale production is usually put in the MBB pool. Because of the well location, we believe the B Shales production should have been put in the MBB pool. When this last change was made in the computer, the computer program erased the past production history from the 29R pool and created a new well history showing that all production from this well had always come from the N and A Shale pool.

As a consequence of these errors, production from the 29R pool was overstated from January to May 1984. Even after NPR-1 officials noted that the 26R designation in January 1984 was wrong and ordered a correcting entry, the change was made incorrectly.

¹⁵ N and A Shales are one pool. Production from B-1 Shales is considered part of the MBB pool.

The N and A Shales production has thus been overstated and the MBB pool production understated.

Well number 322-36R's total production until the allocation change in May 1984 was 675,000 barrels of oil. Its total production through October 31, 1986, was 885,226 barrels of oil.

Unexplained records changes

We also found that numerous changes were made to the production records of a number of wells in the MBB pool. This pool contains about one-third of the remaining recoverable reserves at NPR-1. The pool is comprised of several different strata within this pool, each having a different ownership percentage.

In reviewing the computer-generated production records for the MMB pool, we found 82 wells whose records had been shifted among the different producing strata within this pool at different times. Twenty-six of the wells are currently producers and the rest are injectors. Some of the current injectors, however, were once producers. Because the supporting documents were incomplete or missing, we could not determine whether these wells were commingled, why these changes were made, or if they were appropriate. DOE officials told us that it has initiated a review to determine why these changes were made and if they are correct.

Inability of the system to track production ownership

The current computer system cannot account for production ownership by producing strata, which is the basis for calculating ownership of production by pool and zone, and MER by pool. The system currently accounts for production only by pool and zone. For example, the computer system shows production from the MBB pool that includes the following producing strata: the Lower Main Body sand, Upper Main Body sand, the Western 31S sand, and the B Shales. Each of these strata have different ownership ratios. Since the computer cannot provide petroleum production data for each of the producing strata separately, the computer-generated production reports can only be used to approximate the actual ownership shares of production by pools. This deficiency in the computer system becomes important if NPR-1 is sold prior to the depletion of the reserves.

INADEQUATE INTERNAL CONTROLS

We believe that internal controls at NPR-1 are inadequate to ensure that (1) data errors are identified and corrected, (2) the rationale for any changes to production records is provided and any such changes are accurate and timely, and (3) accurate accounting of ownership occurs. While our review of these controls was limited, we noted several problems with the computerized production record system that should have been preventable or for which corrective actions should have been initiated in a more timely manner.

As previously discussed, we found numerous data entry errors that were not caught, including commingled well allocations changes that were entered incorrectly into the computer and were not identified as errors. Either there was no internal control mechanism in place to meet federal standards for recording transactions properly or it was not effective in catching these errors. Further, we found instances where approved allocation changes were not entered into the computer for as long as 16 months after the approval date, which goes against the federal internal control standard that significant transactions be promptly recorded. In January 1984, the contractor was authorized by DOE to enter allocation changes into the computer system before obtaining the Operating Committee's approval but was required to obtain subsequent approval. The contractor flagged these files to indicate that approval for the change was still needed. When we asked DOE about missing documents related to the flagged entries, DOE officials indicated that the computer system contained numerous flags that had not been cleared. This situation causes us to believe that the internal control standard requiring qualified and continuous supervision was violated by DOE since some of these errors have been in the computer system since early 1981.

In its fiscal year 1986 Federal Managers Financial Integrity Act report, DOE noted that a number of weaknesses in NPR-1 operations and administration had been identified in its internal control reviews and Inspector General audits. DOE further stated that it has taken aggressive action to strengthen the internal controls in all areas involved.

We noted that in July 1986 DOE established a position for a quality assurance specialist. However, as of March 1, 1987, this position remained to be filled.

SECTION 4
CONTRACT ISSUES

THE UNIT PLAN CONTRACT

- REQUIRES A FINAL ACCOUNTING OF TOTAL PRODUCTION FOR EACH OWNER WHEN NPR-1 IS DEPLETED, AND
- IS LESS CLEAR ON PRODUCTION DISTRIBUTION IF CONTRACT TERMINATION OCCURS PRIOR TO DEPLETION.

CONTRACT TERMINATION AT
DEPLETION OF RESERVES

The UPC provides directions for arriving at a balancing of each owner's interests in NPR-1 production and expenses if the contract is continued until all recoverable NPR-1 reserves are depleted. According to the contract terms, the final resolution of how the total production and expenses should be assigned would be determined by balancing the production received by the owners for each zone against the zone ownership percentages identified in the UPC. Any quantity differences between the two totals would be resolved by a cash settlement. The total expenses incurred would be determined and compared in the same manner. Since the zone percentages have been adjusted in the past and may be again in the future, the final reconciliation of accounts would not be expected to require a major cash adjustment if DOE retains ownership until depletion.

CONTRACT TERMINATION PRIOR TO
DEPLETION OF RESERVES

The UPC also contains a provision for terminating the contract prior to depletion of the reserves but is less explicit in providing guidance for settling the owner's accounts if that event should occur. If DOE should decide to terminate the UPC before depletion (such as might occur if NPR-1 were sold), the Secretary of Energy must provide Chevron with written notice of its decision 6 months before the termination date. According to the contract terms, "Termination shall be followed by an adjustment of all such rights and obligations, including the rights and obligations growing out of the costs incurred and the respective quantities of production received by [DOE] and [Chevron], respectively, under the contract, on a fair and equitable basis."

IF NPR-1 WERE SOLD IN THE IMMEDIATE FUTURE, THE GOVERNMENT MIGHT
LOSE THE VALUE OF 11.9 MILLION BARRELS OF OIL.

REQUIREMENT FOR A PRODUCTION
VOLUME ADJUSTMENT

The UPC requires that if contract termination occurs prior to reserve depletion, the final adjustments to each owner's rights and obligations are to be made on a fair and equitable basis. However, the UPC does not define fair and equitable basis and DOE officials would not provide us their interpretation. The UPC prescribes basing settlement at reserve depletion on the percentage of ownership by zone. This methodology, as stated previously, is based on comparing zone ownership percentages with actual production volumes received. This methodology, if used in adjusting the owners' rights and obligations at termination prior to reserve depletion, could lead to a situation where several million barrels of oil produced from the Stevens Zone would not be considered as part of the settlement--to the detriment of the government's interests. We looked at the Stevens Zone production to assess the possible effects of using the zone percentages to settle the owners' accounts if NPR-1 is sold now.

The Stevens Zone has the largest production and estimated recoverable reserves at NPR-1. Total production to date from the pools in this zone has a higher percentage ownership (82.6 percent) than the government's total percentage ownership for the entire zone (79.6 percent). This total zone percentage is the basis on which the production is distributed to the government and Chevron as their shares. The net effect of this situation, whereby the heaviest production is coming from producing pools predominately owned by the government but distribution is on a zone percentage, is that the government has received less oil than is actually being withdrawn from its share of the producing pools. This situation is expected to correct itself by the time the reserve is fully depleted. However, if NPR-1 were sold now and the owners' accounts were not adjusted to reflect the difference between actual ownership and distributed production, the government would lose the value of about 11.9 million barrels of oil because the oil would not be included in the final cash settlement. Therefore, in any cash settlement, the government would lose the value of this oil.

The DOE Assistant Secretary for Fossil Energy told us that DOE "...would give serious consideration, among the possible options, to renegotiating the Unit Plan Contract as a vehicle for divestiture...." Furthermore, he said, "...there is certainly more than one way that the issue can be accommodated in a manner consistent with a divestiture." In support of this assertion, we noted that DOE's solicitation for investment banking support services for the asset divestiture program requires an analysis of divestiture alternatives for NPR-1.

SECTION 5

CONSEQUENCES OF INACCURATE PRODUCTION DATA

INACCURATE AND ERRONEOUS PRODUCTION DATA RESULT IN

- PRODUCTION RATES THAT MAY NOT MEET STATUTORY REQUIREMENTS,
AND
- DOE'S INABILITY TO ACCURATELY DETERMINE EACH OWNER'S SHARE
OF ACTUAL PRODUCTION.

STATUTORY REQUIREMENTS

Production data are a key component of the MER determination. Since DOE's production data are inaccurate, its MERs--based on inaccurate production data--are probably also incorrect. Incorrect MERs do not meet the requirement of Public Law 94-258. The purpose of the law is to ensure that no economically recoverable oil is left behind. Incorrect MERs mean that it is possible that DOE has overproduced or underproduced the pools. In either case, oil could have been left behind that might have been economically recoverable if the pool had been produced at a correct MER.

OWNERSHIP DETERMINATION

DOE knows how much production comes from each zone and bases distribution on the total ownership ratio by zone as called for in the UPC. Therefore, DOE is in compliance with the terms of the contract since it can track production by zone. However, because the computer programming and data entry errors generate inaccurate or incomplete production data by pools and strata, DOE can only estimate how much production belongs to each owner when relying on its computerized production reporting system. Further, we believe that the production inaccuracies are compounded by the inappropriate method that DOE used to determine the production volumes coming from the various pools and strata in commingled wells. In our opinion, this situation adds to the uncertainties of how much oil has been and is being produced from each pool and, consequently, of each owner's appropriate share.

As stated in the previous section, if NPR-1 is sold before the reserves are depleted, the government may not receive a settlement that reflects its actual ownership of past production by using the zone ownership ratio. However, even if the two owners agreed to balance their accounts by using actual ownership percentages and production by strata, DOE could not calculate the appropriate settlement until its data problems are resolved and accurate production numbers are in the system. Further, unless DOE's computer system is revised so that it can calculate a distribution of past production by strata ownership, these calculations would have to be done manually, making for a more time-consuming and difficult process.

SECTION 6

DOE'S CORRECTIVE ACTIONS

DOE HAS ACKNOWLEDGED ITS PRODUCTION DATA PROBLEMS AND IS

-- CORRECTING ITS DATA ENTRY ERRORS,

-- PLANNING TO CORRECT ITS ALLOCATION FACTORS FOR COMMINGLED
WELLS, AND

-- WORKING TO CORRECT ITS COMPUTER PROGRAM ERROR.

DOE'S CORRECTIVE ACTIONS

We brought the production data problems to the attention of the Director, Naval Petroleum and Oil Shale Reserves; the Director, Naval Petroleum Reserves in California; and Chevron's Member of the Operating Committee and officials of its Western Regional Office. They agree that production data problems do exist; however, they do not share our level of concern about the potential effect of these problems either on divestiture of the government's share of NPR-1 or on the ability to produce NPR-1 at its maximum efficient rate.

In response to the production data problems, DOE told us it has initiated the following actions:

- Validation of historical and current production data to correct data entry errors and enhancement of quality control measures to provide greater protection against future data entry errors.
- Review of allocation factors for all wells having commingled production from two or more pools and evaluation of several alternatives to determine the most appropriate basis for developing allocation factors.
- Development of allocation factors for gas and water for all wells with plans to enter these factors into the historical and current data base.
- Changes in the computer program so that it will produce more accurate production reports using historical allocation factors and allocation factors for injection wells.

DOE did not provide timetables for completing these actions or any details on their scope.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

GAO HAS CONCLUDED THAT DOE

- NEEDS TO EXPEDITIOUSLY MAKE THE CHANGES THAT WILL ALLOW DEVELOPMENT OF ACCURATE PRODUCTION AND OWNERSHIP DATA AT NPR-1,
- DOES NOT HAVE AN INTERNAL CONTROL SYSTEM IN PLACE THAT CAN ENSURE FULL IMPLEMENTATION OF THE INITIATIVES UNDERWAY TO RESOLVE THE DATA PROBLEMS, AND
- NEEDS TO CLOSELY EXAMINE THE OPTIONS FOR AND THE IMPACTS OF TERMINATING OR RENEGOTIATING THE UPC TO ENSURE THAT THE GOVERNMENT'S INTERESTS ARE FULLY PROTECTED IF NPR-1 IS SOLD.

CONCLUSIONS

The problems discussed in this report, together with the statutory requirement that NPR-1 be produced at its maximum efficient rate, the dual ownership of the field, and the proposed sale of NPR-1 in the immediate future require that DOE give priority attention to correcting the data problems in the computerized production system. In addition to the basic requirement in the UPC that an accurate set of production records be maintained, production data are important elements in establishing the appropriate MERs to minimize the possible loss of oil and gas. The joint ownership of NPR-1, with the numerous ownership percentages of the various producing strata, and the responsibility to the public to effectively and efficiently manage the asset further emphasize the need for a computerized production system that provides accurate and timely data.

Although DOE has stated that corrective actions are being initiated, it has provided no timetable for completion or details on the scope of the proposed actions. Consequently, we are not certain that appropriate emphasis is being given to these corrective actions or that all of the problems identified are included.

The numerous errors that were found in the production records point up the lack of adequate internal controls to ensure that data input errors are detected and corrected, management decisions are appropriately implemented, and activities that are contracted out are adequately monitored. Although DOE established a position for a quality assurance specialist in July 1986, it had not filled the position as of March 1, 1987. We believe more emphasis needs to be placed on this aspect of the operations. DOE needs to assure that actions initiated to correct problems identified by our audit work will be fully implemented in a timely way and that these problems will not recur.

The proposed sale of NPR-1 in the immediate future has added an extra dimension to the need for accurately defining the amount of production from the various producing strata and the share of production that should be credited to each owner. While the current uneven production from the various strata would likely be of minimal consequence over the life of NPR-1 in a final balancing of the owners' rights and obligations, we believe it could be an important element in any settlement of accounts if the government sells its share of NPR-1. In our opinion, the lack of specificity in the UPC on how a fair and equitable settlement should be reached raises an issue that needs to be resolved by the owners. We believe that for the government to receive its fair share of all past production and pay only its rightful share of all incurred expenses for operating and maintaining NPR-1, DOE must closely

examine the options available to resolve the final accounting issues with Chevron.

RECOMMENDATIONS

We recommend that the Secretary of Energy

- give priority attention to correcting the production data inaccuracies, establishing an allocation system that more accurately reflects the source of petroleum production in commingled wells, and developing a system to better define production ownership;
- establish an effective internal control program to (1) prevent problems similar to those identified in this report from recurring, (2) provide the necessary assurances that corrective actions are and will be fully implemented, and (3) provide continuous oversight of NPR-1 operations; and
- ensure that the government's interests concerning the allocation of past production and remaining recoverable reserves are protected in any proposed sale of NPR-1.

OBJECTIVES, SCOPE, AND METHODOLOGY

On May 7, 1986, Senators Lloyd Bentsen and Albert Gore, Jr. asked that we examine whether the rate of production at NPR-1 meets the requirement of Public Law 94-258. In conducting our audit work, it became apparent that inaccuracies and omissions in the production data and records at NPR-1 would preclude us from reaching a definitive conclusion on this issue. After a briefing to these offices, we agreed to provide a briefing report on production data problems at NPR-1 and their effect on the determination of production rates at NPR-1 and on a final settlement of each owner's share of NPR-1 if the government sells its share in the near future.

Because of the nature of the geology at NPR-1, we limited our analysis of production data and the methodology used to allocate production to the Stevens Zone--the largest of the four producing zones at NPR-1. Our examination and analysis covered the time period from the early 1920's through 1986.

We initially attempted to determine actual production for each oil pool over time. These data are needed to study individual pools and analyze rates of production. Using DOE computer reports of cumulative production generated in September 1984 and October 1986, we compared the cumulative production totals from the start of production at the field until August 1984. Because there were major discrepancies, we compared the wells, the allocation factors, and the production totals for each well on both computer runs to determine what was wrong. We also interviewed DOE, Bechtel, and Chevron officials at NPR-1 about these differences, and analyzed records of changes in allocation factors. However, because of the lack of accurate data, we did not continue our determination of whether or not there was overproduction.

To evaluate production practices by DOE and the unit at NPR-1, we analyzed their well records, production data, Engineering Committee and Operating Committee minutes, and other records at NPR-1. We also conducted interviews with DOE officials at NPR-1 and in Washington, D.C.; Chevron officials at NPR-1 and San Ramone, California; Bechtel officials at NPR-1; and consultants employed by DOE to analyze individual pools at NPR-1.

To analyze commingled production at NPR-1, we reviewed and analyzed production and allocation records for individual wells and pools at the field, and well history records and well logs for many wells in the Stevens Zone. We also compared DOE's practices to petroleum geology and petroleum engineering books and articles, and consultants reports on NPR-1 prepared for DOE and Chevron. In some instances, our report identifies specific numbers of wells and

their related production volumes that are considered to have commingled production. These numbers were determined from our analysis of NPR-1 data and reports that were sometimes incomplete, lacked official approval, and contained inaccuracies. Consequently, they should be viewed as providing an understanding of the magnitude of the problem rather than as absolute numbers.

The report was reviewed by an independent, outside petroleum engineer to assess the technical accuracy of our observations.

To determine current and past regulatory practices relating to commingled production, we spoke to and obtained relevant documents from officials of the Bureau of Land Management in Washington, D.C.; the U.S. Minerals Management Service in Reston, Virginia, Los Angeles, California, and New Orleans, Louisiana; and technical staff of the state oil and gas regulatory bodies of Alaska, California, Louisiana, Oklahoma, and Texas. These states were chosen because collectively they account for about 79 percent of all U.S. crude oil and natural gas liquids production. We also spoke with officials of the American Petroleum Institute and the Society of Petroleum Engineers.

Our review of the unit plan contract and legal ownership determinations of past production were the basis for our analysis of cash settlement effects if NPR-1 is sold.

We reviewed the unit's internal controls only to the extent that they related to the (1) production data input, (2) accuracy and completeness of production records, and (3) review of well allocation procedures. Our observations of their adequacy in these selected areas are based on the requirements in the Standards For Internal Controls In The Federal Government (GAO, 1983).

We conducted our study from June 1986 to January 1987 in accordance with generally accepted government auditing standards.

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