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Naval Petroleum & Oil Shale Reserves

Annual Report of Operations

Fiscal Year 1993

U.S. Department of Energy
Assistant Secretary for Fossil Energy
Washington, D.C. 20585

MASTER

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Naval Petroleum & Oil Shale Reserves

*Fiscal Year 1993
Annual Report of Operations*

United States Department of Energy
Assistant Secretary for Fossil Energy
Naval Petroleum and Oil Shale Reserves

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PROGRAM DESCRIPTION

BACKGROUND

During fiscal year 1993, the Federal Government continued to operate Naval Petroleum Reserve No. 1 in California and Naval Petroleum Reserve No. 3 in Wyoming through its contractors and to produce the reserves at their maximum efficient rates as provided by the Naval Petroleum Reserves Production Act of 1976 (Public Law 94-258). In addition, natural gas production operations were conducted at Naval Oil Shale Reserve No. 3. All productive acreage owned by the Government in Naval Petroleum Reserve No. 2 in California is produced under lease to private companies. The locations of the reserves are shown in figure 1.

Figure 1. Naval Petroleum and Oil Shale Reserves

Under the Naval Petroleum Reserves Production Act of 1976, production was originally authorized for six years and based on findings of national interest, the President was authorized to extend production in three-year increments. President Reagan exercised this authority three times (in 1981, 1984, and 1987) and President Bush authorized extended production once (in 1990). On October 7, 1993, President Clinton authorized production at the maximum efficient rates through April 5, 1997.

FISCAL YEAR 1993 PROGRAM HIGHLIGHTS

During fiscal year 1993, the reserves generated \$440 million in revenues, a \$33 million decrease from the fiscal year 1992 revenues, primarily due to significant decreases in oil and natural gas prices. Total costs were \$207 million, resulting in net cash flow of \$233 million, compared with \$273 million in fiscal year 1992. From 1976 through fiscal year 1993, the Naval Petroleum and Oil Shale Reserves generated \$15.7 billion in revenues for the U.S. Treasury, with expenses of \$2.9 billion. The net revenues of \$12.8 billion represent a return on costs of 441 percent. See figures 2, 3, and 4.

In fiscal year 1993, production at the Naval Petroleum and Oil Shale Reserves at maximum efficient rates yielded 25 million barrels of crude oil, 123 billion cubic feet of natural gas, and 158 million gallons of natural gas liquids.

The Naval Petroleum and Oil Shale Reserves projects that hydrocarbon revenues will decline in fiscal year 1994. The principal challenges for the Naval Petroleum and Oil Shale Reserves in the years to come—which also confront private domestic producers—are that the most prolific oil-bearing reservoirs are being depleted, costs to extract the oil from

the ground are increasing, and market prices for the hydrocarbons are generally stable or declining. In response to these technical and economic conditions, the Naval Petroleum and Oil Shale Reserves managers began efforts to identify opportunities to increase recovery efficiencies and decrease costs, and they are continuing to expand these efforts to fully support the President in his call to “reinvent Government” and to use resources as efficiently as possible.

Figure 2. Naval Petroleum and Oil Shale Reserves Historical Production

Figure 3. Naval Petroleum and Oil Shale Reserves Revenues versus Expenses

In fiscal year 1993, Congress (House Report No. 102-626, accompanying the Department of the Interior and Related Agencies Appropriations Act, 1993) requested that the Department of Energy conduct "...a study by independent experts of development plans, staffing, and organization to optimize the operation of the Reserve...." Five petroleum industry experts completed an extensive, "top down" analysis of the overall mission and operation of the giant Elk Hills field. In its Report to Congress "Evaluation of Operations at Naval Petroleum Reserve No. 1," October 1993, DOE/FE-0283), the independent team presented 18 recommendations for improving operations at Elk Hills and increasing its value as a significant national asset. Chief among these recommendations were the following:

- The Department of Energy and its contractor should manage and operate Elk Hills as a significant national asset.
- Congress and/or the Department of Energy should redefine the goal of Elk Hills' operations to be the "Maximization of the Value of Elk Hills as an Asset."
- To address a number of findings regarding shortcomings in the current organizational structure of the program, budgeting, staffing, and planning, the program should be reorganized as a Government corporation that is independent of the Department of Energy line management structure.

The Naval Petroleum and Oil Shale Reserves has embarked on an effort to identify additional hydrocarbon resources on the reserves for future production. In 1993, in cooperation with the U.S. Geological Survey, the Department initiated a project to assess the oil and gas potential of the program's oil shale reserves, which remain largely unexplored. These reserves, which total a land area of more than 145,000 acres and are located in Colorado and Utah, are favorably situated in oil and gas producing regions and are likely to contain significant hydrocarbon deposits. Alternatively the producing assets may be sold or leased if that will produce the most value. This task will continue through the first quarter of fiscal year 1994.

During fiscal year 1993, Headquarters and field personnel participated in several workshops and training seminars dealing with Total Quality Management. In addition, the program office organized and maintained improvement teams to eliminate waste and improve productivity by streamlining work and management processes, empowering employees, and continuing training.

Finally, the Department has under way various assessments of alternate ways of operating these assets. These are consistent with the themes the Administration adopted in the Vice President's report on "reinventing" Government. Clearly the Department of Energy has run the Naval Oil Shale Reserves in a way that makes money. The Department is wise enough, however, to ask whether there might be better ways of operating these valuable assets. Would corporatization, for example, improve profitability still more? Would selling or leasing assets at the Naval Oil Shale Reserves be a better approach for the Government? These are issues that the Department of Energy had under study during 1993 and expects to produce answers to in the near future.

Other selected highlights for the year follow.

Naval Petroleum Reserve No. 1

Production Achievements

- By September 1993, the Elk Hills Field produced over a billion barrels of crude oil, making it one of only fourteen fields in the United States to achieve that distinction. Of the one billion barrels, about 863 million barrels have been produced since 1944, when the Government and Standard Oil of California (now Chevron U.S.A., Inc.) executed a Unit Plan Contract for the Elk Hills Field. Of this amount, the Government received 660 million barrels, selling 512 million barrels to the private sector, shipping 10 million barrels to the Strategic Petroleum Reserve, and transferring 138 million barrels to the Department of Defense. The Department delivered the remaining 203 million barrels produced during this period to Chevron, its Unit partner.

Crude Oil Shipments to the Strategic Petroleum Reserve

- Pursuant to the Naval Petroleum Reserves Production Act of 1976 pricing provisions (10 U.S.C. 7430(b)(2)), the Department of Energy could not sell the Naval Petroleum Reserves crude oil at a

Figure 4. Naval Petroleum and Oil Shale Reserves Revenues and Costs, 1976-1993

price less than the higher of 90 percent of the current sales price of comparable petroleum in the same area, or the price of petroleum being purchased for the Strategic Petroleum Reserve minus the cost of transporting crude oil from the Naval Petroleum Reserves to the Strategic Petroleum Reserve. The Department held two bid openings for Naval Petroleum Reserve No. 1 crude oil during fiscal year 1993. In each of these, bids for 20,000 barrels per day failed to meet the minimum price test. As a result, this volume was shipped from California through a network of six commercial pipeline systems to the Sun Terminal in Nederland, Texas, for storage at the Strategic Petroleum Reserve. Deliveries of crude oil to the Strategic Petroleum Reserve began on June 1, 1992, and continued through September 30, 1993.

Total Quality Management

- Elk Hills has slowed its production decline by utilizing Total Quality Management principles. Before 1992, production at Naval Petroleum Reserve No. 1 had been declining at a rate of 8 percent per year. Production in fiscal year 1994 is forecast to average about 65,000 barrels of oil per day, the same level as in 1993. In addition, Elk Hills has successfully reduced costs by \$4.4 million for the fiscal year through its waste elimination actions.

Cogeneration Project

- During fiscal year 1993, Congress authorized Naval Petroleum Reserve No. 1 to conduct design, procurement, and environmental permitting work for an electric cogeneration facility. The cogeneration project will provide 42 megawatts of electrical power at an investment cost of \$48.1 million. In addition to the electrical power, 130,000 pounds per hour of steam will be available from the cogeneration process to operate the three Naval Petroleum Reserve No. 1 gas plants. The project is ahead of schedule and will be coming on line in early calendar year 1995.

Equity Redetermination

- Under the Unit Plan Contract, the Department's and Chevron's respective percentage shares of production from the commercially productive zones—their "equity shares"—are subject to periodic revisions, which are retroactive to 1942. During fiscal year 1993, the Department completed and provided Chevron U.S.A. with a report recommending revisions to the percentage shares of production from the Dry Gas Zone that have not been revised since they were initially fixed in 1942. This report was the culmination of an intensive three-year study by staff at Headquarters, the Naval Petroleum Reserves in California, and ECL-Bergeson Petroleum Technologies Inc., a consultant to the Department. Chevron did not accept the results of the Department's study and conducted its own study. Under the Unit Plan Contract, the parties' dispute on the Dry Gas Zone equity shares will be resolved by the Secretary or her designee. During fiscal year 1993 the Department also continued to work on a study that will be used in revising the equity shares for the Shallow Oil Zone. The last revision of the Shallow Oil Zone equity shares took effect in 1957. This will be the third redetermination of the Shallow Oil Zone since the equity shares were first fixed in 1942.

Exploration Drilling

- Exploratory drilling operations began during the last quarter of fiscal year 1993 to redrill Well 934-29R. The well, originally completed in 1987 to a total depth of 24,426 feet, is the deepest well drilled in California to date. Although the well produced some gas from 20,000–24,426 feet, the most promising zone was the Oceanic sand at 17,400 feet, which tested over 900 thousand cubic feet of gas and 1,600 barrels per day of water, plus heavy traces of condensate. In June 1993 the well was redrilled to test this same sand at approximately 1,000 feet above its original total depth. Bottom hole pressures at 17,400 feet were in excess of 13,000 pounds per square inch, making this a very attractive target. Drilling will be completed in fiscal year 1994.

Horizontal Drilling

- Naval Petroleum Reserve No. 1 drilled its seventh and eighth horizontal wells in the 26R Reservoir. Production from wells 312X-26R and 322-35R averages about 1,000 barrels of oil per day, three times the production of a vertical well. The horizontal wells in this reservoir contribute 36 percent (5,100 barrels per day) of the overall reservoir production (14,238 barrels per day). The first horizontal well drilled in the Stevens NWS A1-A2 Sands, Well 323-7R, produced only water; therefore, further action has been suspended pending future geological evaluation.

N and A Shale Gas Injection Project

- The Department of Energy and Chevron approved a gas injection project in the Stevens 31S N and A Shales which will improve oil recovery by a process known as oil vaporization. The cycling of injected gas will reduce residual oil in the reservoir and promote better gravity drainage, thus increasing recoverable reserves. The project cost is estimated to be \$1,300,000 with a net present value of \$14,200,000.

Shallow Oil Zone Gas Injection Projects

- Success of the Shallow Oil Zone Fault Block 12 gas injection pilot has continued in fiscal year 1993 and resulted in expanding the project to a gas and water injection in Fault Blocks 12 and 13. A second gas and water injection project attempted to salvage some economic value from the terminated Fault Block 15 - Light Oil Steam Flood. The Department terminated the second project because it had only marginal value.

Well Completion Process Improvement

- Naval Petroleum Reserve No. 1 implemented the recommendations proposed by a Quality Improvement Team and approved by the Elk Hills Quality Council to improve the well completion process. These actions have substantially reduced the time to complete a new well and to place it on production. The average time to place a new well on production has now been reduced from 200 days in fiscal year 1992 to about 45 days in fiscal year

1993. This has helped to stabilize the field's overall decline rate and to increase the net present value of the new wells. This effort is representative of many other similar initiatives to eliminate waste and inefficiency as part of the Total Quality Management philosophy.

Unit Operations 50th Anniversary

- On November 20, 1942, more than 50 years ago, the Standard Oil Company of California, now Chevron Corporation, the parent company of Chevron U.S.A., Inc., and the Government agreed to a Unit Plan Contract for the cooperative exploration, development, and operation of all lands in Naval Petroleum Reserve No. 1. The Unit Plan Contract, which is still in effect today, was signed by the Navy and Standard Oil Company of California on June 19, 1944, and approved by the President on June 28, 1944. Under the contract, equity shares between the Government and Chevron, as computed from time to time, are made retroactive to November 20, 1942.

Environment and Safety

- On June 27, 1989, the Secretary of Energy announced a 10-point initiative to strengthen environmental protection, safety, and health management activities at the Department of Energy's production, research, and testing facilities. In support of this initiative, the Secretary established independent "Tiger Teams" to conduct compliance assessments at the Department of Energy's facilities. The Naval Petroleum and Oil Shale Reserves in California's environment, safety, and health efforts in fiscal year 1993 related to the Tiger Team Final Corrective Action Plan, approved in April 1993, which consisted of 245 separate actions. Approximately 36 percent (88 of 245) of all action plan milestones were completed at the close of the fiscal year.
- The Naval Petroleum Reserves in California developed and implemented an Environmental, Safety, and Health Self-Assessment Program. At the close of the year approximately 46 self-appraisals, functional appraisals, management appraisals, and internal appraisals had been conducted under the

Self-Assessment Program, resulting in 91 findings and concerns where the program identified improvement opportunities. The Department developed appropriate corrective actions, initiated implementation of activities, and, in many cases, completed activities.

- The Naval Petroleum Reserves in California received the Annual Kern County American Lung Association Award for significant contributions to the improvement of the surrounding air quality. The award resulted from the program's establishment of the largest employee van pool program in the County, which reduced employee travel miles driven to and from work; the establishment of an alternative work schedule for employees, thereby further reducing employee travel; and the implementation of a program to utilize clean burning compressed natural gas in fleet vehicles.
- The Naval Petroleum Reserves in California responded to comments on the Draft Naval Petroleum Reserve No. 1 Supplemental Environmental Impact Statement (released for comment during fiscal year 1992) and finalized its Supplemental Environmental Impact Statement. The Department plans to release the Record of Decision in fiscal year 1994.
- The Naval Petroleum Reserves in California continued to coordinate with the Fish and Wildlife Service on its development of a new Biological Opinion for activities at Naval Petroleum Reserve No. 1, pursuant to the Naval Petroleum Reserves in California's 1991 request for a formal consultation under Section 7 of the Endangered Species Act. In June 1993, the Fish and Wildlife Service transmitted a draft nonjeopardy Biological Opinion to the Naval Petroleum Reserves in California for review and comment. The draft Opinion proposes a large number of new and complex requirements, which were still under review by the Naval Petroleum Reserves in California at the close of the year.
- Naval Petroleum Reserve No. 1 maintained a good safety record. At the close of fiscal year 1993, employees from Bechtel Petroleum Operations,

Inc., the Naval Petroleum Reserve No. 1 management and operating contractor, had completed in excess of two million consecutive hours without a lost-time accident.

- The Naval Petroleum Reserves in California continued to pursue the development and implementation of a comprehensive Occupational Medical Program. As a result of the Tiger Team Assessment and a Department of Energy Headquarters Occupational Medical Program audit in fiscal year 1993 the Naval Petroleum Reserves in California hired a Medical Director.
- The program's development and implementation of a comprehensive Emergency Management Program continued during fiscal year 1993. It finalized the Emergency Management Plan and conducted several drills to test the strengths and weaknesses of various aspects of the program.
- In response to the Tiger Team findings, the program aggressively sought to improve its Quality Assurance Program by developing 12 comprehensive correction action plans that the Secretary later approved. Activities in fiscal year 1993 focused on the completion of these action plans.

Naval Petroleum Reserve No. 3

Tiger Team Environmental and Safety Assessment

- On August 19, 1993, the Secretary approved the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming's Corrective Action Plan. Progress in implementation has been achieved, with 32.1 percent of the Corrective Action Plan already implemented. Implementation of the Corrective Action Plan will continue through fiscal year 1994.

Testing and Evaluation of New Petroleum Technologies

- Following the guidelines established in the Naval Petroleum and Oil Shale Reserves Strategic Plan, Naval Petroleum Reserve No. 3 created a task force to provide the initiative needed to pursue advanced technology projects. Naval Petroleum

Reserve No. 3 entered a partnership with the University of Wyoming on an electric motor efficiency. The Department's Energy Related Inventions Program sponsored the initiation of a testing program to enable Naval Petroleum Reserve No. 3 to test and evaluate new ideas for petroleum industry use. The Naval Petroleum Reserve No. 3 task force plans to develop a training program for universities, small independent oil producers, and Native American educational programs to provide basic and advanced oil production training and hands-on experience. The establishment of the Naval Petroleum Reserve No. 3 as a testing site for new technologies will become an important operational activity during fiscal year 1994.

Steamflood

- The project most responsible for production at Naval Petroleum Reserve No. 3 continues to be the steamflood operation in the Shannon formation. During fiscal year 1993, steam injection continued from Steam Generator Nos. 1, 3, and 4, and injection commenced from the newly constructed Steam Generator No. 5. Steam Generator No. 2 was shut down due to high steam-oil ratios and premature steam breakthrough in all the No. 2 patterns. Crude oil production from the Shannon steamflood project averaged 851 barrels of oil per day, representing 44 percent of total field production.

In its search for greater value and profitability, the Department conducted an analysis of its organization and staffing and initiated a Naval Petroleum Reserve No. 3 Profitability Task Force. Due to declining production and lower than anticipated oil prices, the task force recommended that the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming implement wide-ranging budget cuts. These budget cuts allowed the program to continue oil production at Naval Petroleum Reserve No. 3 at the maximum efficient rate, and to maintain a positive net cash flow for fiscal year 1993. In order to operate profitably in fiscal year 1994, Naval Petroleum Reserve No. 3 reduced its operating and overhead costs by 20 percent at the end of fiscal year 1993. The pro-

gram also established significant initiatives to develop additional missions for the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming.

Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming

Protection Program

- Through fiscal year 1993, 89 commercially producing natural gas wells were drilled by private industry within one mile of Naval Oil Shale Reserve No. 3, located in Colorado, as well as thirteen nonproducing wells that were either plugged, abandoned, or not produced due to marginal production or distance from a pipeline.
- In accordance with Colorado well spacing requirements and standard industry practices, through fiscal year 1993 the Department of Energy participated in 18 privately-operated wells through communitization agreements. In addition, the Department of Energy drilled 15 Government-owned offset wells and six wells operated by the Government that are communitized with adjacent private landowners or leaseholders. This 39-well program has significantly mitigated drainage of Government gas by private development. Sales of natural gas from these wells have substantially contributed to the income of the Naval Oil Shale Reserves in Colorado, Utah, and Wyoming operations. This added income from the Naval Oil Shale Reserves properties in Colorado and Utah could grow if increased well development (beyond drainage protection) is permitted. Projects to assess the oil and gas potential of the Naval Oil Shale Reserves, and options for development of these resources, were initiated in fiscal year 1993. These assets might be sold or leased if that proves the best way to get them developed quickly, avoid bureaucratic and budgetary delays, and ensure the highest return for the American people.

NAVAL PETROLEUM RESERVE NO. 1

Naval Petroleum Reserve No. 1, Elk Hills, occupies 47,409 acres and is located about 35 miles west of Bakersfield in Kern County, California. It produced more than 24 million barrels of crude oil at the rate of 65,000 barrels of oil per day and ranks among the ten largest domestic producing oil fields in the lower 48 States. Elk Hills, also one of the Nation's top ten producing gas fields, produced 323 million cubic feet of natural gas per day and processed 426,000 gallons per day of natural gas liquids in fiscal year 1993.

Most of Naval Petroleum Reserve No. 1 is owned and operated jointly by the Government and Standard Oil Company (now Chevron) under a Unit Plan Contract executed in 1944. The Unit Plan Contract enables the unit participants to develop the field on a reservoir basis rather than on a parcel-by-parcel basis, and allows for more efficient and greater recovery of petroleum resources by avoiding competitive production of individual parcels. Under the Unit Plan Contract, each participant shares in unit costs and production of petroleum in proportion to the acre-feet of commercially productive formations (zones) underlying its surface lands.

The parties' equity shares of the producing zones within the Elk Hills unit are as follows:¹

Zone	Government	Chevron U.S.A.
Dry Gas	77.0492%	22.9508%
Shallow Zone	70.0119%	29.9881%
Stevens	79.6357%	20.3643%
Carneros	100.0000%	0.0000%

¹ A small amount of additional production comes from the Asphaltite Field, a part of Naval Petroleum Reserve No. 1, and 100 percent Government-owned but not unitized under the Unit Plan Contract.

The Government's share of total unit production from Naval Petroleum Reserve No. 1 averages about 78 percent.

Field development and daily operations in fiscal year 1993 were performed by Bechtel Petroleum Operations, Inc., under a management and operating contract that became effective August 1, 1985, and which has been extended through July 31, 1995.

PRODUCTION AND RESERVES

Naval Petroleum Reserve No. 1 reached its peak rate of oil production of 181,000 barrels of oil per day in July 1981. In September 1993, it was producing approximately 65,900 barrels of oil per day. Production in fiscal year 1994 is forecast to average about 65,000 barrels of oil per day. Daily production for fiscal year 1993 averaged 65,421 barrels of oil, of which the Government's share was 50,938 barrels of oil per day. Most of the production, 52,328 barrels of oil per day, was of an average gravity of approximately 35° (by American Petroleum Institute standards) produced from multiple reservoirs in the Stevens Zone. Shallow Oil Zone production averaged 12,763 barrels of oil per day with an average gravity of approximately 25°. Small amounts of high-quality oil were also produced from the Asphaltite Field and Carneros Zone. Production data for crude oil, natural gas, and associated liquids are provided in table 1.

Since the establishment of the reserve in 1912, more than one billion barrels of crude oil have been produced at Elk Hills, 737 million barrels of which have been produced since July 3, 1976. Based on the figures used in determining equity shares with Chevron, total reserves remaining at the end of fiscal year 1993 are estimated at 450 million barrels of crude oil. Despite this very large reserve, improving profitability in the face of declining production is the most important challenge for Naval Petroleum Reserve No. 1.

Table 1
Naval Petroleum Reserve No. 1
Production by Zone and Owner During Fiscal Year 1993

Zone	Crude oil		Natural gas (thousands of cubic feet)	Propane (gallons)	Butane (gallons)	Isobutane (gallons)	Natural gasoline (gallons)
	Barrels/ day	Total/ year					
Stevens Government Chevron	41,672 10,656	15,210,193 3,889,524	86,191,148 22,040,648	39,570, 547 10,118, 910	27,680, 137 7,078, 315	7,972,375 2,038,682	38,559,805 9,860,445
Shallow Oil Government Chevron	8,936 3,827	3,261,548 1,397,014	1,382,540 592,182	985,501 422,118	1,017, 942 436,013	283,155 121,284	3,030,270 1,297,951
Carneros Government	122	44,705	3,040,388	1,169, 187	1,010, 804	310,209	1,823,190
Dry Gas Government Chevron	0	0	3,250,968 968,372	0	0	0	0
Asphalto Field Government	208	75,794	341,224	169,314	154,710	44,527	337,860
Tulare Government	0	0	0	0	0	0	0
Total Government Chevron	50,938 14,483	18,592,240 5,286,538	94,206,268 23,601,202	41,894,549 10,541, 028	29,863, 593 7,514, 328	8,610,266 2,159,966	43,751,125 11,158,396
Grand Total	65,421	23,878,778	117,807,470	52,435, 577	37,377, 921	10,770, 232	54,909,521

DEVELOPMENT AND EXPLORATION

During fiscal year 1993, 22 development wells were drilled at Naval Petroleum Reserve No. 1, for a total of 1,165 wells drilled since the inception of the Development Program in 1974. Fifteen of the 22 wells were drilled in the Stevens Zone: 14 as producers and one as a gas injector. The seven remaining wells were drilled in the Shallow Oil Zone as producers.

There were 210 Stevens Zone remedials completed in fiscal year 1993, with the majority (167 jobs) in support of waterfloods, producer-to-water injector conversion, and artificial lift installation and repair.

Most of the Shallow Oil Zone remedials were acid stimulations and recompletions.

As of the end of fiscal year 1993, a total of 2,404 wells had been completed since establishment of the reserve. Of these, 1,063 wells were classified as active producers or injectors, 1,019 were shut in for remedial action or economics, and 322 were abandoned (see table 2).

FACILITIES AND CONSTRUCTION

Construction activity during fiscal year 1993 increased slightly over the levels in previous years. Sixty-eight projects were completed in fiscal year

1993 compared with the 60 projects completed in fiscal year 1992.

Major fiscal year 1993 projects included the following:

- **3G Gas Plant Demolition (\$830,000):** In 1944–1945, the Navy constructed the 3G Gas Plant to inject gas into the Shallow Oil Zone and to rebuild reservoir pressures reduced by wartime production. In 1987, the Department of Energy

closed the plant and in June 1993 demolished both the gas plant and the cooling tower. The Department also removed the concrete compressor foundations, vapor equipment and vessels, together with all other concrete footings and slabs. The area will be landscaped and revegetated.

- **36S and 36R Compressed Natural Gas Fueling Stations (\$660,000):** The Naval Petroleum Reserves in California worked aggressively to meet air quality regulations by replacing Unit gasoline-

Table 2
Inventory of Completed Wells at Naval Petroleum Reserve No. 1
As of September 30, 1993

Field/zone	Well status				
	Producer/ supply	Injection/ disposal	Shut-in ¹	Abandoned	Total
UNIT					
Elk Hills					
Dry Gas	35	6	9	0	50
Shallow Oil	485	16	664	287	1,452
Stevens ²	343	139	312	13	807
Carneros ³	11	0	3	1	15
Subtotal	874	161	988	301	2,324
Section 14B ⁴					
Shallow Oil	2	0	7	6	15
Unit total	876	161	995	307	2,339
NONUNIT³					
Asphalto	7	0	5	3	15
Tulare ⁵	5	12	14	6	37
Railroad Gap	2	0	5	6	13
Nonunit Total	14	12	24	15	65
Total ⁶	890	173	1,019	322	2,404
¹ Temporarily removed from production status due to field operating requirements. ² Includes wells in Sections 7R and 8R incorporated into the Unit during fiscal year 1980. ³ 100 percent Government owned. ⁴ A field not wholly contained within the boundary of the Reserve. ⁵ The Tulare Zone is not part of the Unit, but costs for the injection/disposal wells were shared by Chevron as part of overall field maintenance under the Unit Plan Contract. ⁶ The total does not include wells that have been spudded but not completed.					

powered cars, vans, and trucks with vehicles powered by compressed natural gas. The abundant source of high octane natural gas at Naval Petroleum Reserve No. 1 is an excellent alternative fuel and is presently being used to power almost one-fourth of the vehicles. The 36S and the 36R compressed natural gas fueling stations together are presently capable of fueling 150 vehicles per day.

- **Safety Analysis Review II - Firewater Modifications (\$372,000):** The second Safety Analysis Review (SAR II) identified deficiencies in the firewater systems at Low Temperature Separation Plants 1 and 2 and the Lean Oil Absorption Plant at 35R. Naval Petroleum Reserve No. 1 added block valves in the Low Temperature Separation firewater loop to allow maintenance without cutting off water flow to other parts of the loop. The Department also installed two firewater monitors at both Low Temperature Separation plants. To meet fire codes, the Department installed pressure gauges on the diesel pump as well as seismic supports for the diesel engine fuel tank and muffler.
- **Parking Improvements (\$506,000):** Naval Petroleum Reserve No. 1 upgraded its parking facilities in the 35R, 36R, and 36S areas and provided asphalt paving. The improvements also included the repair, sealing, and restriping of existing paved areas at 35R, 36R, 36S, and the 4G Closed Loop Gas Lift Compressor Station. This work provided an even parking and walking surface to reduce tripping and eliminate potholes.
- **4G/8R Closed Loop Gas Lift Liquids System (\$265,000):** Because of excessive hydrocarbon releases into the atmosphere, Naval Petroleum Reserve No. 1 installed facilities to reduce emissions at the 4G and 8R Closed

Loop Gas Lift compression stations. These facilities will also reduce filter replacement frequency and safeguard against hydrocarbon releases at the drain tanks, and liquid hydrocarbon accumulation in the gas lift system piping. The Closed Loop Gas Lift compression stations provide gas lifting of Stevens Zone production from 123 wells, approximately one-third of the Stevens wells on production at Naval Petroleum Reserve No. 1.

REVENUES AND EXPENDITURES

The Government's sales and other Naval Petroleum Reserve No. 1 revenues for fiscal year 1993 of \$419,342,208 were deposited in the Naval Petroleum and Oil Shale Reserves appropriation account at the U.S. Treasury pursuant to the Department of the Interior and Related Agencies Appropriation Act, 1993 (Public Law 102-381) of October 5, 1992. This amount includes \$37,222,937, which is Chevron's payment for its share of development and operating expenses. An accounting of revenues from petroleum product sales appears in the appendix, pages A-8 and A-10 to A-18.

During fiscal year 1993, total costs at Naval Petroleum Reserve No. 1 were \$189,278,808. The majority of the costs, \$178,485,321, were incurred for

Low Temperature Separation Gas Plant No. 2 at Naval Petroleum Reserve No. 1

field development and operations under the Bechtel Petroleum Operations, Inc., contract, including \$135,974,130 for operations and maintenance, \$18,695,331 for development drilling, \$3,005,808 for exploratory drilling, and \$20,810,052 for facilities. The remainder includes \$4,000,904 for salaries and support of the Government employees at Elk Hills and \$6,792,583 for miscellaneous contracts. Net income for the period totaled \$230,063,400.

SALES

In fiscal year 1993, the Department of Energy sold the Government's share of Naval Petroleum Reserve No. 1 crude oil under two solicitations, shown in tables 3 and 4.

Bids for 20,000 barrels of oil per day of the 50,700 barrels per day offered for the contract period October 1, 1992, to April 1, 1993, failed the minimum price test and could not be awarded under the law then in effect (10 U.S.C. 7530 (b)(2)). As in the March 1992 bid opening, the Department shipped 20,000 barrels per day of Stevens Zone crude oil, the maximum the Department could economically move by pipeline to the Strategic Petroleum Reserve. The remaining 30,700 barrels per day were awarded to the highest bidders (table 3). Stevens Zone crude oil is the only Naval Petroleum Reserve No. 1 oil that meets the Strategic Petroleum Reserve's storage specifications.

For the contract period April 1, 1993, to October 1, 1993, bids for 20,000 barrels per day of the 50,000 barrels per day offered failed to meet the statutory minimum price. Again, the Department shipped 20,000 barrels of oil per day of the Stevens Zone crude oil via pipeline to the Strategic Petroleum Reserve storage facilities, awarding the remaining 30,000 barrels per day of crude oil to the highest bidders (table 4).

In order to streamline Naval Petroleum Reserve operations and enhance the cost-effectiveness of the sales program, Naval Petroleum Reserve No. 1 consolidated all Stevens Zone crude oil deliveries at the 18G facility beginning with the April 1, 1993, sales contracts. Previously, the Department consolidated deliveries of Shallow Zone oil at the 10G location.

The Department sold natural gas in three offerings. Tables 5, 6, and 7 show the quantities delivered to customers and the prices paid. In July 1993, operational enhancements produced 19,800 million British thermal units per day of additional natural gas that the Department sold.

Beginning on May 1, 1993, the Department changed the existing contract period from four months to five months and for the first time indexed the bids for Naval Petroleum Reserve No. 1 natural gas. For fiscal year 1994, however, the contract period will revert back to four months, consistent with industry preference. The indexing will be retained on the recommendation of the Department's traditional natural gas customers.

During fiscal year 1993, the Department sold all of Naval Petroleum Reserve's No. 1's gas liquids (natural gasoline, propane, butane, and isobutane) in one offering. Table 8 shows the delivery quantities and prices.

Naval Petroleum and Oil Shale Reserves

Table 3
Naval Petroleum Reserve No. 1 Crude Oil Sales, Fiscal Year 1993
October 1, 1992, to April 1, 1993
Offering of 50,700 Barrels of Oil Per Day

Company	Quantity delivered — barrels per day		Average price billed
	Shallow Oil Zone	Stevens Zone	
Casey Company	1,382		\$14.68
Celeron Gathering Corporation		2,900	16.12
Celeron Trading & Transportation Company	5,632		14.75
Chevron U.S.A. Products		317	16.77
Kern Oil & Refining Company		2,058	16.71
Lunday-Thagard Company		696	16.72
Shell Oil Company	2,048		14.71
Sunbelt Refining Company		1,035	16.50
Sunland Refining Corporation		4,131	16.37
Texaco Trading & Transportation		5,996	16.67
U.S. Oil & Refining Company		5,125	16.60
Strategic Petroleum Reserve		20,000	16.57
Total actual deliveries (barrels/day)	9,062	42,258	
Average sales price (\$/barrel) based on actual deliveries	\$14.73	\$16.66	
NOTES: Billing prices are adjusted monthly to reflect changes in spot market prices. Small refiners awarded 25 percent.			

Table 4
Naval Petroleum Reserve No. 1 Crude Oil Sales, Fiscal Year 1993
April 1, 1993, to October 1, 1993
Offering of 50,000 Barrels of Crude Oil Per Day

Company	Quantity delivered — barrels per day		Average price billed
	Shallow Oil Zone	Stevens Zone	
Casey Company	408		\$14.46
Celeron Gathering Corporation		5,622	16.49
Celeron Trading & Transportation Company	6,119		14.88
Crysen Refining Company		5,106	16.71
EOTT Energy Corporation		343	16.30
Sound Refining Company		4,397	16.48
Texaco Refining & Marketing	2,550		14.47
		6,124	16.55
Strategic Petroleum Reserve		20,000	16.54
Total actual deliveries (barrels/day)	9,077	41,592	
Average sales price (\$/barrel) based on actual deliveries	\$14.75	\$16.43	
NOTES: Billing prices are adjusted monthly to reflect changes in spot market prices. Small refiners awarded 25 percent.			

Table 5 Naval Petroleum Reserve No. 1 Natural Gas Sales, Fiscal Year 1993 September 1, 1992, through December 31, 1992 Offering of 39,500 Million British thermal units of Natural Gas Per Day		
Company	Quantity delivered (million British thermal units/day)	Average billing price
Midway-Sunset Cogeneration Company	24,579	\$1.89
Mock Resources, Inc.	8,378	1.90
Tiger Natural Gas Company	11,175	2.01
Total actual deliveries (million British thermal units/day)	44,132	
Average sales price (\$/million British thermal units) based on actual deliveries	\$1.92	
NOTES: Contracts were for a fixed price and all deliveries were from 24Z location. Deliveries from October 1, 1992 through December 31, 1992 (Fiscal Year 1993).		

Table 6 Naval Petroleum Reserve No. 1 Natural Gas Sales, Fiscal Year 1993 January 1, 1993, through April 30, 1993 Offering of 39,200 MMBtu of Natural Gas Per Day		
Company	Quantity delivered (mil- lion British thermal units/day)	Average billing price
Midway-Sunset Cogeneration Company	42,217	\$1.73
Total deliveries (million British thermal units/day)	42,217	
Average sales price (\$/million British thermal units) based on actual deliv- eries	\$1.73	
NOTES: Contract was for a fixed price. All deliveries were from 24Z location.		

Table 7
Naval Petroleum Reserve No. 1 Natural Gas Sales, Fiscal Year 1993
May 1, 1993, through September 30, 1993
Offering of 41,700 Million British thermal units of Natural Gas Per Day

Company	Quantity delivered (million British thermal units/day)	Average billing price
San Diego Gas & Electric Company	45,670	\$2.12
Southern California Edison Company	6,222	2.21
Total deliveries (million British thermal units/day)¹	51,892	
Average sales price (\$/million British thermal units) based on actual deliveries	\$2.13	
NOTES: First contract period when pricing was based on relevant spot market prices. All deliveries were from 24Z location.		
¹ An additional 19,800 million British thermal units/day became available July 15, 1993, and both purchasers accepted increased delivery quantities.		

Naval Petroleum and Oil Shale Reserves

Table 8
Naval Petroleum Reserve No. 1 Liquid Product Sales, Fiscal Year 1993
October 1, 1992, through September 30, 1993
Offering Gallons Per Day of Natural Gasoline (117,000),
Propane (109,000), Butane (77,000), and Isobutane (25,000)

Company	Quantity delivered – gallons per day				Average billing price (\$/gallon)
	Natural Gasoline	Propane	Butane	Isobutane	
Andrews Petroleum, Inc.		15,817	27,332	11,840	\$0.41 0.25 0.48
Enron Gas Liquids, Inc.	14,260		13,549		0.39 0.26
Enron Oil Trading & Transportation	62,274		9,051		0.41 0.29
Lone Star Gas Liquids Processing, Inc.			31,876	11,789	0.27 0.45
Koch Oil Company, Inc.	42,835				0.40
Suburban Propane		98,841			0.40
Total actual deliveries (gallons/day)	119,369	114,658	81,808	23,629	
Average sales price (\$/gallon) based on actual deliveries	\$0.40	\$0.40	\$0.27	\$0.47	
NOTES: Billing prices were adjusted monthly based on relevant spot market prices. All deliveries were from 35R location.					

ENVIRONMENT

Environmental activities at Naval Petroleum Reserve No. 1 in fiscal year 1993 focused on compliance with applicable Department of Energy Orders, and Federal, State, and local environmental regulations including wildlife and habitat management. The site continues to enjoy outstanding working relationships with local and State environmental offices.

Compliance

Air Quality

Work continued in fiscal year 1993 on projects designed to comply with San Joaquin Valley Unified Air Pollution Control District, Rule 4701. Phase II work, which involves retrofitting approximately 175 internal combustion engines ranging in size from 50 to 500 horsepower, will be completed in fiscal year 1996.

Efforts are under way to assess the amount of particulate matter generated on unpaved and paved roadways. This information will be instrumental in the development of a master road plan to set priorities for road closures and paving.

Naturally Occurring Radioactive Material

In 1988, Naval Petroleum Reserve No. 1 initiated a survey of naturally occurring radioactive materials that was completed in 1990. The survey showed exposures well below acceptable levels. Departmental orders require radiological surveys for wastes generated by Naval Petroleum Reserve No. 1 activities and the Tiger Team Assessment conducted in 1991 detailed deficiencies related to radiological monitoring. Naval Petroleum Reserve No. 1 developed the radiological monitoring program encompassing health, safety, and waste issues in fiscal year 1991, with full implementation expected in early fiscal year 1994. The program will include monitoring field equipment

for naturally occurring radioactive materials and storage and disposal of contaminated facilities equipment.

Waste and Water Management

Waste management activities in fiscal year 1993 concentrated on identifying and managing process waste streams in order to implement the waste minimization program. Naval Petroleum Reserve No. 1 emphasized recycling as much waste as possible to reduce the amount of waste destined for offsite disposal.

Remediation plans to mitigate arsenic- and lead-contaminated sites and finalization of the postclosure plan are in progress. Activities included the following:

- Negotiations continue with State regulatory agencies to determine the most economical and environmentally acceptable remediation alternative for the arsenic- and lead-contaminated sites. A risk assessment will be prepared in fiscal year 1994 to ascertain risk-based cleanup levels.
- Naval Petroleum Reserve No. 1 initiated quarterly monitoring using a neutron probe of the vadose zone underneath the clay cap at the 27R Hazard-

35R Gas Plant at Naval Petroleum Reserve No. 1

ous Waste Trenches and established a moisture baseline. Future monitoring will continue to determine if there has been any leakage of water through the cap.

- The program to eliminate wastewater sumps continued. Naval Petroleum Reserve No. 1 investigated and closed a total of four sumps during this period.
- Naval Petroleum Reserve No. 1 issued a revised Spill Prevention Control and Countermeasure Plan.
- Development of the Naval Petroleum Reserve No. 1 Groundwater Protection and Management Program continued.
- Naval Petroleum Reserve No. 1 received approval of the Water Quality Solid Waste Assessment Test for two of the four inactive landfills. The Department expects approval of the other two in fiscal year 1994. Alternatives to capping of the landfills are presently being considered.
- The Draft Supplemental Environmental Impact Statement for Naval Petroleum Reserve No. 1 is in the final stage of the approval process. Naval Petroleum Reserve No. 1 developed a draft Mitigation Action Plan, and final approval for both the Supplemental Environmental Impact Statement and the Mitigation Action Plan is expected in fiscal year 1994.
- The U.S. Fish and Wildlife Service issued a partial draft Biological Opinion on the effects of oil production at maximum efficient rates on Elk Hills. The Department expects the final Biological Opinion in fiscal year 1994.
- Progress continues to complete milestones and schedules for Environmental Corrective Actions identified in the Tiger Team Corrective Action Plan. Naval Petroleum Reserve No. 1 closed on a total of 37 environmental corrective actions in fiscal year 1993.

Wildlife and Habitat Management

Endangered Species Program

Naval Petroleum Reserve No. 1's comprehensive endangered species program encompasses research and various techniques for the conservation and protection of endangered and threatened species, while allowing for continued production of hydrocarbons at the maximum efficient rate. At present, the San Joaquin kit fox, Tipton kangaroo rat, giant kangaroo rat, blunt-nosed leopard lizard, and Hoover's woolly-star are all endangered or threatened species found at the Naval Petroleum Reserves in California. Activities in fiscal year 1993 included the following:

- Preactivity surveys were conducted for 459 projects prior to any field construction, operation, or maintenance activities that could disturb habitat. The program resolved all conflicts in order to eliminate or reduce impacts to endangered species and critical habitats.
- The Department conducts habitat reclamation on disturbed areas no longer required for oil field operations. In fiscal year 1993, the Naval Petroleum Reserves in California revegetated approximately 170 sites covering approximately 100 acres. Also, the program made a qualitative assessment of reclamation success for more than 750 sites revegetated in 1988, 1991, and 1992.
- Work continued on ecological studies to monitor annual changes in kit fox, lagomorph, small mammal, and coyote populations. In addition, the Naval Petroleum Reserves in California initiated new studies for monitoring populations of giant kangaroo rats and blunt-nosed leopard lizards.
- The Naval Petroleum Reserves in California concluded a study on the effects of reseeding burned areas on small mammal and lagomorph populations with the data analysis to be completed in fiscal year 1994. Also in fiscal year 1993, the program completed kit fox survival studies.

Typical Stevens Zone tank setting at Naval Petroleum Reserve No. 1

SAFETY AND HEALTH

The Safety and Health Program at Naval Petroleum Reserve No. 1 in fiscal year 1993 concentrated on the following areas: appraisals, safety culture, training, planning, subcontractor safety, process safety management, accident reduction, fire protection, industrial hygiene concerns, and emergency preparedness.

A Tiger Team assessment determined compliance levels with the Department of Energy's Orders and Occupational Safety and Health Administration standards and Naval Petroleum Reserve No. 1 has completed the majority of the corrective actions for non-compliances. During fiscal year 1993, Naval Petroleum Reserve No. 1 completed 88 of 245 plans and corrected deficiencies identified in Technical Safety Appraisals 1 and 2 and the Independent Fire Protection Survey.

The Bechtel Petroleum Operations, Inc. work force achieved two million consecutive hours without a lost-time injury. Initiatives that contributed to the positive development of the safety culture included defining and publishing goals and performance, field presence of safety and health staff, safety meetings, positive promotion of safety through incentives, promotion of the safety suggestion program, and "All

Hands" meetings emphasizing senior management's commitment to the Safety and Health Program.

In addition, the Naval Petroleum Reserves in California trained its employees extensively in safety and health areas, addressing personal protective equipment and fire protection. Also, the fiscal year 1993 five-year Safety and Health Plan for Naval Petroleum Reserve No. 1 provides a framework under which safety and health activities are identified and prioritized as part of a Department of Energy-wide initiative.

Naval Petroleum Reserve No. 1 developed a "Process Hazards Analysis" comprehensive plan to implement the Occupational Safety and Health Administration's regulations. Naval Petroleum Reserve No. 1's onsite team analyzed approximately one-third of the existing facilities and all new major projects.

In addition, the program developed the Naval Petroleum Reserve No. 1 Emergency Management Plan, which is currently in use and awaiting Headquarters approval. The program also completed the annual revision to the Naval Petroleum Reserve No. 1 Emergency Readiness Assurance Plan and conducted a site-wide earthquake emergency exercise and four emergency drills.

LITIGATION

- *United States v. California State Board of Equalization*, Civil Action No. 88-600-LKK-EM (N.D. Calif.). The Department of Energy brought this action against the California State Board of Equalization, seeking \$27 million in State sales taxes paid by Williams Brothers Engineering Co., the Naval Petroleum Reserves in California contract operator from 1975 through 1981. The district court granted the State summary judgment in June 1989; the Ninth Circuit Court of Appeals affirmed and denied the Department of Energy's petition

for a rehearing *en banc*. The U.S. Supreme Court granted the Department of Energy's petition for *certiorari* but in 1993 the Court denied the Department of Energy's appeal.

- Appeals of **Powerine Oil Company** (EBCA No. 278-2-83), **USA Petrochem** (EBCA Nos. 280-2-83 and 300-10-83), **Tosco Corporation** (EBCA Nos. 281-2-83 and 282-2-83), **LaJet** (EBCA No. 283-2-83), **Pacific Refining Company** (EBCA Nos. 290-6-83 and 321-8-84), **C. Itoh & Company** (EBCA No. 296-9-83), **Fletcher Oil & Refining Company** (EBCA Nos. 301-11-83 and 307-12-83), **Newhall Refining Company, Inc.** (EBCA Nos. 302-11-83, 303-11-83, and 304-11-83), and **Oasis Petroleum Corporation** (EBCA No. 305-11-83). Nine purchasers of Naval Petroleum Reserve No. 1 crude oil during 1978, 1979, and 1980 filed 15 appeals before the Energy Board of Contract Appeals claiming the Government overcharged them a total of approximately \$17 million by using incorrect posted prices as the "crude base price" under their contracts' price provisions.

In 1991, the Energy Board of Contract Appeals ruled for the Department of Energy on 14 out of the 15 appeals, ruling for Newhall Refining on its 1978 contract claim for approximately \$88,000. On June 8, 1993, the Court of Appeals for the Federal Circuit upheld the Energy Board of Contract Appeals decision denying the 14 other claims of overcharge and subsequently the Court denied appellants' motion for a rehearing *in banc*.

- Appeals of **Beacon Oil Company** (EBCA Nos. 215-6-82, 216-2-82, and 345-12-85). A Naval Petroleum Reserve No. 1 crude oil purchaser filed two claims before the Energy Board of Contract Appeals during fiscal year 1985 seeking recovery of alleged overcharges under its 1978 and 1979 contracts. The Energy Board of Contract Appeals initially dismissed the appeals, but, after a lengthy appeal process, the U.S. Court of Appeals for the Federal Circuit vacated those decisions. Pursuant to a subsequent Energy Board of Contract Appeals order, Beacon filed two complaints on May 31, 1988, claiming approximately \$1.3 million. The

board denied Beacon's motion for partial summary judgment on the issue of timeliness in June 1990 and denied Beacon's motion for reconsideration in July 1990. The parties are awaiting the board's decision on the Department of Energy's motion for summary judgment on the 1979 contract claims. The parties settled the 1978 contract claim in fiscal year 1991.

- Appeals of **Golden West Refining Co., Kern Oil & Refining Co., Lunday-Thagard Co., and Sunland Refining Corp.** (EBCA Nos. C-9208134 through C-9208137, respectively). These appellants filed virtually identical contract claims alleging that the Department of Energy wrongfully extended their contracts to purchase Naval Petroleum Reserve No. 1, Elk Hills, crude oil for 30 days beyond their April 1, 1992, expiration date and that as a result the appellants incurred damages totaling in excess of \$860,000. The Department of Energy contracting officer denied the four claims, and appellants appealed those decisions to the Energy Board of Contract Appeals. On September 10, 1993, the Department of Energy answered appellants' motion for summary judgment and filed its cross-motion for summary judgment. These motions are pending before the Board.
- **Celeron v. United States**, U.S. Court of Appeals Claims No. 93-260 C. In October 1988, Celeron Gathering Corporation contracted to buy Naval Petroleum Reserve No. 1 crude oil from a delivery site at the 24Z sales point. The Department of Energy underdelivered to Celeron at 24Z due to wastewater disposal problems. Later in the contract term and after crude oil prices had risen, Celeron requested and the Department of Energy delivered oil at 18G to make up for 24Z underdeliveries. Celeron submitted a claim for \$1,126,000, the difference between the purchase price at the time of initial delivery and the price Celeron paid for the crude that was later delivered at 18G. The Department of Energy denied Celeron's claim and Celeron sued the Department of Energy in the Claims Court, where the matter is pending.

NAVAL PETROLEUM RESERVE NO. 2

Naval Petroleum Reserve No. 2, Buena Vista Hills, California, covers 30,181 acres adjacent to and south of Naval Petroleum Reserve No. 1. The Buena Vista Hills Field has been producing crude oil continuously since the early 1920's. The Government owns 10,446 acres (34.6 percent) of Naval Petroleum Reserve No. 2, and the remainder is privately owned. All of the Government's productive land (9,224 acres) has been leased in 17 separate parcels that "checkerboard" Naval Petroleum Reserve No. 2. All Naval Petroleum Reserve No. 2 development and production operations are performed by the lessees, with the Government receiving production royalties.

EXPLORATION

Fred S. Holmes Oil Company drilled a producing oil well on a Phillips Petroleum Company Federal oil and gas lease at Naval Petroleum Reserve No. 2 under a farm-out agreement with Phillips. This was the third successful oil well drilled on the Holmes farm-out parcel in the past two years. The Department approved a fourth well to be drilled horizontally from one of the three existing pads; it should be completed in fiscal year 1994. Recent changes in ownership of a few Federal leases on Naval Petroleum Reserve No. 2 indicate that there may be additional exploration drilling proposals in the near future.

PRODUCTION

Total Naval Petroleum Reserve No. 2 production, predominantly from stripper wells, averaged 3,847 barrels of oil per day during fiscal year 1993. More than 649 million barrels of oil have been produced

from Naval Petroleum Reserve No. 2 from the early 1920's through fiscal year 1993. Total remaining recoverable reserves at Naval Petroleum Reserve No. 2 are estimated at 4 million barrels (table 9). Of the 2,205 barrels of oil per day produced during fiscal year 1993, the Government's royalty share of oil averaged 318 barrels of oil per day. Table 10 lists the quantities of crude oil, natural gas, and associated liquids produced and sold from Government leases on Naval Petroleum Reserve No. 2 during fiscal year 1993.

REVENUES AND EXPENDITURES

The Government's royalty revenues from Naval Petroleum Reserve No. 2 during fiscal year 1993 totaled \$2,615,775. A breakdown of revenues by product appears in the appendix, pages A-10 to A-18. Nominal expenses associated with the Naval Petroleum Reserve No. 2 operations in fiscal year 1993 include costs for lease surveillance, production accounting, and oversight.

ENVIRONMENT

The Department of Energy's environmental activities at Naval Petroleum Reserve No. 2 in fiscal year 1993 included endangered species research and protection, habitat reclamation, cultural resource protection, Department of Energy Environmental Survey corrective actions, general environmental inspections and surveys, National Environmental Policy Act documentation, and Endangered Species Act section 7 compliance activities.

Naval Petroleum and Oil Shale Reserves

Table 9 Reserves and Cumulative Annual Oil Production at Naval Petroleum Reserve No. 2 As of September 30, 1993						
Pool/unit	Cumulative production (barrels)	Percentage of ultimate recovery	Total Naval Petroleum Reserve No. 2 remaining reserves (barrels)	Govern- ment lease reserves (barrels)	Total fiscal year 1993 production (barrels)	Government lease production (barrels)
27-B Pool Unit	99,558,142	100.0	20,000	4,109	6,942	1,426
Antelope Shale Zone Unit	22,489,801	99.6	100,000	37,586	73,912	27,781
Antelope Shale Pool Nonunit	10,175,242	94.0	648,217	286,520	58,035	27,828
555 Stevens Pool Unit	50,178,900	99.0	500,000	385,951	243,313	187,814
Stevens Pool Nonunit	4,335,479	99.5	20,000	20,000	14,144	14,144
2-D Unit	434,479	95.6	20,000	6,534	15,831	5,172
11-D Unit	949,985	97.9	20,000	4,330	13,086	2,833
Shallow Pool	461,010,868	99.4	2,900,000	400,000	978,782	510,975
Total	649,132,896	99.4	4,228,217	1,145,030	1,404,045	777,973

Table 10
Naval Petroleum Reserve No. 2
Production and Royalty Data, Fiscal Year 1993

Zone	Oil (barrels)	Natural gas (thousands of cubic feet)	Liquid products		
			Propane (gallons)	Natural gasoline (gallons)	Butane (gallons)
27-B Pool Unit					
Government Lease Sales	1,465	38,586	12,763	49,720	23,247
Royalty Rate (%)	12.9%	12.5	5.6	5.6	5.6
Royalty Quantity	189	4,823	709	2,762	1,292
Antelope Shale Zone Unit					
Government Lease Sales	27,787	588,431	272,574	517,142	168,249
Royalty Rate (%)	14.0	14.0	4.7	4.7	4.7
Royalty Quantity	3,890	82,380	12,720	24,133	7,852
Antelope Shale Zone Nonunit					
Government Lease Sales	25,607	297,737	53,678	250,761	76,626
Royalty Rate (%)	12.5	12.5	7.2	6.9	7.0
Royalty Quantity	3,200	37,216	3,868	17,383	5,381
555 Stevens Zone Unit					
Government Lease Sales	183,314	293,288			
Royalty Rate (%)	12.5	12.5			
Royalty Quantity	22,914	36,661			
Stevens Pool Nonunit					
Government Lease Sales	14,086	61,674	21,562	268,628	45,744
Royalty Rate (%)	12.5	12.5	6.2	6.1	6.1
Royalty Quantity	1,762	7,711	1,331	16,371	2,778
2-D Unit					
Government Lease Sales	5,515				
Royalty Rate (%)	13.5				
Royalty Quantity	745				
11-D Unit					
Government Lease Sales	2,733				
Royalty Rate (%)	13.5				
Royalty Quantity	369				
Shallow Pool					
Government Lease Sales	544,326	681,665	450,644	1,298,356	220,128
Royalty Rate (%)	15.3	14.6	6.0	5.9	5.8
Royalty Quantity	83,014	99,348	26,821	77,062	12,740
Total					
Government Lease Sales	804,833	1,961,381	811,221	2,384,607	533,994
(Daily Average)	2,205	5,374	2,223	6,533	1,463
Royalty Quantity	116,083	268,139	45,449	137,711	30,043
(Daily Average)	318	735	125	377	82

NAVAL PETROLEUM RESERVE NO. 3

Naval Petroleum Reserve No. 3, Teapot Dome, is a Federally owned oil field of 9,481 acres located 35 miles north of Casper, Wyoming, in Natrona County. In 1976, the Department of Energy initiated full production. Prior activity included lease production in the 1920's and offset production from 1958 to 1976. FD Services, Inc. (a subsidiary of Fluor Daniel, Inc.) currently serves as the management and operating contractor at Naval Petroleum Reserve No. 3.

PRODUCTION AND RESERVES

More than 725,000 barrels of oil were produced from Naval Petroleum Reserve No. 3 during fiscal year 1993 at an average rate of 1,988 barrels of oil per day. Approximately 24.7 million barrels of oil have been produced from Naval Petroleum Reserve No. 3 since initiation of production at the reserve in 1922, and 17.3 million barrels since July 3, 1976. The Shannon and the Second Wall Creek formations account for 77 percent of the total production. Except for an average of 92 barrels of oil per day produced from the Tensleep formation, oil produced from the nine reservoirs at Naval Petroleum Reserve No. 3 is light, sweet (low sulfur) crude. Table 11 shows crude oil, natural gas, and associated liquids production data by zone.

Estimated remaining recoverable reserves at Naval Petroleum Reserve No. 3 are 2.2 million barrels using primary and secondary production techniques. It is estimated that tertiary recovery by steamflooding portions of the Shannon formation could add five million barrels of otherwise unrecoverable oil.

DEVELOPMENT AND EXPLORATION

In 1976, prior to initiating the Development and Exploration Program at Naval Petroleum Reserve No. 3, 233 wells had been drilled. Since that time, an additional 910 development wells and 90 exploratory wells have been drilled. Of the 910 development wells, 44 were drilled during fiscal year 1993.

A total of 1,233 wells have been drilled at Naval Petroleum Reserve No. 3 since it was created. At the end of fiscal year 1993, 697 wells were classified as active producers, injectors, or observation wells. Of these, 376 wells were shut in, 38 more than the 338 shut-in wells in fiscal year 1992. Naval Petroleum Reserve No. 3 completed 44 wells in 1993, and has plugged and abandoned 153 wells since 1922 (table 12).

ENHANCED OIL RECOVERY

The Shannon reservoir is estimated to have originally contained 144 million barrels of oil, of which only seven million barrels are estimated to be recoverable by primary means. Planning for enhanced oil recovery pilot projects began in fiscal year 1980 to determine the optimum recovery methods. Pilot projects to test in-situ combustion and polymer-improved waterflood were implemented in the early 1980's and completed in fiscal year 1986. Favorable production responses to steam preheating in the in-situ combustion pilot led to the development of a steam drive pilot in October 1985, which operated with an increasingly favorable production response in fiscal year 1986 and fiscal year 1987. From fiscal years 1988 through 1993, the project was expanded as five steam generators were purchased and placed in service.

Naval Petroleum and Oil Shale Reserves

Table 11
Naval Petroleum Reserve No. 3 Production
Fiscal Year 1993

Zone	Crude oil (barrels/day)	Crude oil (total production in fiscal year 1993)	Natural gas (thousands of cubic feet)	Propane (gallons) ¹	Butane-plus (gallons) ¹
Shannon	1,233	450,137	3,513		
Steele Shale	179	65,179	2,609		
Niobrara Shale	127	46,385	1,467		
Second Wall Creek	311	113,560	2,166,711		
Third Wall Creek	20	7,181	0		
Muddy Sand	23	8,421	107,106		
Dakota	3	952	0		
Lakota	1	358	9,485		
Tensleep	92	33,592	0		
Total	1,989	725,765	2,290,891	551,877	1,747,029

¹ Data for propane and butane-plus production by zone are not available.

Table 12
Inventory of Wells, Naval Petroleum Reserve No. 3
As of September 30, 1993

Zone	Injector/ observer	Producer ¹	Enhanced oil recovery ²	Water source	Shut-in	Plugged & abandoned	Drilling/ completing	Total
Shannon	70	234	180	0	187	18	2	691
Shales	0	80	0	0	37	30	4	151
Wall Creek	11	101	0	0	130	44	0	286
Muddy/Dakota/Lakota	2	9	0	0	13	8	0	32
Morrison	0	0	0	0	0	8	0	8
Tensleep	0	6	0	0	0	4	0	10
Madison ³	3	0	0	1	9	41	1	55
Total	86	430	180	1	376	153	7	1,233

¹ Includes intermittent producing wells.

² Includes enhanced oil recovery producers, injection wells, and observation wells.

³ Includes wells in the Crow Mountain zone, potable water wells, and historical wells of unknown purposes.

During fiscal year 1993, the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming added two additional steam patterns at the Shannon steamflood project. To develop a new Steam Generator No. 1 pattern, Naval Petroleum Reserve No. 3 drilled 14 producing wells and 10 injection wells with an anticipated recovery of an additional 0.25 million barrels of oil from this pattern. The second pattern expansion included drilling 16 producing wells and 10 injection wells for a new Steam Generator No. 2 pattern. An estimated additional recovery of 0.25 million barrels of oil is expected from this new pattern. Due to forecasts of low oil prices during the coming year, the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming does not plan further development of the Shannon steamflood.

Starting in fiscal year 1994, all natural gas used to fuel the steam generators will be procured from outside sources and will be included in assessing the economics of the project. As a means of improving the economics of the steamflood project, gas volumes required for the entire year will be procured and stored during the summer months when gas prices are at the lowest range. The Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming estimates costs to purchase natural gas for the steam generators at \$1.3 million for fiscal year 1994.

The requirement for purchasing natural gas from outside sources, coupled with declining production from all steamflood patterns, prompted a study of possible changes in operations that would help project profits. To increase field profitability the following changes will be made during fiscal year 1994:

- The program will continue to identify cost reductions associated with the treatment of water produced from the Tensleep formation which is used as source water for the steam generators.
- Steam-oil ratios will be reduced from the current level of 13 barrels of water equivalent (as steam) per barrel of oil to 9 barrels of water equivalent per barrel of oil. This will allow cost savings of \$300,000 in purchasing natural gas that is burned in the generators to produce steam. An additional \$100,00 will be saved during fiscal year 1994 by accelerating gas purchases at lower prices during summer months, and using this gas in the winter.

The Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming plans an additional enhanced oil recovery project that will be applied to the Shannon formation by its natural gas Huff & Puff project. This process includes injecting natural gas into a Shannon well, letting the injection gas mix with formation fluids for seven days, then producing the crude oil and associated liquids in the well. The Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming implemented a six-well pilot Huff & Puff project in fiscal year 1993 with very promising results and plans to implement an additional 50-well Huff & Puff project in fiscal year 1994.

Tubing rotator used to reduce tubing wear in crooked holes at Naval Petroleum Reserve No. 3.

With current estimated remaining oil-in-place at more than 100 million barrels in the Shannon formation, even a modest increase in recovery factors expected from the two Shannon enhanced oil recovery projects would result in a substantial increase in revenues.

REVENUES AND EXPENDITURES

The fiscal year 1993 revenues derived from all sources at Naval Petroleum Reserve No. 3 totaled \$14,227,421. These revenues were deposited in the Naval Petroleum and Oil Shale Reserves appropriation account at the U.S. Treasury. A breakdown of revenues by product appears in the appendix, pages A-10 to A-18. Expenditures at Naval Petroleum Reserve No. 3 totaled \$13,548,650, producing a net cash flow of \$678,771. Program direction expenditures (not included in the aforementioned total) were \$1,138,642. These expenditures were incurred for managing the operation of Naval Petroleum Reserve No. 3 and the Naval Oil Shale Reserves.

SALES

In fiscal year 1993, Naval Petroleum Reserve No. 3 sweet crude oil was sold at an average price of \$18.74 per barrel (table 13). Due to field operating requirements, natural gas has not been sold since May 1, 1983. The gas is reinjected or burned to produce steam for enhanced oil recovery. Associated gas liquids sales totaled 551,877 gallons of propane and 1,747,029 gallons of butane-plus natural gasoline at average prices of \$0.3337 and \$0.324 per gallon respectively (table 14).

In fiscal year 1994, Naval Petroleum Reserve No. 3 will continue to be produced at its maximum efficient rate and all the crude oil and natural gas liquids produced will be sold competitively.

SAFETY AND HEALTH, ENVIRONMENTAL PROTECTION, AND EMERGENCY PREPAREDNESS

Tiger Team Assessment Response

The Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming underwent a Tiger Team Environment, Safety, and Health Assessment in fiscal year 1992. This assessment, which took place from June 15 to July 20, 1992, was in response to a 10-point Initiative introduced by the Secretary of Energy in 1989. In August 1993, the Secretary approved the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming's Corrective Action Plan. A significant portion of the plan has either already been implemented or was in the process of being implemented.

Safety and Health

During fiscal year 1993, safety and health activities at Naval Petroleum Reserve No. 3 included implementation of the Corrective Action Plan responding to the 1992 Tiger Team audit findings and the transition of the new management and operating contractor into management of the Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming. An increased emphasis on safety awareness training and a highly experienced staff have resulted in no reportable lost-time accidents during fiscal year 1993.

Table 13
Naval Petroleum Reserve No. 3 Crude Oil Sales (Deliveries)
Fiscal Year 1993

Company	Sweet (barrels/day)	Average billing price (\$/barrel)¹	Sour (barrels/day)	Average billing price (\$/barrel)¹
Enron Oil Trading & Transportation October 1, 1992–November 30, 1992	1,920	\$20.34		
Conoco Inc. October 1, 1992–November 30, 1992			85	\$15.62
Coastal States Trading, Inc. December 1, 1992–May 31, 1993	1,971	19.13		
Conoco Inc. December 1, 1992–May 31, 1993			76	15.21
EOTT Energy Corporation June 1, 1993–September 30, 1993	1,812	17.27		
Sinclair Oil Corporation June 1, 1993–September 30, 1993			73	13.57
Average daily sales volume	1,909		76	
Average sales price (\$/barrel)		\$18.74		\$14.77

¹ Prices for Naval Petroleum Reserve No. 3 crude oil are the average of the three highest prices for similar oil produced in Wyoming, plus a bonus or discount bid.

Table 14
Naval Petroleum Reserve No. 3 Liquid Product Sales (Deliveries)
Fiscal Year 1993

Company	Propane (gallons/day)	Average billing price (\$/gallon)	Butane-plus (gal- lons/day)	Average billing price (\$/gallon)
V-1 Oil Company October 1, 1992–September 30, 1993	1,512	\$0.3337		
Vessels Oil & Gas Company October 1, 1992–September 30, 1993			4,786	\$0.324

NOTE: Billing prices are adjusted monthly, based on relevant spot market prices.

Environmental Protection

The Environmental Department initiated Total Quality Management principles which resulted in improved morale and efficiency, as demonstrated by the following accomplishments:

- Completing 11 (29 percent) of the Environmental Protection Tiger Team Assessment Corrective Action Plans and 96 (51 percent) of the Corrective Action Plan milestones;
- Reclaiming drill sites;
- Installing flares at three batteries to reduce hydrogen sulfide emissions; and
- Submitting 25 Categorical Exclusions to National Environmental Policy Act requirements.

During fiscal year 1993, the Environmental Department wrote the following reports, programs, and plans: Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Program, Pollution Prevention Awareness Plan, Waste Minimization Program, Air Quality Management Program, Public Relations Program, Annual Site Environmental Report, Meteorological Monitoring Plan, Pre-Operational Monitoring Plan, and Spill Prevention Control and Countermeasure Plans for Naval Petroleum Reserve No. 3 and Naval Oil Shale Reserve Nos. 1 and 3.

Emergency Preparedness

In fiscal year 1993, the environmental protection, safety, and field operations groups developed a formal Emergency Preparedness Program for Naval Petroleum Reserve No. 3 which was recently submitted to Headquarters for approval. The Naval Petroleum and Oil Shale Reserves at Colorado, Utah, and Wyoming's management and operating contractor conducted area-specific emergency preparedness drills for fire protection, medical assistance, hazardous materials handling, and emergency operations center procedures and completed a full-scale drill encompassing all four areas in September 1993.

In late fiscal year 1993, Naval Petroleum Reserve No. 3 emergency response team members provided medical assistance to the victims of a severe automobile accident near Naval Petroleum Reserve No. 3 until the local emergency response personnel arrived. These employees' actions resulted in commendations and a commitment for increased assistance to the Naval Petroleum Reserve No. 3 emergency response program from the Midwest emergency response organization.

LITIGATION

- *In re Black Thunder Marketing, Inc.* (U.S. Bankruptcy Court, District of Wyoming, No. 90-05344-B). Black Thunder Marketing, Inc., failed to provide a required performance guarantee and defaulted on a 92-day contract to buy 6,800 gallons per day of Naval Petroleum Reserve No. 3 butanes-plus at \$0.3640 per gallon in fiscal year 1990. The Department of Energy terminated the Black Thunder contract for default, recovered the \$9,000 bid guarantee, resold the product at \$0.22 per gallon, and billed Black Thunder for liquidated damages of \$86,533.92 under its contract, the difference between the contract price and the price the Department of Energy actually received. The Department of Energy's claim totals about \$107,000, which includes the liquidated amount plus about \$20,000 incurred for tankage used to store the product until it could be resold pursuant to an emergency invitation for bids.

In November 1990, Black Thunder filed for protection and reorganization under Chapter 11. Black Thunder failed to provide a timely reorganization plan and the court, therefore, converted the action to a Chapter 7 liquidation of the estate in bankruptcy. The Trustee is proceeding with the sale of Black Thunder's assets. The Cheyenne, Wyoming, U.S. Attorney's office is representing the Department of Energy's interests.

NAVAL OIL SHALE RESERVES

Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 are adjacent oil shale reserves of 40,760 and 14,130 acres, respectively, located eight miles west of Rifle, Colorado, in Garfield County. Except for private oil shale claims of about 600 acres of Naval Oil Shale Reserve No. 1, the Government owns all lands and minerals at Naval Oil Shale Reserve Nos. 1 and 3. Naval Oil Shale Reserve No. 1 is estimated to have more than 18 billion barrels of shale oil in place, with approximately 2.5 billion barrels of oil recoverable from shale rated at 30 gallons or more per ton. Naval Oil Shale Reserve No. 3 has no commercial oil shale, but was set aside to gain closer access to the Colorado River for water and to provide space to support Naval Oil Shale Reserve No. 1 activities.

Naval Oil Shale Reserve No. 2 covers 90,400 acres located in Carbon and Uintah Counties, Utah. The Government owns all of the minerals at Naval Oil Shale Reserve No. 2, except for those contained in 640 acres of State lands and 320 acres of homestead entries. Approximately 40 percent of Naval Oil Shale Reserve No. 2 is contained within the Uintah-Ouray Indian Reservation. Naval Oil Shale Reserve No. 2 is estimated to have almost 4 billion barrels of shale oil in place. No estimate of recoverable reserves has been made, but the shale beds are thought to be too thin to be economically recoverable using current available technologies. Seismic surveys, however, indicate potential traps for the accumulation of oil and natural gas within Naval Oil Shale Reserve No. 2.

The Department of Energy has no current plans to develop the Naval Oil Shale Reserves shale resources. The Naval Oil Shale Reserve No. 1 Pre-Development Plan, completed in fiscal year 1982, provided a compilation and analysis of important technical, environmental, and economic data that identified the potential for production of 200,000 barrels of shale oil per day for more than 30 years. The operating contract with FD Services requires the operator to update these plans periodically according to current economic factors and technology. Table 15 shows the Naval Oil Shale Reserves expenditures since 1978 for the (1) Oil Shale Pre-Development Project, (2) costs of surface resource management paid to the Bureau of Land Management, (3) costs for demolition of the Anvil Points oil shale demonstration facility, and (4) costs of the Department of Energy's Gas Protection Drilling Program.

The Naval Petroleum and Oil Shale Reserves Strategic Plan recognizes that although development of shale oil has been deferred, the potential for conventional oil and gas resources within the Naval Oil Shale Reserves properties must be assessed and plans must be formulated to develop these resources in the near to mid-term. Toward this end, a resource/reserve assessment project was planned during fiscal year 1992 and initiated through the U.S. Geological Survey in fiscal year 1993. This work will be completed in late fiscal year 1994 and will support studies currently underway of various options for future development of the Naval Oil Shale Reserves.

Naval Petroleum and Oil Shale Reserves

Table 15
Naval Oil Shale Reserves Program
Estimated Total Cost Through 1993

Year	Oil shale pre-development and restoration	Bureau of Land Management surface manage- ment	Anvil Points demolition	Naval Oil Shale Reserves Gas Protection Drilling Program	Total
1978	\$1,448,144				\$1,448,144
1979	1,320,051				\$1,320,051
1980	3,177,132	\$54,774			\$3,231,906
1981	3,283,386	58,374			\$3,341,760
1982	622,944	21,833			\$644,777
1983	189,901	41,157			\$231,058
1984	277,047				\$277,047
1985	320,012	16,171	\$736,785	\$1,299,380	\$2,372,348
1986	17,500	70,717	2,133,775	1,047,781	\$3,269,773
1987		51,526		9,917	\$61,443
1988	23,211	37,054		92,258	\$152,523
1989	22,769	48,617		1,928,347	\$1,999,733
1990	28,200	65,154		2,504,637	\$2,597,991
1991	19,380	131,609		2,198,577	\$2,349,566
1992	18,512	160,145	6,049	3,310,200	\$3,494,906
1993	78,204	111,207	108,301	3,669,192	\$3,966,904
Total	\$10,846,393	\$868,338	\$2,984,910	\$16,060,289	\$30,759,930

SURFACE RESOURCE MANAGEMENT

A Memorandum of Understanding was completed in 1987 between the Department of Energy and the Department of the Interior's Bureau of Land Management for the latter's surface resource management of the Naval Oil Shale Reserves. Under this agreement, the Bureau of Land Management receives funding from the Department of Energy to maintain multiple use of the lands within the Naval Oil Shale Reserves and to prevent the surface resource values from declining.

During fiscal year 1993, the Bureau of Land Management maintained access roads at the Naval Oil Shale Reserves in Colorado and Utah and maintained the Department of Energy Administrative Site at Naval Oil Shale Reserve No. 1.

NATURAL GAS PROTECTION PROGRAM

General Description

Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 are situated on the north and north-west flanks of three large natural gas-producing fields: the Parachute, Rulison, and Grand Valley (see figure 5). The Office of Naval Petroleum and Oil Shale Reserves continuously monitors development activities on lands adjacent to the reserves to evaluate potential drainage and migration of natural gas from the reserves. The natural gas deposits on the reserves requiring protection are contained on lands located along the reserves' boundaries. Private property owners or their lessees have been developing land adjacent to the Naval Oil Shale Reserves through drilling, resulting in increasing pressure differences between natural gas deposits and commercial producing wells adjacent to the reserves.

Figure 5. Naval Oil Shale Reserves Nos. 1 and 3 Gas Fields

The Department of Energy's monitoring activities determined in 1983 that the potential existed for drainage of natural gas by commercial development in the Rulison Field on the southeast boundary of Naval Oil Shale Reserve No. 3. Since 1983, additional commercial gas wells have been drilled near the Naval Oil Shale Reserves boundaries in the Parachute and Grand Valley Fields.

To protect the Government's interest in the natural gas underlying the Naval Oil Shale Reserves, the Department of Energy has developed a program with two key elements, "communitization" and "offset" or wholly-owned Department of Energy drilling. In communitization, the Government enters into agreements with producers drilling near the boundary of the Naval Oil Shale Reserves. Under the communitization agreements, each well is operated as a unit and development costs and hydrocarbon production are shared among the unit partners, with the actual percentage of ownership based on the acreage of each partner's mineral rights within the unit. Tracts are pooled under communitization agreements when the separate tracts cannot be developed and operated independently in conformity with State well-spacing requirements or established well-development programs.

In addition, the Government drills its own gas wells inside the reserves' boundaries to directly "offset" wells drilled on private lands. Although most of these wells are entirely Government-owned and operated, some offset or protective wells may be communitized with adjacent private property owners and/or lessees.

Through fiscal year 1993, 102 wells have been drilled by private industry within one mile of the Naval Oil Shale Reserves boundaries, thirteen of which were either plugged, abandoned, or have not been produced due to their marginal production or distance from a pipeline.

The Department of Energy has entered into communitization agreements for 20 wells that are operated by private interests, but two of the 20 wells have been deferred to early fiscal year 1994. To mitigate drainage and migration of natural gas to the commercial producers, the Department of Energy drilled 15 offset wells that are owned entirely by the Government, and six wells that are communitized with adjacent private landowners or leaseholders and operated by the Department of Energy. This 39-well program (see table 16) has prevented significant drainage. Four protection wells are planned for fiscal year 1994.

The gas protection program is a reactive, ongoing program that is constantly revised to respond to commercial drilling along the Naval Oil Shale Reserves boundaries. Based on the Department of Energy projections of future drilling plans by neighboring operators, engineering estimates, current Colorado well-spacing regulations, and standard industry practices, the Department of Energy expects ultimately to communitize approximately 111 offset or protection wells within Naval Oil Shale Reserve Nos. 1 and 3. These projections are revised as appropriate in response to budgetary constraints, actual commercial gas development along the Naval Oil Shale Reserve borders, transportation constraints, and the natural gas market.

TABLE 16
Naval Oil Shale Reserves Wells
Fiscal Year 1993

Well #	Operator	Location	DOE Interest	Formation	Year Drilled
Rulison Field					
1-M-9	DOE	SWSW 9-6S-94W	100%	Mesaverde	1985
1-M-19	DOE	NENE 19-6S-94W	73.09082%	Mesaverde	1986
1-W-9	DOE	SWSW 9-6S-94W	100%	Wasatch	1990
1-W-17	DOE	SWSW 17-6S-94W	58.7052%	Wasatch	1990
1-W-19	DOE	NENE 19-6S-94W	67.09429%	Wasatch	1990
9-17-MV	Barrett	NESE 17-6S-94W	12.6839%	Mv/Cameo	1991
1-M-17	DOE	SWSW 17-6S-94W	98.36075%	Mv/Cameo	1991
Parachute Field					
W-29-26	Barrett	SWSW 26-6S-95W	50%	Wasatch	1987
W-18-27	Barrett	SWSW 27-6S-95W	50%	Wasatch	1987
W-17-27	Barrett	SWSE 27-6S-95W	75%	Wasatch	1987
W-43-28	Barrett	NENW 28-6S-95W	50%	Wasatch	1987
W-9-28	Barrett	NESW 28-6S-95W	50%	Wasatch	1987
W-19-28	Barrett	SWSE 28-6S-95W	50%	Wasatch	1987
W-20-32	Barrett	SENE 32-6S-95W	75%	Wasatch	1987
W-5-33	Barrett	NENW 33-6S-95W	50%	Wasatch	1987
1-W-21	DOE	SESW 21-6S-95W	100%	Wasatch	1989
1-W-26	DOE	SENW 26-6S-95W	100%	Wasatch	1989
1-W-27	DOE	SWNW 27-6S-95W	100%	Wasatch	1989
2-W-27	DOE	SENE 27-6S-95W	100%	Wasatch	1989
1-W-28	DOE	SWNE 28-6S-95W	100%	Wasatch	1989
1-W-29	DOE	NESE 29-6S-95W	100%	Wasatch	1989
2-W-29	DOE	NENE 29-6S-95W	100%	Wasatch	1989
1-W-32	DOE	SENW 32-6S-95W	100%	Wasatch	1989
GV-39-32	Barrett	NESW 32-6S-95W	50%	Mv/Cameo	1990
1-895	Barrett	NENW 8-6S-95W	26.21875%	Wasatch	1990
1-995	Barrett	SENW 9-6S-95W	25.7625%	Wasatch	1990
1-1695	Barrett	NENW 16-6S-95W	36.825%	Wasatch	1990
1-2095	Barrett	NENW 20-6S-95W	4.25%	Wasatch	1990
3-W-29	DOE	SESW 29-6S-95W	100%	Wasatch	1991
1-W-20	DOE	SWSE 20-6S-95W	100%	Wasatch	1991
2-W-21	DOE	NWSE 21-6S-95W	100%	Wasatch	1991
MV-43-31	Barrett	SESE 31-6S-95W	87.24205%	Mv/Cameo	1992
MV-37-32	Barrett	SWNE 32-6S-95W	75%	Mv/Cameo	1992
MV-13-33	Barrett	SENW 33-6S-95W	50%	Mv/Cameo	1992
2-W-20	DOE	NENE 20-6S-95W	94.925%	Wasatch	1993
2-W-26	DOE	NWSE 26-6S-95W	100%	Wasatch	1993
1-M-29	DOE	NESE 29-6S-95W	100%	Mv/Cameo	1993
Grand Valley Field					
GV-24-36	Barrett	SWSE 36-6S-96W	47.5723%	Mv/Cameo	1989
1-M-36	DOE	SWNW 36-6S-96W	100%	Mv/Cameo	1993

A typical Mesaverde well shortly after flow test at Naval Oil Shale Reserve No. 3

Naval Oil Shale Reserve Nos. 1 and 3 Drainage Protection

Production from wells near the Naval Oil Shale Reserve Nos. 1 and 3 boundaries is continuously monitored to maintain a current estimate of the quantity of gas drained from the Naval Oil Shale Reserves and the effect of the Department of Energy's protective drilling efforts. As of May 1993, 23.8 billion cubic feet of gas had been produced from 71 non-Department of Energy wells within a mile of the Naval Oil Shale Reserves' boundary. Eighteen Department of Energy communitized wells produced 6.9 billion cubic feet of natural gas, and 13 Department of Energy-owned offset or protection wells produced 3.2 billion cubic feet of natural gas. The Department of Energy's share from both wholly owned and communitized wells totaled 7.7 billion cubic feet.

Naval Oil Shale Reserve No. 2

Naval Oil Shale Reserve No. 2 is located in an area of known oil and gas production. Within a 30-mile radius of the reserve there are a large number of fields producing hydrocarbons from ten different geologic formations, at least seven of which are believed to underlie Naval Oil Shale Reserve No. 2.

The Department of Energy and the U.S. Geological Survey initiated a joint study to determine its resource/reserve potential. This study will be completed late in fiscal year 1994.

Within the last two years, no producing wells have been drilled that would threaten drainage from Naval Oil Shale Reserve No. 2. If a commercial well threatens to drain Naval Oil Shale Reserve No. 2, then the Department of Energy will implement a protection strategy similar to that of Naval Oil Shale Reserve No. 3.

Future Development of the Oil and Gas Resources of the Naval Oil Shale Reserves

At the request of the Deputy Secretary, the Naval Petroleum and Oil Shale Reserves will continue studies of the potential oil and natural gas reserves underlying the Naval Oil Shale Reserves. These studies will estimate and categorize the potential reserves and will analyze development options.²

SALES

In fiscal year 1993, the Department of Energy sold an average of 5,414 million British thermal units per day of Naval Oil Shale Reserve No. 3 natural gas at an average price of \$1.32 per million British thermal units. Sales of associated gas liquids totaled 5.6 barrels of natural gas condensate per day at an average price of \$16.70 per barrel (table 17).

² On January 24, 1994, the program submitted its study for Naval Oil Shale Reserve No. 3 to the Deputy Secretary.

Table 17
Naval Oil Shale Reserve No. 3
Natural Gas and Condensate Sales, Fiscal Year 1993
Quantity Delivered

Natural gas					
Company	Average quantity delivered ¹ (million British thermal units/day)	Average billing price (paid to Department of Energy)	Gathering fee (paid by purchaser to pipeline company)	Questar tariff ² (paid by purchaser to pipeline company)	Purchaser's cost of gas delivered to pipeline
Kirnball Energy Corporation October 1, 1992– October 31, 1992	3,783	\$1.33	\$.35	-----	\$1.68
Grand Valley Gas Company October 1, 1992– October 31, 1992	4,957	1.24	.31	----	\$1.55
Chevron November 1, 1992– September 30, 1993	4,532 (Williams Field Services Company)	1.34	.31	----	\$1.65
	2,970 (Grand Valley)	1.38	.35		\$1.73
Average daily sales volume (million British thermal units/day)	5,414				
Average sales price (\$/mil- lion British thermal units)		\$.32			
Condensate					
Company	Average quantity delivered (barrels/day)	Average billing price (\$/barrel)			
Enron Oil Trading and Transportation Corporation October 1, 1992– September 30, 1993	5.63	\$16.70			

¹ The daily averages shown are average quantities delivered during periods of sales, not for the whole year. During the first five months of the sales contract, the Department of Energy must make natural gas available for purchase, and purchasers must buy a minimum quantity of natural gas. For each month during the balance of the contract, the Department of Energy may nominate quantities of natural gas for purchasers to buy or decline to buy. The Naval Oil Shale Reserve No. 3 wells were shut-in during June 1993 due to the non-acceptance of nominations by the buyers.

² Natural gas flowing through the Williams Field Services Clough Rulison System must flow through Questar Pipeline. Natural gas flowing through the Grand Valley Gathering System may flow through the Questar Pipeline, or it could flow through the Union Lateral Pipeline into the Williams Field Services Pipeline's main line, avoiding the \$0.22 Questar tariff.

Anvil Points shale pile after diversion ditch and base of the pile were reshaped to allow runoff into the West Sharrard Creek at Naval Oil Shale Reserve No. 3

REVENUES AND EXPENDITURES

The fiscal year 1993 Naval Oil Shale Reserve No. 3 natural gas sales revenues totaled \$3,536,152, which were deposited in the Naval Petroleum and Oil Shale Reserves appropriation account at the U.S. Treasury. For fiscal year 1993, expenditures totaled \$3,966,903, to drill three wells in the Parachute Field and one in the Grand Valley Field and for miscellaneous operation and maintenance expenses.

Specifically, capital expenditures totaled \$2,853,497 for drilling and completing two Wasatch formation wells and one Mesaverde formation well in the Parachute Field and one Mesaverde well in the Grand Valley Field. Operation and maintenance expenses for existing wells totaled \$815,695. Surface management and environmental restoration activities totaled \$297,711.

The capital investment for drilling natural gas wells is initially high, and revenues from the production will not normally exceed drilling and operating costs until at least the third year. An internal review of the Naval Oil Shale Reserve No. 3 wells' individual economics disclosed that 13 wells have already recovered the initial capital expenditures and operating

costs. Geologists estimate that approximately two-thirds of the recoverable natural gas reserves for these 13 wells remain in place, for generation of future revenues.

Wells currently producing at Naval Oil Shale Reserve No. 3 are extremely close to providing a positive cumulative cash flow, if the Naval Oil Shale Reserve projects unrelated to natural gas production are eliminated from calculations (i.e., the oil shale predevelopment costs, the Anvil Points Mine demolition project, and cost-plus award fee expenses). Recoverable reserves for the existing wells are conservatively estimated at 16 billion cubic feet, which further supports the projection that these wells will provide a positive cumulative

cash flow (excepting new development costs) in the near future.

The Department has initiated a study to advise Congress on the relative merits of various options for full development of the oil and gas resources at Naval Oil Shale Reserve No. 1, Naval Oil Shale Reserve No. 2, and Naval Oil Shale Reserve No. 3. Assuming that full development of the Naval Oil Shale Reserves is complete by 1997, a positive net cash flow is projected by that time for the new wells.

ENVIRONMENT AND SAFETY

Oil shale development efforts at the Anvil Points Facility on Naval Oil Shale Reserve No. 3 between 1946 and 1982 generated a 178,000-cubic-yard waste shale pile. The Naval Energy and Environmental Support Activity studied the potential for environmental contamination from this pile and concluded in February 1985 that the waste pile presents no significant threat to human health or the environment. The Naval Energy and Environmental Support Activity recommended that a groundwater monitoring survey further define the existing conditions. A preliminary assessment of the shale pile conducted in fiscal year

1991 determined that the shale pile presents a low risk to the environment.

The Department of Energy, the Bureau of Land Management, and the U.S. Fish and Wildlife Service have been studying peregrine falcons since 1990, when a nest was discovered on the cliffs at Naval Oil Shale Reserve No. 1. Since that time, one nest has been located in the area. The Naval Petroleum and Oil Shale Reserves in Colorado, Utah, and Wyoming restricts work in this area during the nesting period.

During fiscal year 1993, the Department retained an environmental protection firm to conduct environmental protection and cultural resource surveys on a number of wellsites, access roads, and flowline routes constructed on Naval Petroleum Reserve No. 3, as a part of the natural gas protection program. The firm also studied proposed pipeline easements and a number of maintenance and improvement projects for existing roads across Naval Oil Shale Reserve No. 3.

The Safety Department provided and enforced safety requirements for all subcontractors and site employees during the fiscal year 1993 Naval Oil Shale Reserves drilling program. An emergency preparedness program was prepared for Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 prior to commencement of the fiscal year 1993 Naval Oil Shale Reserves drilling program. The safety and health group also supervised the safety of the demolition of the Anvil Points mine buildings, which began in October 1992 and was completed in the spring of 1993.

The effectiveness of the Naval Oil Shale Reserve Nos. 1 and 3 emergency preparedness, safety, and environmental protection programs was tested in September 1993 following a fracture stimulation when control of natural gas well 1-M-29 at Naval Oil Shale Reserve No. 3 was temporarily lost. The staff member in charge of the drilling program took expedient action in securing the site to protect the safety of workers and the public, contacting appropriate emergency response agencies to ensure the safety of the public, and constructing a dike to prevent environmental damage.

As a result of the Tiger Team Assessment Corrective Action Plan implementation, improvements will continue in the environmental protection, safety, and health programs during fiscal year 1994. The safety and health program will focus on implementation of the Corrective Action Plans that resolve Category II Tiger Team Assessment concerns, particularly in the areas of maintenance management and electrical safety. The environmental protection, safety, and health program will strengthen compliance with Federal, State, and local laws, while continuing to request exemption from excessively arduous Departmental environmental, safety, and health requirements.

Planned safety training programs include blowout prevention training for the workover crews, occupational safety and health training, defensive driving, cardiopulmonary resuscitation certification, and continued emphasis on maintaining and updating the emergency preparedness program.

Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 site restoration activities which commenced in fiscal year 1993 will continue during fiscal year 1994. These activities include removing asbestos-contaminated material at the Naval Oil Shale Reserve No. 3 Water Plant, disposing of fuel and chemical containers from the Anvil Points Mine, and removing scrap metal from the draw above West Sharrard Creek. In connection with the full development study of Naval Oil Shale Reserve No. 3, the environmental protection division will evaluate the environmental impacts to the site under the National Environmental Policy Act. A comprehensive survey of threatened and endangered flora and fauna will also be conducted at Naval Oil Shale Reserve No. 3 during fiscal year 1994. Planned activities for Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 in the safety area include improved subcontractor safety programs, enhanced safety monitoring through inspections and employee training, and maintaining and updating the Naval Oil Shale Reserve No. 1 and Naval Oil Shale Reserve No. 3 Emergency Preparedness Plan.

STATISTICAL APPENDIX

PRODUCTION CRUDE OIL - Barrels

Fiscal Year	Naval Petroleum Reserve No. 1¹	Naval Petroleum Reserve No. 2²	Naval Petroleum Reserve No. 3¹	Total
FY77 ³	3,807,974	33,769	147,392	3,989,135
1977	36,999,238	142,714	388,861	37,530,813
1978	43,485,349	128,971	714,467	44,328,787
1979	52,639,748	121,331	1,540,200	54,301,279
1980	58,281,170	107,340	1,603,477	59,991,987
1981	62,609,584	98,606	1,235,835	63,944,025
1982	60,698,376	97,283	1,144,500	61,940,159
1983	57,353,109	93,080	1,043,248	58,489,437
1984	50,473,675	94,179	1,074,799	51,642,653
1985	47,683,491	92,122	1,061,098	48,836,711
1986	42,166,485	83,209	1,150,411	43,400,105
1987	39,812,627	69,663	1,130,402	41,012,692
1988	39,316,391	67,848	979,279	40,363,518
1989	35,214,837	63,250	832,643	36,110,730
1990	29,945,732	70,429	829,492	30,845,653
1991	27,154,434	70,432	819,886	28,044,752
1992	25,442,293	70,743	858,433	26,371,469
1993	23,878,778	116,083	725,765	24,720,626
TOTAL	736,963,291	1,621,052	17,280,188	755,864,531

¹ Total Reserve production.² Government's royalty share of production.³ Transition period for change of fiscal year —7/1/76 to 9/30/76.

Naval Petroleum and Oil Shale Reserves

NATURAL GAS - Thousands of Cubic Feet

Fiscal Year	Naval Petroleum Reserve No. 1 ¹	Naval Petroleum Reserve No. 2 ²	Naval Petroleum Reserve No. 3 ¹	Naval Oil Shale Reserve No. 3 ³	Total
FY77 ⁴	768,125	117,698	7,595	---	893,418
1977	19,535,104	428,179	179,226	---	20,142,509
1978	34,347,853	379,581	530,145	---	35,257,579
1979	53,310,089	361,982	1,269,530	---	54,941,601
1980	60,615,227	297,787	1,792,477	---	62,705,491
1981	101,043,169	251,902	2,799,377	---	104,094,448
1982	119,485,538	274,806	2,774,155	---	122,534,499
1983	121,254,625	254,306	2,641,015	---	124,149,946
1984	128,969,441	256,450	2,907,516	---	132,133,407
1985	134,745,060	268,262	3,033,315	---	138,046,637
1986	127,430,198	262,488	3,037,404	---	130,730,090
1987	125,249,760	231,372	3,906,102	---	129,387,234
1988	131,379,158	225,870	3,923,434	---	135,528,462
1989	134,832,380	245,979	3,386,559	215,535	138,680,453
1990	125,586,458	271,653	3,042,560	1,575,731	130,476,402
1991	120,664,855	274,011	3,210,393	2,079,745	126,229,004
1992	114,290,283	271,547	2,809,435	1,496,815	118,868,080
1993	117,807,470	268,140	2,290,891	2,402,108	122,768,609
TOTAL	1,771,314,793	4,942,013	43,541,129	7,769,934	1,827,567,869

¹ Total Reserve production on a wet basis - includes reinjection, sales, shrinkage, and usage.

² Government's royalty share of sales on a dry basis.

³ Department of Energy share from both wholly-owned and communitized wells.

⁴ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

PROPANE - Gallons

Fiscal Year	Naval Petroleum Reserve No. 1¹	Naval Petroleum Reserve No. 2²	Naval Petroleum Reserve No. 3¹	Total
FY77 ³	740,604	57,206	---	797,810
1977	13,099,501	270,945	---	13,370,446
1978	20,490,769	247,109	---	20,737,878
1979	40,123,793	226,877	---	40,350,670
1980	54,282,703	235,308	---	54,518,011
1981	75,906,589	228,134	600,294	76,735,017
1982	100,094,374	224,167	1,986,637	102,305,178
1983	96,275,277	182,996	2,012,841	98,471,114
1984	89,311,465	220,703	2,466,499	91,998,667
1985	96,662,714	161,815	2,185,776	99,010,305
1986	93,123,652	153,509	1,785,883	95,063,044
1987	89,514,424	120,403	1,882,298	91,517,125
1988	89,496,614	122,609	1,325,162	90,944,385
1989	86,759,718	124,289	1,154,060	88,038,067
1990	74,060,718	87,876	812,161	74,960,755
1991	66,432,443	73,109	729,815	67,235,367
1992	56,615,255	40,903	655,631	57,311,789
1993	52,435,577	45,449	551,877	53,032,903
TOTAL	1,195,426,190	2,823,407	18,148,934	1,216,398,531

¹ Total Reserve volume extracted from wet gas.

² Government's royalty share of LPG (propane and/or butane) extracted from wet gas.

³ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

Naval Petroleum and Oil Shale Reserves

NATURAL GASOLINE - Gallons

Fiscal Year	Naval Petroleum Reserve No. 1 ¹	Naval Petroleum Reserve No. 2 ²	Naval Petroleum Reserve No. 3 ¹	Total
FY77 ³	477,168	160,195	---	637,363
1977	8,664,010	657,568	---	9,321,578
1978	19,391,317	626,530	---	20,017,847
1979	35,076,349	514,950	---	35,591,299
1980	40,466,632	740,197	2,051,043 ⁴	41,206,829
1981	48,871,367	483,588	4,142,815 ⁴	49,354,955
1982	63,308,858	447,417	---	63,756,275
1983	61,583,866	411,652	---	61,995,518
1984	64,099,013	453,442	---	64,552,455
1985	80,675,823	333,846	---	81,009,669
1986	68,960,820	269,675	---	69,230,495
1987	71,028,620	216,619	---	71,245,239
1988	75,729,193	233,417	---	75,962,610
1989	75,852,694	233,451	---	76,086,145
1990	65,025,816	158,374	---	65,184,190
1991	59,094,208	167,728	---	59,261,936
1992	55,381,613	160,743	---	55,542,356
1993	54,909,521	137,713	---	55,047,233
TOTAL	948,596,888	6,407,105	6,193,858⁴	955,003,992

¹ Total Reserve volume extracted from wet gas.

² Government's royalty share of volume extracted from wet gas.

³ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

⁴ De-ethanized LPG (natural gasoline plus propane and butane) extracted from wet gas, not included in natural gasoline totals.

MIXED BUTANE - Gallons

Fiscal Year	Naval Petroleum Reserve No. 1¹	Naval Petroleum Reserve No. 2²	Naval Petroleum Reserve No. 3^{1,3}	Total
FY77 ⁴	393,138	---	---	393,138
1977	12,466,858	---	---	12,466,858
1978	16,351,281	---	---	16,351,281
1979	21,071,136	---	---	21,071,136
1980	38,060,833	---	---	38,060,833
1981	60,743,858	---	1,136,676	61,880,534
1982	72,909,022	---	3,376,161	76,285,183
1983	79,494,982	---	3,084,910	82,579,892
1984	74,608,592	---	3,144,964	77,753,556
1985	71,865,022	30,677	3,013,570	74,909,269
1986	68,881,553	24,786	2,825,464	71,731,803
1987	69,852,117	21,812	3,298,409	73,172,338
1988	71,686,357	17,588	2,820,663	74,524,608
1989	68,796,470	12,922	2,843,090	71,652,482
1990	58,718,305	17,539	2,406,607	61,142,451
1991	49,660,429	16,320	2,338,454	52,015,203
1992	40,020,225	19,403	2,131,255	42,170,883
1993	37,377,921	30,042	1,747,029	39,154,992
TOTAL	912,958,099	191,089	34,167,252	947,316,440

¹ Total Reserve volume extracted from wet gas.² Government's royalty share of production.³ Butane-plus heavier liquids extracted from wet gas.⁴ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

Naval Petroleum and Oil Shale Reserves

ISOBUTANE - Gallons

Fiscal Year	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
1991	4,049,633	---	---	4,049,633
1992	8,926,706	---	---	8,926,706
1993	10,770,232	---	---	10,770,232
TOTAL	23,746,571	---	---	23,746,571

CARBON DIOXIDE - Gallons

Fiscal Year	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2¹	Naval Petroleum Reserve No. 3	Total
FY77 ²	---	6,644	---	6,644
1977	---	26,793	---	26,793
1978	---	18,274	---	18,274
1979	---	27,449	---	27,449
1980	---	27,208	---	27,208
1981	---	24,491	---	24,491
1982	---	15,575	---	15,575
1983	---	21,197	---	21,197
1984	---	1,398	---	1,398
1985	---	0	---	0
1986	---	0	---	0
1987	---	0	---	0
1988	---	0	---	0
1989	---	0	---	0
1990	---	0	---	0
1991	---	0	---	0
1992	---	0	---	0
1993	---	0	---	0
TOTAL	---	169,029	---	169,029

¹ Government's royalty share of production.

² Transition period for change of fiscal year — 7/1/76 to 9/30/76.

Naval Petroleum and Oil Shale Reserves

REVENUES - All Sources

Fiscal Year	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserves	Total
FY77 ¹	\$ 31,484,923	\$ 552,843	\$ 2,001,105	---	\$ 34,038,871
1977	395,596,017	1,668,707	5,671,709	---	402,936,433
1978	492,405,349	2,288,024	11,027,244	---	505,720,617
1979	719,072,530	2,637,088	32,800,360	---	754,509,978
1980 ²	1,518,057,603	4,154,637	68,251,699	---	1,590,463,939
1981 ²	1,615,111,610	3,920,794	47,429,283	---	1,666,461,687
1982 ²	1,560,022,925	4,005,332	42,774,817	---	1,606,803,074
1983 ²	1,492,359,890	3,607,751	36,626,029	---	1,532,593,670
1984 ²	1,375,874,960	3,667,670	34,969,021	---	1,414,511,651
1985 ²	1,264,265,523	3,481,073	31,482,721	---	1,299,229,317
1986 ²	737,822,563	2,453,465	23,096,234	---	763,372,262
1987	644,983,493	1,833,539	21,346,149	---	668,163,181
1988	622,857,317	1,769,096	17,868,311	---	642,494,724
1989	613,546,143	1,781,214	16,096,309	\$ 143,570	631,567,236
1990	580,376,895	2,070,647	18,610,484	1,428,345	602,486,371
1991	629,260,321	2,339,349	20,396,852	2,185,342	654,181,864
1992	451,214,157	2,071,969	18,266,925	1,247,361	472,800,412
1993	419,342,208	2,615,775	14,227,422	3,536,152	439,721,557
TOTAL	\$15,163,654,427	\$46,918,973	\$462,942,674	\$8,540,770	\$15,682,056,844

¹ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

² Includes Windfall Profit Taxes.

EXPENDITURES - All Sources

Fiscal Year	Naval Petroleum Reserves Nos. 1 & 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserves	Total
FY77 ¹	\$ 19,415,052	\$ 325,197	\$ 0	\$ 19,740,249
1977	97,900,910	17,350,000	0	115,250,910
1978	126,678,825	24,258,434	1,448,144	152,385,403
1979	107,701,600	21,344,958	1,320,051	130,366,609
1980	98,815,854	18,210,312	3,231,906	120,258,072
1981	192,357,818	18,615,440	3,341,760	214,315,018
1982	224,585,590	20,222,965	644,777	245,453,332
1983	196,724,031	20,502,543	231,058	217,457,632
1984	103,313,414	21,812,456	277,047	125,402,917
1985	110,945,390	24,219,175	2,372,348	137,536,913
1986	132,047,125	19,471,206	3,269,773	154,788,104
1987	132,129,532	13,552,081	61,443	145,743,056
1988	167,225,441	14,488,726	152,523	181,866,690
1989	159,100,177	13,721,502	1,999,733	174,821,412
1990	161,153,546	15,184,654	2,597,991	178,936,191
1991	179,761,945	18,375,143	2,349,566	200,486,654
1992	180,996,659	17,728,698	3,494,906 ²	202,220,263 ²
1993	189,278,808	13,548,650	3,966,903	206,794,361
TOTAL	\$2,580,131,717	\$312,932,140	\$30,759,929	\$2,923,823,786

¹ Transition period for change of fiscal year — 7/1/76 to 9/30/76.

² Revision to the fiscal year 1992 *Annual Report of Operations*.

Naval Petroleum and Oil Shale Reserves

REVENUES - Fiscal Year 7T¹

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil	\$30,451,322	\$403,690	\$2,001,105	\$32,856,117
Natural gas	---	110,697	---	110,697
Propane	175,594	9,672	---	185,266
Butane	69,998	---	---	69,998
Gasoline	82,065	28,473	---	110,538
Carbon dioxide	---	311	---	311
Subtotal	\$30,778,979	\$552,843	\$2,001,105	\$33,332,927
Other	705,944	---	---	705,944
TOTAL	\$31,484,923	\$552,843	\$2,001,105	\$34,038,871

¹ Transition period for change fiscal year — 7/1/76 to 9/30/76.

REVENUES - Fiscal Year 1977

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil	\$366,382,890	\$ 948,904	\$5,639,664	\$372,971,458
Natural gas	---	502,747	---	502,747
Propane	2,189,201	57,486	---	2,246,687
Butane	1,493,916	---	---	1,493,916
Gasoline	1,452,572	157,358	---	1,609,930
Carbon dioxide	---	1,252	---	1,252
Subtotal	\$371,518,579	\$1,667,747	\$5,639,664	\$378,825,990
Other	24,077,438	960	32,045	24,110,443
TOTAL	\$395,596,017	\$1,668,707	\$5,671,709	\$402,936,433

REVENUES - Fiscal Year 1978

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil	\$458,662,162	\$1,449,662	\$11,014,212	\$471,126,036
Natural gas	---	574,564	---	574,564
Propane	4,257,529	70,388	---	4,327,917
Butane	3,164,961	---	---	3,164,961
Gasoline	4,257,736	191,156	---	4,448,892
Carbon dioxide	---	1,294	---	1,294
Subtotal	\$470,342,388	\$2,287,064	\$11,014,212	\$483,643,664
Other	22,062,961	960	13,032	22,076,953
TOTAL	\$492,405,349	\$2,288,024	\$11,027,244	\$505,720,617

REVENUES - Fiscal Year 1979

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil	\$656,385,700	\$1,725,560	\$32,796,213	\$690,907,473
Natural gas	---	617,201	---	617,201
Propane	7,664,366	55,586	---	7,719,952
Butane	4,619,905	---	---	4,619,905
Gasoline	8,523,008	235,499	---	8,758,507
Carbon dioxide	---	2,282	---	2,282
Subtotal	\$677,192,979	\$2,636,128	\$32,796,213	\$712,625,320
Other	41,879,551	960	4,147	41,884,658
TOTAL	\$719,072,530	\$2,637,088	\$32,800,360	\$754,509,978

Naval Petroleum and Oil Shale Reserves

REVENUES - Fiscal Year 1980

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$1,437,284,113	\$3,083,379	\$67,505,561	\$1,507,873,053
Natural gas	5,561,808	669,573	---	6,231,381
Propane	14,237,566	70,475	---	14,308,041
Butane	13,570,458	---	---	13,570,458
Gasoline	19,212,861	327,937	728,325 ²	20,269,123
Carbon dioxide	---	2,313	---	2,313
Subtotal	\$1,489,866,806	\$4,153,677	\$68,233,886	\$1,562,254,369
Other	28,190,797	960	17,813	28,209,570
TOTAL	\$1,518,057,603	\$4,154,637	\$68,251,699	\$1,590,463,939

¹ Includes Windfall Profit Taxes.

² De-ethanized LPG sales.

REVENUES - Fiscal Year 1981

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$1,430,543,043	\$2,849,575	\$44,901,638	\$1,478,294,256
Natural gas	61,517,438	639,056	141,519	62,298,013
Propane	29,417,603	98,750	234,114	29,750,467
Butane	22,799,279	---	693,373	23,492,652
Gasoline	29,785,069	330,371	1,421,512 ²	31,536,952
Carbon dioxide	---	2,082	---	2,082
Subtotal	\$1,574,062,432	\$3,919,834	\$47,392,156	\$1,625,374,422
Other	41,049,178	960	37,127	41,087,265
TOTAL	\$1,615,111,610	\$3,920,794	\$47,429,283	\$1,666,461,687

¹ Includes Windfall Profit Taxes.

² De-ethanized LPG sales.

REVENUES - Fiscal Year 1982

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$1,296,145,893	\$2,707,616	\$37,810,098	\$1,336,663,607
Natural gas	110,067,587	879,605	2,319,619	113,266,811
Propane	36,564,609	103,778	688,429	37,356,816
Butane	26,811,192	---	1,936,678	28,747,870
Gasoline	39,109,867	308,843	---	39,418,710
Carbon dioxide	---	1,324	---	1,324
Subtotal	\$1,508,699,148	\$4,001,166	\$42,754,824	\$1,555,455,138
Other	51,323,777	4,166	19,993	51,347,936
TOTAL	\$1,560,022,925	\$4,005,332	\$42,774,817	\$1,606,803,074

¹ Includes Windfall Profit Taxes.**REVENUES - Fiscal Year 1983**

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$1,184,364,058	\$2,353,182	\$32,101,634	\$1,218,818,874
Natural gas	168,825,590	879,333	2,135,679	171,840,602
Propane	32,844,166	94,335	664,573	33,603,074
Butane	32,642,055	---	1,705,465	34,347,520
Gasoline	36,142,539	278,149	---	36,420,688
Carbon dioxide	---	1,792	---	1,792
Subtotal	\$1,454,818,408	\$3,606,791	\$36,607,351	\$1,495,032,550
Other	37,541,482	960	18,678	37,561,120
TOTAL	\$1,492,359,890	\$3,607,751	\$36,626,029	\$1,532,593,670

¹ Includes Windfall Profit Taxes.

Naval Petroleum and Oil Shale Reserves

REVENUES - Fiscal Year 1984

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$1,076,981,925	\$2,324,197	\$32,018,705	\$1,111,324,827
Natural gas	174,278,241	956,175	---	175,234,416
Propane	34,283,975	113,676	1,029,954	35,427,605
Butane	36,261,900	---	1,914,737	38,176,637
Gasoline	35,604,763	272,543	---	35,877,306
Carbon dioxide	---	119	---	119
Subtotal	\$1,357,410,804	\$3,666,710	\$34,963,396	\$1,396,040,910
Other	18,464,156	960	5,625	18,470,741
TOTAL	\$1,375,874,960	\$3,667,670	\$34,969,021	\$1,414,511,651

¹ Includes Windfall Profit Taxes.

REVENUES - Fiscal Year 1985

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$957,211,205	\$2,261,874	\$29,179,047	\$988,652,126
Natural gas	186,850,058	940,999	---	187,791,057
Propane	37,027,630	77,626	794,504	37,899,760
Butane	27,260,501	14,070	1,493,501	28,768,072
Gasoline	35,722,005	185,544	---	35,907,549
Carbon dioxide	---	---	---	0
Subtotal	\$1,244,071,399	\$3,480,113	\$31,467,052	\$1,279,018,564
Other	20,194,124	960	15,669	20,210,753
TOTAL	\$1,264,265,523	\$3,481,073	\$31,482,721	\$1,299,229,317

¹ Includes Windfall Profit Taxes.

REVENUES - Fiscal Year 1986

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$524,200,210	\$1,434,686	\$21,373,493	\$547,008,389
Natural gas	119,654,200	821,509	---	120,475,709
Propane	27,581,098	57,092	548,682	28,186,872
Butane	18,102,838	9,433	1,136,650	19,248,921
Gasoline	23,719,211	129,785	---	23,848,996
Carbon dioxide	---	---	---	0
Subtotal	\$713,257,557	\$2,452,505	\$23,058,825	\$738,768,887
Other	24,565,006	960	37,409	24,603,375
TOTAL	\$737,822,563	\$2,453,465	\$23,096,234	\$763,372,262

¹ Includes Windfall Profit Taxes.

REVENUES - Fiscal Year 1987

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$498,142,010	\$1,033,756	\$19,539,710	\$518,715,476
Natural gas	73,872,765	672,485	---	74,545,250
Propane	17,949,731	34,338	403,874	18,387,943
Butane	12,978,619	5,981	1,139,591	14,124,191
Gasoline	20,894,746	82,981	---	20,977,727
Carbon dioxide	---	---	---	0
Subtotal	\$623,837,871	\$1,829,541	\$21,083,175	\$646,750,587
Other	21,145,622	3,998	262,974	21,412,594
TOTAL	\$644,983,493	\$1,833,539	\$21,346,149	\$668,163,181

Naval Petroleum and Oil Shale Reserves

REVENUES - Fiscal Year 1988

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Total
Crude oil ¹	\$453,378,011	\$999,692	\$16,563,866	\$470,941,569
Natural gas	79,087,749	638,315	---	79,726,064
Propane	20,312,185	35,490	267,301	20,614,976
Butane	14,647,458	4,916	1,023,419	15,675,793
Gasoline	24,192,974	89,403	---	24,282,377
Carbon dioxide	---	---	---	0
Subtotal	\$591,618,377	\$1,767,816	\$17,854,586	\$611,240,779
Other	31,238,940	1,280	13,725	31,253,945
TOTAL	\$622,857,317	\$1,769,096	\$17,868,311	\$642,494,724

¹ Revenues represent accrued earnings.

REVENUES - Fiscal Year 1989

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserve No. 3	Total
Crude oil ¹	\$441,898,134	\$920,165	\$14,921,345	---	\$457,739,644
Natural gas	89,277,429	709,684	---	\$143,570	90,130,683
Propane	19,078,608	36,664	212,004	---	19,327,276
Butane	13,981,521	3,565	958,607	---	14,943,693
Gasoline	25,030,467	80,179	---	---	25,110,646
Carbon dioxide	---	---	---	---	0
Subtotal	\$589,266,159	\$1,750,257	\$16,091,956	\$143,570	\$607,251,942
Other	24,279,984 ²	30,957	4,353	---	24,315,294
TOTAL	\$613,546,143	\$1,781,214	\$16,096,309	\$143,570	\$631,567,236

¹ Revenues represent accrued earnings.

² Includes refunds to Defense Fuel Supply Center, settlement of court cases, and a write-off as a result of bankruptcy proceedings.

REVENUES - Fiscal Year 1990

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserve No. 3	Total
Crude oil ¹	\$422,054,994	\$1,115,015	\$17,572,488	\$ 35,346	\$440,777,843
Natural gas	67,805,847	789,650	---	1,362,329	69,957,826
Propane	20,116,810	30,418	197,700	---	20,344,928
Butane	13,398,830	4,287	824,378	---	14,227,495
Gasoline	23,930,568	62,386	---	---	23,992,954
Carbon dioxide	---	---	---	---	0
Subtotal	\$547,307,049	\$2,001,756	\$18,594,566	\$1,397,675	\$569,301,046
Other	33,069,846	68,891	15,918	30,670	33,185,285
TOTAL	\$580,376,895	\$2,070,647	\$18,610,484	\$1,428,345	\$602,486,331

¹ Revenues represent accrued earnings.

REVENUES - Fiscal Year 1991

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserve No. 3	Total
Crude oil	\$459,198,105	\$1,419,348	\$19,324,074	\$ 35,115	\$479,976,642
Natural gas	69,670,222	777,910	---	2,150,227	72,598,359
Propane	21,716,102	30,356	207,014	---	21,953,472
Mixed butane	15,610,643	6,478	865,764	---	16,482,885
Isobutane	1,588,063	---	---	---	1,588,063
Gasoline	26,349,756	88,397	---	---	26,438,153
Carbon dioxide	---	---	---	---	0
Subtotal	\$594,132,891	\$2,322,489	\$20,396,852	\$2,185,342	\$619,037,574
Other	35,127,430	16,860	0	0	35,144,290
TOTAL	\$629,260,321	\$2,339,349	\$20,396,852	\$2,185,342	\$654,181,864

Naval Petroleum and Oil Shale Reserves

REVENUES - Fiscal Year 1992

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserve No. 3	Total
Crude oil ¹	\$326,616,795	\$1,079,460	\$17,364,144	\$ 40,595	\$345,100,994
Natural gas	35,203,883	664,600	---	1,206,766	37,075,249
Propane	17,678,715	13,702	173,063	---	17,865,480
Mixed butane	9,887,300	5,246	729,414	---	10,621,960
Isobutane	3,280,460	---	---	---	3,280,460
Gasoline	21,211,609	63,569	---	---	21,275,178
Subtotal	\$413,878,762	\$1,826,577	\$18,266,621	\$1,247,361	\$435,219,321
Other	37,335,395	245,392	304	---	37,581,091
TOTAL	\$451,214,157	\$2,071,969	\$18,266,925	\$1,247,361	\$472,800,412

¹ Revenues represent accrued earnings.

REVENUES - Fiscal Year 1993

Product	Naval Petroleum Reserve No. 1	Naval Petroleum Reserve No. 2	Naval Petroleum Reserve No. 3	Naval Oil Shale Reserve No. 3	Total
Crude oil	\$302,257,380	\$1,829,639	\$13,473,077	\$ 34,317	\$317,594,413
Natural gas	33,504,911	626,068	---	3,501,835	37,632,814
Propane	16,860,322	19,898	184,128	---	17,064,348
Mixed butane	7,916,849	7,739	565,955	---	8,490,543
Isobutane	4,030,141	---	---	---	4,030,141
Gasoline	17,514,249	53,588	---	---	17,567,837
Subtotal	\$382,083,852	\$2,536,932	\$14,223,160	\$3,536,152	\$402,380,096
Other	37,258,356	78,843	4,262	0	37,341,461
TOTAL	\$419,342,208	\$2,615,775	\$14,227,422	\$3,536,152	\$439,721,557

**Naval Petroleum Reserve No. 1
Development and Exploratory Program — Wells Drilled**

	1974 Through Fiscal Year 77		Fiscal Year 77		Fiscal Year 78		Fiscal Year 79		Fiscal Year 80		Fiscal Year 81		Fiscal Year 82		Fiscal Year 83		Fiscal Year 84		Fiscal Year 85	
	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.
Tulare	0	2	0	0	0	0	2	0	2	0	4	0	8	0	0	0	4	0	4	0
Dry Gas	12	3	5	0	6	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Shallow	163	3	99	0	65	0	34	0	16	0	0	0	31	0	25	0	10	0	8	0
Olig	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Stevens	81	5	63	1	47	1	43	0	46	1	42	3	61	5	62	2	15	3	10	0
Carneros	2	1	1	0	2	0	0	3	0	0	0	0	0	1	0	1	1	0	0	1
Basement	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1 ¹
TOTAL	258	14	168	1	120	3	82	3	64	1	46	3	101	6	87	3	30	3	22	2

	Fiscal Year 86		Fiscal Year 87		Fiscal Year 88		Fiscal Year 89		Fiscal Year 90		Fiscal Year 91		Fiscal Year 92		Fiscal Year 93		Total		Grand Total
	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	
Tulare	0	0	1	0	0	0	0	0	6	0	1	0	1	0	0	0	33	2	35
Dry Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	3	29
Shallow	12	0	4	0	9	0	7	0	0	0	4	0	10	0	7	0	504	3	507
Olig	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Stevens	10	0	24	0	28	0	13	0	12	0	9	0	14	0	15	0	595	21	616
Carneros	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	8	14
Basement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	4
TOTAL	22	0	29	1	37	0	20	0	18	0	14	0	25	0	22	1	1,165	41	1,206

¹ Initiated in Fiscal Year 1985.

**Naval Petroleum Reserve No. 3
Development and Exploratory Program — Wells Drilled**

	1974 Thru Fiscal Year 76		Fiscal Year 77		Fiscal Year 78		Fiscal Year 79		Fiscal Year 80		Fiscal Year 81		Fiscal Year 82		Fiscal Year 83		Fiscal Year 84		Fiscal Year 85	
	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.
Shannon	0	0	78	0	105	0	41	0	4	0	0	0	0	0	0	0	9	0	6	0
Wall Creek	0	1	76	0	23	0	0	0	12	0	20	0	9	0	3	0	7	0	9	0
Shale ¹	0	0	1	0	15	0	20	0	10	0	0	0	8	0	5	20	10	7	10	0
Tensleep	0	1	0	0	0	3	0	1	0	0	2	0	1	0	1	0	0	0	1	0
MDL ²	0	2	0	0	0	7	0	6	1	1	0	0	1	0	8	0	8	0	6	0
Subtotal	0	4	155	0	143	10	61	7	27	1	22	0	19	0	17	20	34	7	32	0
Shannon EOR ³	0	0	0	0	0	0	0	0	29	0	0	0	5	0	0	0	6	0	26	0
TOTAL	0	4	155	0	143	10	61	7	56	1	22	0	24	0	17	20	40	7	58	0

	Fiscal Year 86		Fiscal Year 87		Fiscal Year 88		Fiscal Year 89		Fiscal Year 90		Fiscal Year 91		Fiscal Year 92		Fiscal Year 93		Total		Grand Total ⁴	
	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.	Dev.	Exp.
Shannon	18	0	15	0	8	0	4	0	0	0	1	0	6	0	24	0	319	0	319	
Wall Creek	17	0	7	0	5	1	0	0	0	0	0	0	0	0	0	0	188	2	190	
Shale ¹	26	0	18	16	2	19	6	5	0	0	0	0	13	0	0	0	144	67	211	
Tensleep	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	5	12	
MDL ²	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	16	41	
Subtotal	63	0	41	16	15	20	10	5	0	0	1	0	19	0	24	0	683	90	773	
Shannon EOR ³	0	0	7	0	32	0	12	0	40	0	20	0	30	0	20	0	227	0	227	
TOTAL	63	0	48	16	47	20	22	5	40	0	21	0	49	0	44	0	910	90	1,000	

¹ Includes 27 Shallow Steele Shale Wells not previously accounted for that were drilled in fiscal year 1983 and 1984 and were plugged and abandoned.

² Muddy/Dakota/Lakota and other (Morrison, Madison, Crow Mountain, potable, wells and X unknown)

³ Enhanced oil recovery

⁴ Does not reflect the current number of active wells in each formation. Subsequent recompletion to other formations during the period fiscal year 1974 through fiscal year 1992 are not listed in this table.

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END