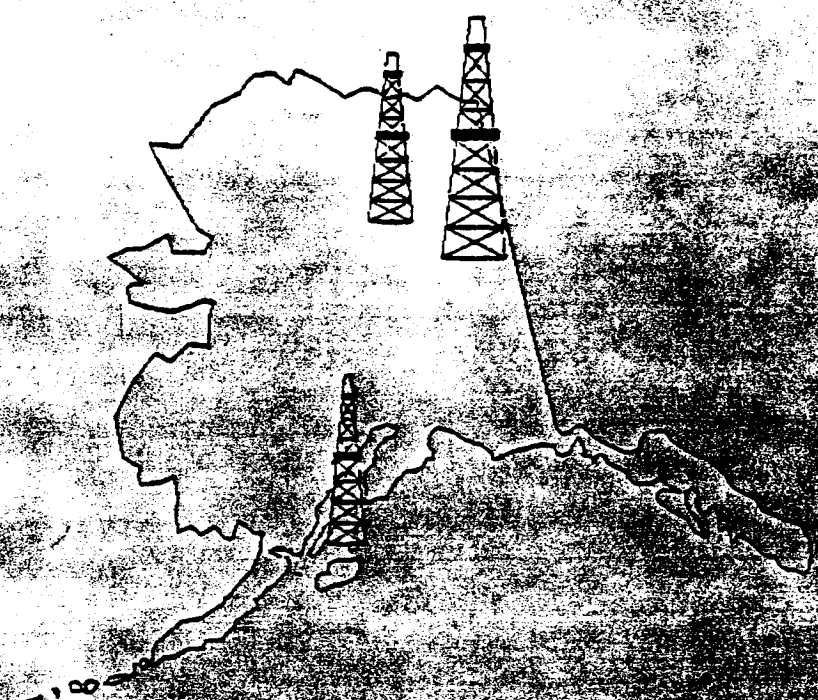
115 RGV-E

Oil Industry Profitability

in Alaska

1969 through 1987



Prepared for the Department of Revenue
State of Alaska

by

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SUMMARY

Total Profit. The oil industry received an estimated $42.6 billion in profit from production and transportation activities in Alaska from 1969 through 1987. The $42.6 billion represents amounts accruing to producers after accounting for all expenses, including exploration, lease acquisition and income taxes, and allowing for recovery of investment costs (depreciation). The main section of this report presents details of profit for each calendar year. The technical section of this report describes each component of the profit, investment and cash flow elements. Below is a summary statement.

Total Alaska Oil Profit
1969 through 1987
(billions of dollars)

Revenues:		
Production revenues	$ 97.6	
TAPS revenues	33.7	
Total Revenues		**$131.3**
Expenses:		
Depreciation	12.1	
Operating Expenses	9.1	
Exploration Expenses	4.1	
Overhead	.8	
Interest	7.5	
Royalty	11.8	
Severance Taxes	10.4	
Property Taxes	3.5	
State Income Taxes	3.6	
Windfall Profit Taxes	6.4	
Federal Income Taxes	19.4	
Total Expenses		88.7
Profit		**$ 42.6 Billion**

Profit per barrel: $6.59

Alaska North Slope (ANS) production contributed $29.1 billion to profit, with $27.8 billion of this amount attributable to Prudhoe Bay and $1.3 billion

attributable to Kuparuk. TAPS provided $12.4 billion. Production in Alaska other than ANS production added $1.1 billion in profit. (Lisburne is included with Prudhoe Bay and Milne Point with Kuparuk. Endicott did not have significant production until after 1987. Alaska production other than ANS production is at Cook Inlet).

Shares. The $42.6 billion in after-tax profit that accrued to the oil industry compares to $29.3 billion in State of Alaska receipts from oil industry activities during this period. During the same period, Federal government receipts were $25.8 billion from these activities.

Investment. From 1969 through 1987, the industry invested $25.0 billion in ANS development costs and for TAPS. $13.1 billion of this represents the initial costs of Prudhoe Bay and TAPS. Of the $25.0 billion investment, $11.6 billion has been recovered through depreciation charges ($6.6 billion from Prudhoe, $1.0 billion from Kuparuk and $4.0 billion from TAPS).

Rates of Return on Investment. Cash flows from all Alaska investments from 1976 through 1987, assuming no debt, total $61.3 billion ($41.8 billion of profit plus $12.0 billion of depreciation plus $7.5 billion of interest[1]). Comparing these cash flows to the investment amounts over time implies that the after-tax rate of return on Alaska investments has been 29.7% from 1976 through 1987. Assuming that 75% of the initial investment was borrowed, an assumption that is indicated by available data, the rate of return on the investment is 43.7% after tax.

[1] Interest is added back under the assumption of no debt because there would be no interest expense if the entire project were funded with equity. This analysis incorporates all ANS investments prior to 1976 into 1976 and 1977. A more detailed timing of these investments was beyond the scope of this study. As indicated in the technical discussion, the effects of this assumption create minimal changes in the results.

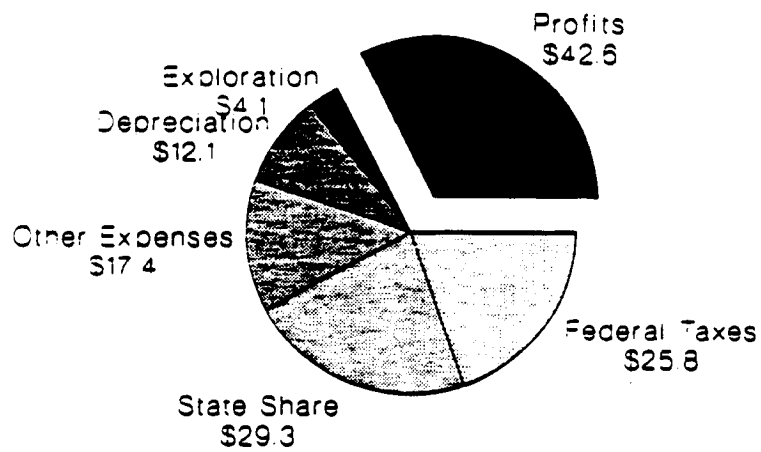
These rates of return compare to the long run rate of return on the New York Stock Exchange of 10% *before* tax. [*Wall Street Journal* (February 20, 1989)] The prime rate peaked at 21.5% *before* tax in 1982, but that was an exceptional year. During this period, a prime rate of 10% to 18% *before* tax was more typical. Using an average effective tax rate of 36%, which approximates the tax rate observed in this study, the equivalent after-tax return on the New York Stock Exchange is 6.4%. The equivalent peak prime rate after an effective tax rate of 36% is 13.76%.

Reinvestment of Alaska Cash Flows. Subsequent to the initial investment for Prudhoe Bay field and TAPS, the industry invested $15.8 billion for ANS development and exploration throughout Alaska from 1978 through 1987. This includes $3.9 billion in exploration expenses which are not included in the analyses of profits from individual fields. The reinvestment rate has been 27.8% of cash flows received during this period.

Seventy-five sources of data about Alaska oil operations were researched to develop this report. Although details do not exist on each and every data item, the information available in the references is sufficient to develop a reasonably accurate picture of industry profit. A study of the data suggests that the actual profit number could be as low as $41 billion or as high as $47 billion. The estimate reported here is at the conservative end of this range.

Figure 1 graphs the relationship among the revenues, expenses and profit for all Alaska oil production and transportation activities.

Figure 1
Revenues, Expenses and Profit
All Alaska Oil Activities
(billions of dollars)



The $42.6 billion in profit is what the producers received after accounting for all expenses, including exploration, lease acquisition, and after allowing recovery of the costs of investments in Alaska oil activities related to the useful lives of the investments.[1]

From 1977 through 1987, virtually all of these profits were earned from the Alaska North Slope (ANS). ANS production contributed $29.1 billion to profit, with $27.8 billion of this amount attributable to Prudhoe Bay. Total production profit for the Prudhoe Bay field is given in Table 2.

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[1] Details of how the profit estimates were obtained are provided in the technical discussion. Some of the amounts could not be readily determined from publicly available data or the data were ambiguous. In these situations, a conservative approach was taken. As a result, this report gives a low-end estimate of oil industry profits. Throughout this report, the sum of the individual numbers may not add to identical totals due to rounding.

Oil Industry Profit in Alaska: 1969-1987
Overview

How profitable is the oil industry in Alaska? This is a question of major significance to the State of Alaska and to its residents because the State's share of the revenues from oil production and transportation activities are a primary factor in determining the State's General Fund revenues as well as the additions to the Permanent Fund. This report looks at available information on industry activities in Alaska to derive a picture of the profit attained from these activities. The results of the study indicate that the oil industry received $42.6 billion in after-tax profit from 1969 through 1987 from oil production and from TAPS. The components of this profit estimate are given in Table 1:

Table 1
Total Alaska Oil Profit
1969 through 1987
(billions of dollars)

Revenues:		
Production revenue	$ 97.6	
TAPS revenue	33.7	
Total Revenues		**$131.3**
Expenses:		
Depreciation	12.1	
Operating Expenses	9.1	
Exploration Expenses	4.1	
Overhead	.8	
Interest	7.5	
Royalty	11.8	
Severance Taxes	10.4	
Property Taxes	3.5	
State Income Taxes	3.6	
Windfall Profit Taxes	6.4	
Federal Income Taxes	19.4	
Total Expenses		**88.7**
Profit		**$ 42.6 Billion**

Profit per barrel: $6.59

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Table 2
Total Prudhoe Bay Production Profit
1977 through 1987
(billions of dollars)

Production Revenue	$ 83.5
Less Expenses:	
Depreciation	6.6
Operating Expenses	4.4
Overhead	.7
Interest	1.3
Royalty	10.0
Severance Taxes	9.9
Property Taxes	1.4
State Income Taxes	2.5
Windfall Profit Taxes	5.9
Federal Income Taxes	13.0
Profit	**$ 27.8 Billion**

Profit per barrel: $5.81

Figure 2 shows the division of these revenues, expenses and profit.

Figure 2
Revenues, Expenses and Profit
Prudhoe Bay Production
(billions of dollars)

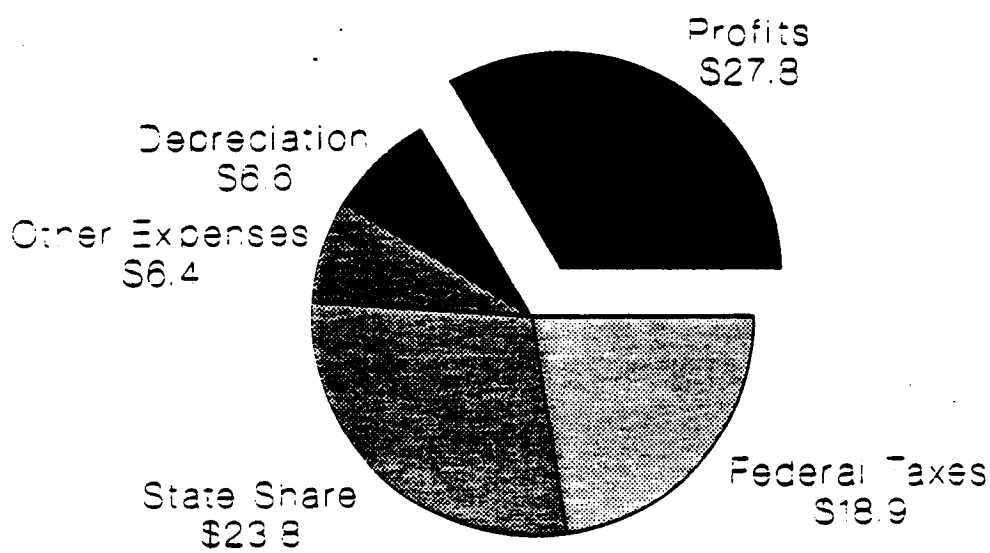

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Table 3 shows Prudhoe Bay production profit for the oil producers on a year-by-year basis from 1977 through 1987.

Table 3
Profit from Prudhoe Bay Production
(millions of dollars)

1983 - 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Production Revenue	$6,573	$4,327	$9,847	$10,097	$10,079
Expenses:					
Depreciation	1,074	1,110	873	710	632
Operating Expenses	740	514	535	578	394
Overhead	109	104	139	89	93
Interest	146	139	141	119	119
Royalty	787	518	1,179	1,209	1,207
Severance Taxes	787	571	1,300	1,333	1,331
Property Taxes	150	148	150	148	147
State Income Taxes	83	37	165	171	172
Windfall Profit Taxes			39	211	426
Federal Income Taxes	917	0	2,212	1,469	1,756
Profit	**$1,780**	**$1,186**	**$3,114**	**$4,061**	**$3,801**
Profit per barrel:	**$3.55**	**$2.40**	**$6.25**	**$8.26**	**$7.75**

1977 - 1982:

	1982	*1981*	*1980*	*1979*	*1978*	*1977*
Revenue	$11,271	$13,330	$9,541	$5,892	$1,849	$ 717
Expenses:						
Depreciation	581	510	476	320	254	38
Operating Expenses	504	546	182	184	157	46
Overhead	77	51	15	2	0	2
Interest	139	17	10	156	203	117
Royalty	1,350	1,596	1,143	706	221	86
Severance Taxes	1,488	1,291	924	622	195	76
Property Taxes	147	146	146	123	104	30
State Income Taxes	168	669	550	367	67	30
Windfall Profit Taxes	1,375	3,089	797			
Federal Income Taxes	2,125	1,971	2,086	383	9	32
Profit	**$3,315**	**$3,443**	**$3,212**	**$3,030**	**$ 639**	**$ 260**
Profit per barrel:	**$6.78**	**$7.09**	**$6.61**	**$7.39**	**$1.84**	**$2.58**

Total revenues, costs and profit from Alaska production activities from 1969 to the end of 1987 are given in Table 6.

Table 6
Total Alaska Production Profit
1969 through 1987
(billions of dollars)

Production Revenue	$ 97.6
Less Expenses:	
Depreciation	8.1
Operating Expenses	5.3
Exploration Expenses	4.1
Overhead	.8
Interest	1.7
Royalty	11.8
Severance Taxes	10.4
Property Taxes	1.8
State Income Taxes	2.7
Windfall Profit Taxes	6.4
Federal Income Taxes	14.3
Profit	**$ 30.2 Billion**
Profit per barrel: $4.96	

A graph showing the distribution of these revenues, expenses and profit is shown in Figure 3.

Figure 3
Revenues, Expenses and Profit
All Alaska Production
(billions of dollars)

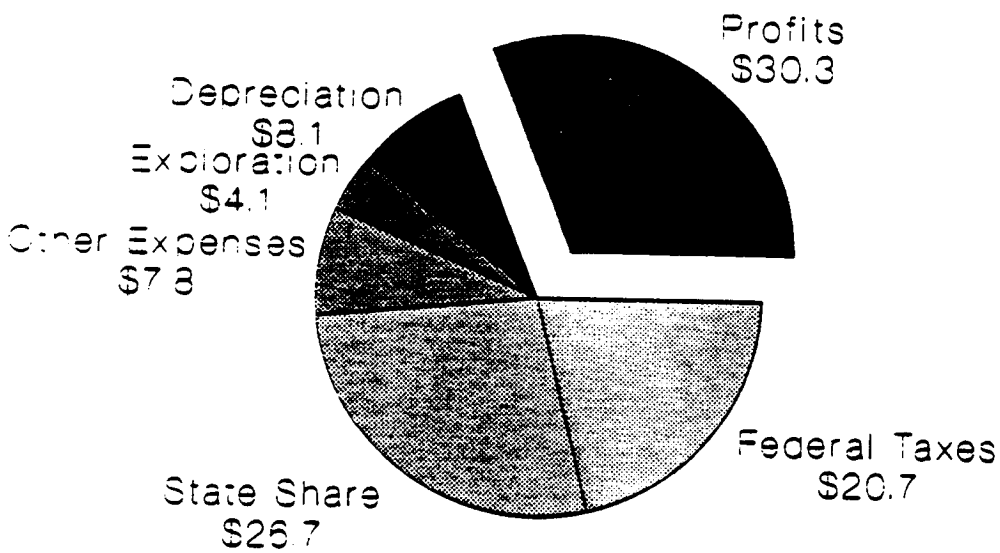

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Table 7 shows the annual profits received from production activities in Alaska from 1969 through 1987.

Table 7
Total Alaska Production Profit
1969 through 1987
(millions of dollars)

1983 - 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Production Revenue	$8,046	$5,367	$11,735	$11,592	$11,564
Depreciation	1,394	1,418	1,123	866	779
Operating Expenses	940	653	679	678	500
Exploration Expenses	288	288	514	258	818
Overhead	139	133	173	106	111
Interest	192	183	183	148	150
Royalty	970	647	1,414	1,397	1,393
Severance Taxes	871	623	1,403	1,395	1,388
Property Taxes	197	192	188	172	159
State Income Taxes	92	37	182	189	174
Windfall Profit Taxes			39	235	475
Federal Income Taxes	1,007	0	2,424	1,627	1774
Profit	**$1,956**	**$1,192**	**$3,413**	**$4,521**	**$3,841**
Profit per barrel:	**$3.18**	**$2.01**	**$5.83**	**$8.15**	**$6.97**

1978 - 1982:

	1982	*1981*	*1980*	*1979*	*1978*
Revenue	$12,785	$14,484	$9,961	$6,321	$2,254
Expenses:					
Depreciation	698	540	504	345	280
Operating Expenses	506	571	183	188	176
Exploration Expenses	647	419	176	174	274
Overhead	91	55	16	2	a
Interest	171	18	10	167	247
Royalty	1,641	1,745	1,198	762	272
Severance Taxes	1,536	1,291	923	622	195
Property Taxes	165	151	152	130	113
State Income Taxes	175	702	556	369	66
Windfall Profit Taxes	1,491	3,314	861		
Federal Income Taxes	2,212	2,067	2,110	399	8
Profit	**$3,452**	**$3,610**	**$3,270**	**$3,161**	**$ 623**
Profit per barrel:	**$6.33**	**$6.96**	**$6.21**	**$6.97**	**$1.56**

Table 7 (continued)
Total Alaska Production Profit
1969 through 1987
(millions of dollars)

1973 - 1977:

	1977	*1976*	*1975*	*1974*	*1973*
Revenue	$ 1,054	$ 380	$ 396	$ 372	$ 377
Expenses:					
Depreciation	53	16	16	16	16
Operating Expenses	64	16	15	10	3
Exploration Expenses	25	25	25	25	25
Overhead	3	a	a	a	a
Interest	177	1	1	a	a
Royalty	131	46	48	45	45
Severance Taxes	76	28	27	15	15
Property Taxes	31	12	13	13	13
State Income Taxes	49	23	24	24	24
Federal Income Taxes	52	85	91	89	89
Profit	**$ 394**	**$ 133**	**$ 142**	**$ 140**	**$ 140**
Profit per barrel:	**$2.49**	**$1.94**	**$1.94**	**$1.89**	**$1.33**

1969 - 1972:

	1972	*1971*	*1970*	*1969*
Revenue	$ 283	$ 279	$ 278	$ 227
Expenses:				
Depreciation	16	16	17	14
Operating Expenses	3	2	1	1
Exploration Expenses	25	25	25	25
Overhead	a	a	a	a
Interest	a	a	a	a
Royalty	34	34	34	27
Severance Taxes	12	11	8	6
Property Taxes	13	10	14	13
State Income Taxes	17	17	17	13
Federal Income Taxes	63	63	64	50
Profit	**$ 99**	**$ 98**	**$ 100**	**$ 79**
Profit per barrel:	**$1.23**	**$1.22**	**$1.17**	**$1.04**

a. Less than $1 million.

TAPS PROFIT

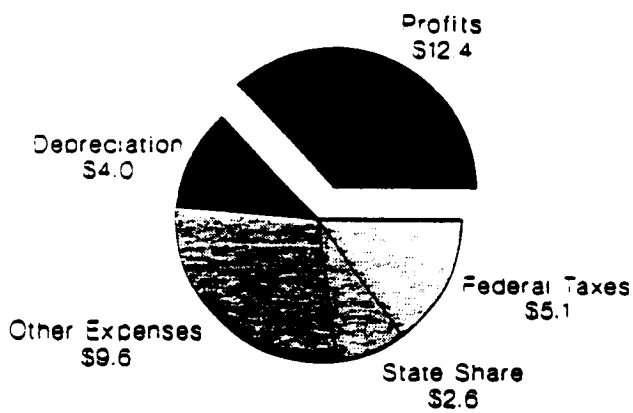
The Trans-Alaska Pipeline System (TAPS) is owned by the Prudhoe Bay producers in approximately the same proportion as their ownership interest in the Prudhoe Bay field. Profit from TAPS, therefore, accrues to the same producers. Table 8 shows the overall revenues, expenses and profit for TAPS from 1978 through 1987.[2]

Table 8
Total Estimated TAPS Profit
(billions of dollars)

Revenue	$ 33.7
Expenses:	
Depreciation	4.0
Operating and Administrative	3.8
Interest	5.8
Property Taxes	1.7
State Income Taxes	.9
Federal Income Taxes	5.1
Profit	**$12.4 Billion**
Profit per barrel: $2.41	

The distribution of these items are shown in Figure 4.

Figure 4
TAPS Revenues, Costs and Profit
(billions of dollars)



[2]The one-half year of activity during 1977 when TAPS started does not have a significant effect on the results. Data from that year are unavailable.

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A year-by-year comparison of TAPS profit is shown in Table 9.

Table 9
Annual TAPS Profit
(millions of dollars)

1983 through 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Revenue	$2,765	$3,080	$3,578	$3,926	$3,899
Expenses:					
Depreciation	299	310	309	431	475
Operating and Administrative	255	343	247	387	483
Interest	150	440	411	570	579
Property Taxes	147	164	168	171	165
State Income Taxes	57	55	73	71	66
Federal Income Taxes	631	0	984	610	674
Profit	**$1,226**	**$1,768**	**$1,386**	**$1,686**	**$1,457**
Profit per barrel:	**$2.08**	**$3.07**	**$2.44**	**$3.17**	**$2.77**

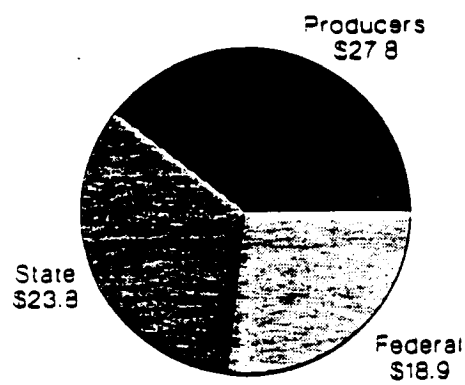
1978 to 1982:

	1982	*1981*	*1980*	*1979*	*1978*
Revenue	$3,896	$3,605	$3,554	$2,963	$2,394
Expenses:					
Depreciation	467	431	503	421	355
Operating and Administrative	498	474	435	330	381
Interest	648	681	720	771	846
Property Taxes	168	171	168	174	174
State Income Taxes	63	203	162	119	60
Federal Income Taxes	802	599	617	129	8
Profit	**$1,250**	**$1,046**	**$ 949**	**$1,019**	**$ 570**
Profit per barrel:	**$2.42**	**$2.15**	**$1.95**	**$2.49**	**$1.64**

SHARES

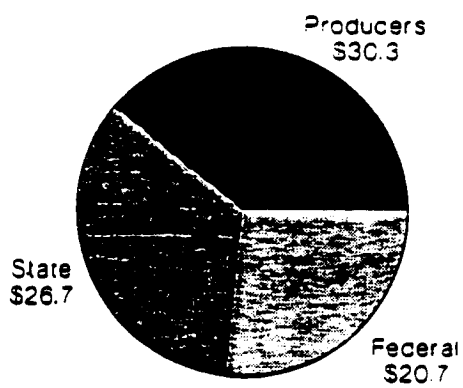
At the super-giant Prudhoe Bay field, producers earned $27.8 billion. The State received $23.8 billion from Prudhoe Bay and the Federal government received $18.9 billion. This is shown visually in Figure 5. The nearby giant Kuparuk field added $1.3 billion to producer profit, $1.2 to the state and $0.6 billion to the Federal government's revenues.

Figure 5
Shares
Prudhoe Bay Production
(billions of dollars)



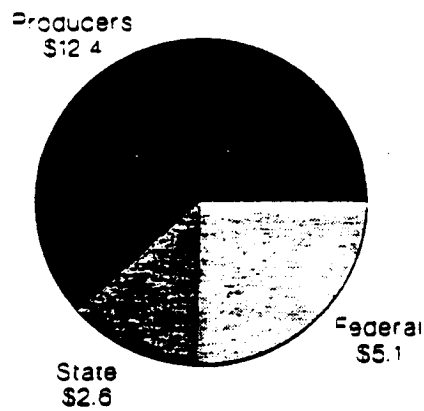
The sharing from all production in Alaska between 1969 and 1987 is shown in Figure 6, with $30.3 billion to the producers, $26.7 billion to the State and $20.7 billion to the Federal government.

Figure 6
Shares
All Alaska Production
(billions of dollars)



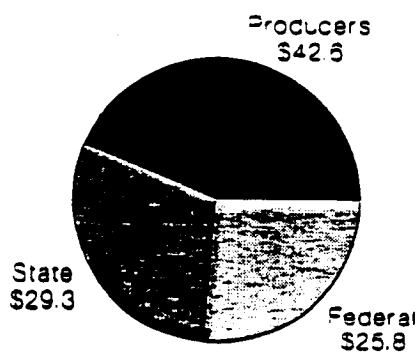
TAPS profit of $12.4 billion went to the producers, $2.6 billion went to the State through property and income taxes and $5.1 billion went to the Federal government through income taxes. This distribution is shown in Figure 7.

Figure 7
TAPS Shares
(billions of dollars)



A summary of the distribution for all Alaska oil operations is shown in Figure 8. The $42.6 billion in after-tax profit that accrued to the oil producers compares to $29.3 billion in State of Alaska receipts from oil industry activities during this period. During the same period, Federal government receipts were $25.8 billion from these activities. Figure 8 shows the relationship between industry profit and the state and federal receipts from oil industry revenues.

Figure 8
Shares
All Alaska Production and Transportation
(billions of dollars)



ADDITIONAL BENEFITS OF ANS OIL

ANS producers receive profits from Alaska oil outside of Alaska which provides an additional bonus beyond what it would cost if they had to purchase imported oil. An additional profit of approximately $0.7 billion went to the producers through the operation of the U.S. Department of Energy crude oil entitlements program. Producers are believed to earn additional profit through the refining of ANS crude because, among other things, they have access to a secure source of crude oil. If they did not have the ANS crude, it would be necessary for them to acquire crude from foreign sources.

Others estimate that profits on tanker operations and trans-Panama shipment activities added between $.25 and $1.00 profit per barrel of ANS crude produced. These additional profits would have been received on the nearly 6 billion barrels of ANS production. These added profits are not included in the $42.6 billion of total oil industry profit in Alaska covered in this report.

INVESTMENTS MADE ON THE ALASKA NORTH SLOPE

Figure 9 shows the relative amounts of money invested in projects to produce ANS crude. The greatest investment was $9.4 billion in TAPS. The total investment to date in Prudhoe Bay was $8.7 billion. This includes the waterflood project and the miscible gas injection project as well as infield drilling. The investment in Kuparuk was $4.3 billion which includes amounts for the newly installed waterflood project that had not been in operation during the period of this study. Milne Point cost $575 million. Endicott and Lisburne each cost approximately one billion dollars. As of the end of 1987, Milne Point had been shut in, while Endicott and Lisburne had just begun operations too recently to have a significant impact on the revenue numbers reported here. The investments made in Cook Inlet during this period were not significant relative to the ANS investments during this period.

Figure 9
ANS Investments
(billions of dollars)

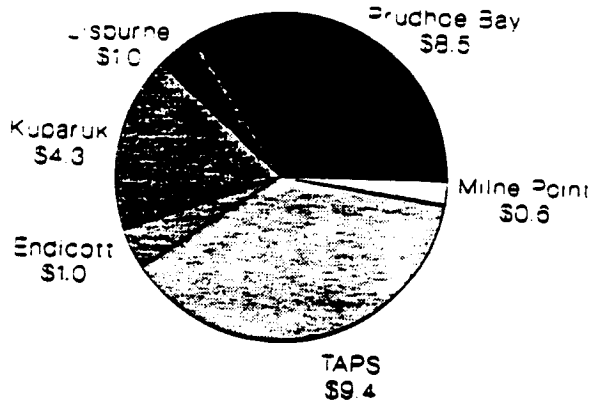


Table 10 shows the timing of the investments in Prudhoe Bay and other ANS projects together with an estimate of the timing of the investment in TAPS. These investment timings are based on information from the producers and may not be exact.

Table 10
ANS Investments
(millions of dollars)

Year	*Project*	*Amount*
1987	Prudhoe gas	$ 720
1987	Kuparuk waterflood	900
1987	Endicott	1,000
1986	Lisburne	1,000
1985	Prudhoe gas plant	720
1984	Milne Point	570
1983	Prudhoe waterflood	2,000
1981	Kuparuk	3,400
1981	Prudhoe drilling	1,100
1980	Prudhoe drilling	250
1979	Prudhoe drilling	250
1977	Prudhoe*	1,850
1977	TAPS*	4,700
1976	Prudhoe*	1,850
1976	TAPS*	4,700
Total		**$ 25,015**

*These amounts were spent over the period 1969 through 1977, with the majority of the funds spent later in the construction phase of the project.

Cash flows can be related to these investments to compute a rate of return on the investment in Alaska. Assuming the entire investment was made with equity funds, cash flows are deemed equal to profit plus depreciation and interest. A schedule of these "all-equity" cash flows is shown in Table 11.

Table 11
All-Equity Cash Flows
(millions of dollars)

		—Cash Flows—		Net
Year	*Investment*	*Production*	*TAPS*	*Cash Flow*
1987	2,620	3,542	1,675	2,597
1986	1,000	2,793	2,518	4,311
1985	720	4,719	2,106	6,105
1984	570	5,512	2,687	7,629
1983	2,000	4,770	2,511	5,281
1982	0	4,321	2,365	6,686
1981	4,500	4,168	2,158	1,826
1980	250	3,764	2,172	5,686
1979	250	3,673	2,211	5,634
1978	0	1,151	1,771	2,922
1977	6,550	655	0	-5,895
1976	6,550	0	0	-6,550

The equivalent rate of return earned on this stream of cash flows after tax is 29.7%.

As it happened, a substantial portion of the investment was financed with borrowed monies. The 1978 Sohio annual report to shareholders indicated that 75% of the company's funds were from debt. In this case, the investments in 1976 and 1977 as shown in Table 11 would be $1,638 net each year. This is 25% of the investment outflows in those years. The remainder would have been financed with debt. Interest expense would be incurred on this debt and the debt would have to be repaid. The cash flow data in Table 12 is the profit plus depreciation. These cash flows include a deduction for interest expense. Assuming that all of the cash flows were used to pay of the debt as quickly as possible, the loan repayment would have consumed all of the cash flows in 1978

through 1979 and all but $2,131 million in 1980. The net cash flows in each year are shown in column 4 of Table 12.[3]

Table 12
Cash Flows with 75% Borrowing
(millions of dollars)

		----Cash Flow----		Net Cash
	Investment	*Production*	*TAPS*	*Flow*
1987	2,620	3,350	1,525	2,255
1986	1,000	2,610	2,078	3,688
1985	720	4,536	1,695	5,511
1984	570	5,364	2,117	6,911
1983	2,000	4,620	1,932	4,552
1982	0	4,150	1,717	5,867
1981	4,500	4,150	1,477	1,127
1980	250	3,754	1,452	2,131
1979	250	3,506	1,440	0
1978	0	903	925	0
1977	6,550	478	0	-1,160
1976	6,550	0	0	-1,637

The rate of return implied from the stream of cash flows shown in Table 12 is 43.7%.

REINVESTMENT OF ALASKA PROFIT

A question of importance to Alaska is what happens to the profit earned from oil activities in Alaska. It has been necessary for the industry to make certain investments to maximize production from the Prudhoe Bay field. Initial investments are shown in 1976 and 1977 in Table 10. Reinvestments are shown in Table 10 for the years 1978 through 1987. In addition, the industry has reinvested through exploration.

Reinvestments shown in Table 10 are added to exploration expenses to obtain total reinvestments for the period 1978 through 1987. These reinvestments are shown in the first column of Table 13. For the years 1978

[3]Loan repayments took place over a longer time period, but it is not feasible within this project to determine actual repayment dates for ANS investment-related debt. This model assumes earlier repayment, but also includes the later interest costs reported by the producers. The net effect of this is to understate the rate of return.

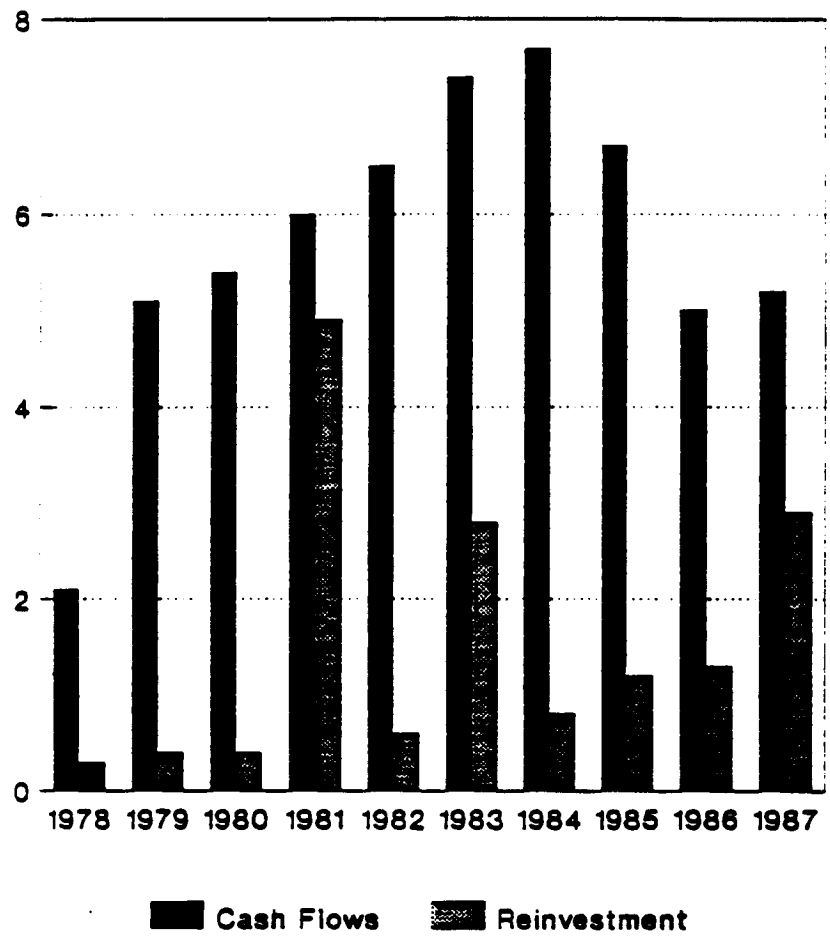
through 1987, these reinvestments are compared to cash flows received from Alaska oil operations. These cash flows are equal to profit plus depreciation and exploration expenses. They are shown as the third and fourth columns in Table 13. Each year's ratio of reinvestment to cash flows is shown in the last column of Table 13.

Table 13
Reinvestment and Reinvestment Flows
(millions of dollars)

	Re-	*—Cash Flows—*			*Reinvestment*
Year	*investment*	*Production*	*TAPS*	*Total*	*Ratio*
1987	2,908	3,638	1,525	5,163	56.32%
1986	1,288	2,898	2,078	4,976	25.88%
1985	1,234	5,050	1,695	6,745	18.30%
1984	828	5,622	2,117	7,739	10.70%
1983	2,818	5,438	1,932	7,370	38.24%
1982	647	4,797	1,717	6,514	9.93%
1981	4,919	4,569	1,477	6,046	81.36%
1980	426	3,930	1,452	5,382	7.92%
1979	424	3,680	1,440	5,120	8.28%
1978	274	1,177	925	2,102	13.04%

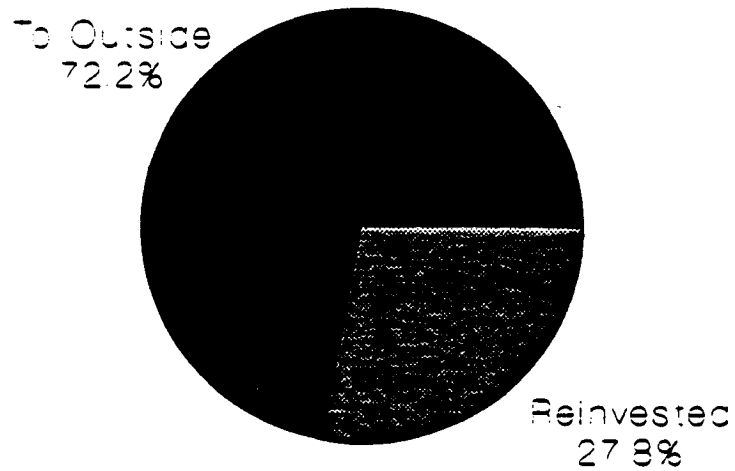
Table 13 indicates that 27.8% of the cash flows from oil and gas industry activities in Alaska was reinvested in Alaska. The reinvestment is shown graphically in Figure 10.

Figure 10
Reinvestment in Alaska by Years
(billions of dollars)



The relationship between the percentage of funds reinvested in Alaska oil projects and those which flow outside is shown in Figure 11.

Figure 11
Overall Reinvestment of Oil Industry Flows
(percentage)



HOURLY PROFIT RATE

Looking at these profits as an hourly earnings number may bring the amounts into better perspective. After-tax profits have been earned by the producers at the rate of $463,144 per hour, twenty-four hours per day for each day of the first ten and one-half years of ANS production.

SENSITIVITY OF ESTIMATES

Where possible, the different assumptions used to develop these profit estimates were studied in more detail to see how sensitive the profit estimates were to the different assumptions. When in doubt, a conservative approach was taken. A total of $7.5 billion in potential profit increases related to assumptions

that were resolved in favor of conservatism was ignored. By contrast, a total of $.6 billion in potential profit decreases related to assumptions were also ignored.

After considering the impact of all potential adjustments due to the assumptions used in the report, the range of profit estimates runs from a minimum of $41 billion to a maximum of $47 billion. The $42.6 billion reported here is at the low end of this range.

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Oil Industry Profitability in Alaska

1969 through 1987

TECHNICAL DISCUSSION

Confidential Pursuant to
APUC Order P-97-4(22)

RTSXMB 519694

Oil Industry Profitability in Alaska
1969 through 1987
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Technical Discussion

The profit estimates reported in this report were developed from publicly available information about oil industry activities in Alaska. Although a substantial amount of information exists about oil industry activities in Alaska, a complete picture of profit from Alaska activities is not published in any known reference. Assembling a report on oil industry profit requires gathering information from a number of different sources, piecing together an overall picture of profit and cross-checking the estimate obtained in this manner with other data sources. In the end, the profit estimate should be quite close to the actual results.

Throughout this report the terms "approximate" and "estimate" appear quite frequently. These terms are necessary because public data do not exist which would enable one to compute Alaska profit precisely. The approach taken here, when there are questions about amounts, is to take the conservative approach. The profit reported then will represent the low end of the range. This section of the report provides details on how the pieces of the puzzle were assembled and how the resulting profit estimates were cross checked. After all of this, some questions still remain. The effect of these remaining questions is covered in Section III of this technical discussion.

APPROACH TO MEASURING ALASKA OIL COMPANY PROFIT

In its most fundamental form, profit is the amount that is left over from revenues after paying all expenses including income taxes and an allowance for the cost of the initial investment. In accounting terms, estimation of profit becomes more complex because accountants must relate revenues to expenses that occur in different times. Accounting profits therefore are based on an

analysis of transactions that took place in the past with appropriate adjustments to determine the profit attributable to a specific period of time. In this report, profit from Alaska oil industry activities are estimated over the period 1969 through 1987.[1]

Alaska oil producers earn profit from the production, transportation and sale of crude oil. The primary sources of these profits are production from Prudhoe Bay field on the Alaska North Slope (ANS) and TAPS.

A company engaged in Alaska oil activities can estimate its own profit rather readily by extracting transaction data from its own books and by making appropriate adjustments. To make such an estimate from the outside is much more complex because a significant portion of company data is kept private. Hence, it is necessary to identify that information which is public and piece together a picture of the profitability of Alaska oil operations. This task requires obtaining as much information as possible and then making assumptions about the missing data and, where possible, cross-checking the results with other public data sources. This is the process followed to develop the profit estimates reported here.

For example, Standard Oil Company of Ohio (formerly Sohio, now BP America) includes a section in its corporate annual report that states its profit from Alaska oil production operations. (See Appendix A for an example of this disclosure.) If every other producer obtained the same revenues per barrel of crude oil and incurred the same costs to produce that oil, one could project from the Sohio data to all Alaska production. However, this approach cannot be used because it is widely known that Sohio sells most of its ANS crude on the U.S. Gulf Coast whereas other producers sell their crude oil on the U.S. West Coast.

[1]See Financial Accounting Standards Board, *Statement of Financial Accounting Concepts No. 3*, Pars. 12 and 56 - 62 for a comprehensive discussion of profit concepts.

Prices in the two markets differ. According to Barclay's de Zoete Wedd (1988), U.S. West Coast prices are about $1 lower than the Gulf Coast, but it costs about $2.45 more to ship a barrel of crude oil to the Gulf Coast. To obtain revenues for all producers, it is necessary to adjust Sohio revenues by taking account of the differences in crude oil values. This is one of the many adjustments necessary to obtain an estimate of profit.

The more assumptions that need to be made, the more questions that will arise about the profit number that is obtained. However, there are alternate sources of information that can be used to compare a significant portion of the data used to compute profit. To the extent that these alternate sources are consistent, the computed profits will be more reliable. The most important item in the profit equation is revenue. Fortunately, estimates of producers can be checked against Alaska severance tax collections. For most of the period covered by this report, the Alaska severance tax is stated as 15% of the value of producers' production, subject to certain adjustments. This implies that for production subject to the 15% rate, an amount equal to 15% of production revenue should approximate the reported severance tax collections by the State of Alaska. Similar comparisons can be made for production subject to other severance tax rates.

In addition, the estimate included in this report is not the only estimate of oil industry profit in Alaska. Financial analysts and others have, from time to time, estimated profit from Alaska oil industry activities. (See Appendices B and C for examples.) The numbers reported here have been checked, to the extent possible, with other data sources.

Not all of the numbers can be checked and many of the alternate information sources use different bases for reporting their data. The last part of section III of

this report discusses the effects that substantial questions raised by the estimation process are likely to have on the total estimated profit. As noted in this report, most of the effects are quite small. This is an unavoidable problem. Indeed, it is very likely that producers are unable to estimate their own profits down to the last cent because of the assumptions that they make in developing their profit numbers. The point is that the estimate developed here is, on balance, consistent with other estimates of profits earned in Alaska. Indeed, the total effect of questions about alternate treatments is that the profit reported here is on the conservative side. One may perhaps argue that total profit is $2 billion higher or lower than this estimate, but such a debate should not detract from the validity of the overall picture presented here.

The first part of this report develops estimated revenues from production activities, essentially the gross receipts from operations. This report focuses on the revenues that accrue to the producers, net of royalty. This is defined as "working interest revenue." To calculate working interest revenue, it is necessary to know production and the value of each barrel of production. Those matters are discussed in Section I under "Production Revenues".

Section II covers the expenses that must be deducted from revenues to obtain profit for this project. These expenses include depreciation, severance taxes, operating expenses, windfall profit taxes, exploration expenses, overhead and interest. Each of these items is discussed in turn. Both the State of Alaska and the U.S. government levy taxes on income as defined in their laws. These are expenses for accounting purposes and are also presented in Section II. Royalties are eliminated from revenues reported by oil and gas producers. In Section III, royalties are included as a separate line item to determine both the working interest (producers') revenues and total revenues.

The third section of the report gives the detailed statements of profit for Prudhoe Bay, Kuparuk and all Alaska production. This section also includes a discussion of the sensitivity of the profit estimates to cost estimates, missing data, various allocations, and other factors on the profit estimates.

The fourth section of the report shows the profit earned from TAPS. Here it is reasonable to rely extensively on Sohio Pipeline Company's disclosures. Other data sources generally confirm the Sohio Pipeline information.

Each part of this technical discussion is designed to provide further detail about the way the data presented in the report was developed. To the extent possible, the report follows accounting practices and conventions that enable one to obtain a reasonable estimate of the profitability of Alaska's oil industry activities. The resulting estimates give an accurate, although not exact, picture of the profitability of Alaska's oil industry operations.

Profit has been estimated for Prudhoe Bay, Kuparuk, all Alaska production and TAPS. After making all of the calculations and cross-checking available data, total oil industry profit in Alaska is estimated as $42.6 billion. This includes $27.8 billion from Prudhoe Bay, $1.3 billion from Kuparuk and $12.4 billion from TAPS. An additional $1.1 billion was earned elsewhere in Alaska.

After looking at the effects of all of the estimates made on reported profit, a range within which the actual number is likely to fall can be developed. The low end of this range is $41 billion and the high end is $47 billion. The estimated profit of $42.6 billion reported here is in the low end of this conservative estimated range.

Finally, reported profit is based on public information which was available at the time this report was written. It is entirely possible that data not available

could affect the analysis. Any such data would be welcomed to advance the goal of obtaining a more precise estimate of Alaska oil industry profit.

I. PRODUCTION REVENUES

PRODUCTION ESTIMATES

Production estimates for crude oil and natural gas were obtained from different data sources and compared. Since the foundation of reported profit depends on production estimates, it is important to note how the estimates compare. Moreover, each company's reported accounting data are based on its production estimates. Thus, the production data are needed for making certain computations from company reports. The estimates for crude oil are discussed first in this section, followed by the estimates for natural gas.

Crude Oil. Production estimates were obtained from the corporate annual reports of Arco, Sohio and BP America, the Alaska Oil and Gas Conservation Commission Statistical Series, DeGolyer and MacNaughton's *20th Century Petroleum Statistics* (1987) and the *International Petroleum Encyclopedia*, as well as from the *U.S. Energy Statistics Sourcebook* (1988). As shown below, the estimates provided by each of these sources differ with respect to the time periods covered, the level of detail and the volumes of production.

The producers' corporate annual reports present production information in terms of barrels per day of production. The data as reported by each company are shown in Table I-1.

Arco presented separate information on the production from Prudhoe Bay, Kuparuk and Lisburne for the years 1980 through 1987. From 1978 on, Sohio/BP presented data for all of its Alaska operations. Prior to 1982, virtually all of Sohio/BP's production was from the Prudhoe Bay field. These data facilitated obtaining production estimates for each of those fields.

Table I-1
Company Net Production Data
(000 barrels per day)

	------Arco Reports------			
Year	*Prudhoe*	*Kuparuk*	*Lisburne*	*Sohio/BP*
1987	324.9	122.0	15.0	827.2*
1986	306.9	109.9	4.1	706.4#
1985	304.9	94.9	8.5	699.7
1984	326.1	71.7	8.9	617.9
1983	336.4	69.9	10.0	594.8
1982	292.4	61.8	na	676.6
1981	275.5	2.1	na	698.2
1980	274.7			696.4
1979	248.6**			590.8
1978	213.3**			506.8
1977	213.3**			143.8
1976	78.4**			
1975	27.9**			

* BP America data.
# Sohio data. BP America reported 781.4 thousand barrels per day.
** Arco's total Alaska production.

The data reported in Table I-1 were converted to an annual number by multiplying the daily figures by 365. The company statistics were then divided by the company's proportionate share in production to arrive at an estimate of total production based on each company estimate. Adjustments were made for the 1982 redetermination of each company's Prudhoe Bay share of production. The estimates of total Prudhoe Bay production based on Arco's and Sohio/BP's corporate disclosures are in the first two columns of Table I-2, below. The estimates of total Kuparuk production based on Arco's corporate disclosures are in the first column of Table I-3, below. The corporate disclosures give the company's working interest production (net of royalty).

The Alaska Oil and Gas Conservation Commission provides gross production by field for all years covered by this study. The *International Petroleum Encyclopedia* reports gross production from major fields by year. However, the *Encyclopedia* is not complete. In certain years it does not show all fields.

The DeGolyer and MacNaughton statistics are based on the U.S. Department of Energy reports and show gross production from Alaska. They do not show production from specific fields.

The *U.S. Energy Statistics Sourcebook* data show total ANS production for 1981 through 1987 and total Alaska production for prior years. An assumed 1/8 royalty interest was deducted from this number to arrive at an estimate of ANS working interest production. Production from Kuparuk and Lisburne (based on Arco's disclosures) were deducted to arrive at an estimate of Prudhoe Bay production. These data are in Column 3 of Table I-2.

The estimates presented under each method differed. To test the different estimates for reasonableness, TAPS and Kuparuk pipeline throughputs were analyzed. This analysis is based on the assumption that all of Kuparuk production (including royalty oil) should equal the Kuparuk pipeline throughput. TAPS throughput should be comprised of Kuparuk, Lisburne, and Prudhoe Bay crude, including royalty oil. Deducting Kuparuk, Lisburne and Prudhoe Bay royalty oil should give the working interest production from Prudhoe Bay.

Annual total TAPS throughput for 1982 through 1987 was obtained from the Arco annual report. Similar data for 1980 to 1981 were obtained from the Sohio report. Royalty interests as well as Lisburne and Kuparuk production were deducted from total TAPS throughput to obtain an estimate of Prudhoe Bay production. The results of this analysis are shown in Column 5 of Table I-2.

In addition to these estimates, data on total production from Prudhoe Bay, including royalty, were presented in the *International Petroleum Encyclopedia*. These data were available for 1983, 1984, 1985, and 1987. Royalty of 1/8 was deducted from gross production to obtain another estimate of Prudhoe Bay working interest production for comparison purposes.

The sources that provided reasonably complete data series included Arco, Sohio/BP, the *U.S. Energy Statistics Sourcebook*, the Alaska Oil and Gas Conservation Commission statistics and the analysis of pipeline throughput. The estimated working interest production from Prudhoe Bay based on each of these different estimates is shown in Table I-2. After reviewing the data and the different levels of complexity required for each alternate estimate, it appears that the Alaska Oil and Gas Conservation Commission (AOGCC) statistics provided a reasonable, conservative and consistent data series over the period covered by this report.

Table I-2
Annual Production Estimates: Prudhoe Bay
Net of Royalty
(000,000 barrels per year)

Year	*Arco*	*Sohio/BP*	*U.S. Energy Data Sourcebook*	*AOGCC Statistics*	*Pipeline Throughput Analysis*
1987	544.5	592.0	507.3	500.8	520.9
1986	500.1	508.8	493.6	494.5	493.8
1985	496.8	503.9	497.8	498.5	497.3
1984	531.4	467.5	492.1	491.9	489.6
1983	547.4	458.6	487.3	490.8	486.1
1982	492.7	490.0	489.2	489.2	488.4
1981	493.4	480.8	486.7	485.8	495.0
1980	527.7	479.6	517.7	486.0	479.1
1979	na	406.9	447.4	409.9	na
1978	na	349.0	392.5	348.0	na
1977	na	99.1	148.1	100.9	na

For 1977 through 1986, production estimates used for computing Prudhoe Bay profit are based on the AOGCC statistics shown in Table I-2. The 1987 estimate used the AOGCC estimate for Prudhoe Bay plus Arco's estimate for Lisburne. The production number chosen was neither the highest nor the lowest for all years. It is generally believed that the AOGCC estimates are reliable and acceptable estimates of field production.

Kuparuk production estimates are based on 7/8 of Kuparuk pipeline throughput as reported by Arco. The 7/8 number reflects the net working interest

production. The *International Petroleum Encyclopedia* also reported estimated production from Kuparuk. The *International Petroleum Encyclopedia* data were adjusted to reflect a 1/8 royalty interest. The AOGCC reported Kuparuk production was adjusted to reflect a 1/8 royalty interest also. These different annual working interest production estimates for Kuparuk are reproduced in Table I-3.

Table I-3
Annual Production Estimates: Kuparuk
Net of Royalty
(000,000 barrels per year)

Year	*Arco*	*International Petroleum Encyclopedia*	*AOGCC Statistics*
1987	90.4	87.1	89.6
1986	87.2	na	82.2
1985	70.3	69.6	69.7
1984	40.2	32.6	40.4
1983	38.3	34.0	34.9
1982	28.4	na	28.6
1981	na	na	.1

The Arco data are slightly higher for most of the years of Kuparuk production. Since the differences are minor, the Arco production data were used for Kuparuk. The very small production from Milne Point and Endicott would be included with Kuparuk. However, the amounts are too small to affect the analysis.

Lisburne production was reported by Arco at 14.4 million barrels in 1987. The *International Petroleum Encyclopedia* and the AOGCC reported this production at 14.3 million barrels in 1987. This amount has been included with Prudhoe Bay production in subsequent analysis.

For 1981 through 1987 and for years prior to 1978, other Alaska production was reported separately in the *U.S. Energy Statistics Sourcebook.* These data were used for comparison for those periods. For 1978 through 1980, other Alaska production was estimated as the difference between total Alaska production as reported in the *U.S. Energy Statistics Sourcebook* and ANS

production as computed in the two tables above. The results gave significantly higher estimates of other Alaska production during those three years. It was not possible to ascertain the reasons for the difference between these data and the AOGCC data. The two series of working interest production estimates for non-ANS production reproduced in Table I-4.

Table I-4
Non-ANS Production Estimates
Net of Royalty
(millions of barrels)

Year	*AOGCC Statistics*	*U.S. Energy Statistics Sourcebook*
1987	14.3	14.1
1986	15.4	15.4
1985	14.8	14.8
1984	19.3	19.2
1983	21.7	21.7
1982	24.0	24.0
1981	27.1	27.2
1980	31.7	98.1
1979	37.5	91.4
1978	43.8	87.1
1977	49.1	61.4
1976	58.6	55.5
1975	63.0	61.1
1974	63.2	61.8
1973	64.0	63.3
1972	64.4	63.8
1971	69.0	70.0
1970	73.2	73.2
1969	65.0	64.7

The Alaska Oil and Gas Commission statistics were used for purposes of non-ANS production in this report. The differences between AOGCC and an approach based on the Energy Statistics Sourcebook appears significant only in the years 1977 through 1980. During that period, the AOGCC data appear more reliable because the significant increase in production indicated for 1978 - 1980 by the *U.S. Energy Statistics Sourcebook* cannot be confirmed from other sources. It appears that this increase is a statistical fluke. In other years the two

data series track one another closely. It is unlikely that the differences in other years would have any substantial effect on the results.

Natural Gas. Estimation of natural gas production was simplified because there were fewer data sources. BP/Sohio provided information about gas production in their annual reports. All of Sohio's gas production was on the North Slope, and most of that was produced from Prudhoe Bay for use in production operations. Estimates of natural gas production in column 1 of Table I-5 are based on these data. The *U.S. Energy Statistics Sourcebook* provided data on total Alaska natural gas production. This data series is gross of royalty. Adjusting the *U.S. Energy Statistics Sourcebook* data for a 1/8 royalty and deducting the Sohio-based estimate of ANS production gives an estimate of ANS natural gas working interest production and other Alaska natural gas working interest production. The non-ANS production data computed by this method are reported in column 3 of Table I-5. These estimates were compared with AOGCC data and with data reported by the U.S. Department of Energy. The differences were not significant.

Table I-5
Natural Gas Production Estimates
Net of Royalty
(billions of cubic feet)

Year	*ANS per BP/Sohio*	*All Alaska per Sourcebook*	*Non-ANS Estimate*
1987	80.1	314.8	234.6
1986	70.4	266.7	196.4
1985	55.5	281.2	225.6
1984	41.8	253.0	211.2
1983	39.4	242.1	202.7
1982	35.8	231.3	195.5
1981	33.2	212.2	179.0
1980	48.5	201.8	153.2
1979	25.6	193.2	167.5
1978	20.5	177.7	157.2
1977	8.0	164.4	156.4
1976			145.3
1975			140.2
1974			112.8
1973			114.6
1972			110.0
1971			106.4
1970			97.6
1969			44.5

REVENUE ESTIMATES

Production data multiplied by the price per unit of production gives gross revenues. The question is how to obtain an accurate estimate of the price per barrel of ANS crude oil given that the oil is disposed of at different prices.

There are several estimates of ANS per barrel revenue which must be considered when preparing a total revenue estimate. The approach used here was based primarily on the weighted average of the reported per barrel prices given in the producers' corporate annual reports. Adjustment was made to reflect the transportation and quality differences between Kuparuk and Prudhoe Bay crude. These adjustments were based on information provided by Salomon Brothers and Barclay's.

The first set of data used were the reported per barrel prices for crude oil obtained from the annual reports of Sohio and Arco as well as the *U.S. Energy*

Statistics Sourcebook. These data are presented in columns 1 through 3 respectively of Table I-6. In 1988, Barclay's produced a report on BP which, among other things, detailed revenues at Pump Station 1 for 1985 through 1987. This information is included in column 4 of Table I-6 for comparison.

Estimates given in Table I-6 are based on overall production. It is necessary to disaggregate the data for Prudhoe Bay and for Kuparuk. Given that Arco reported production for both fields, and that its per barrel revenue is, effectively, a weighted average of the prices from these two fields, it is possible to disaggregate the prices if the difference between the two prices is known. The difference between the Prudhoe Bay price and the Kuparuk price would be due to the Kuparuk pipeline tariff and a quality differential between the two fields.

Table I-6
Per Barrel ANS Revenue Data
(Pump Station #1)

Year	*Sohio*	*Arco*	*Sourcebook*	*Barclay's*
1987		$ 10.95	$ 10.84	$ 10.74
1986	$ 7.38	6.43	6.45	6.76
1985	16.92	16.81	16.98	17.83
1984	17.78	17.11	17.91	
1983	17.73	17.31	17.69	
1982	19.97	19.08	19.92	
1981	23.86	22.65	23.23	
1980	16.79	16.95	16.87	
1979	10.72	na	10.57	
1978	4.56	na	5.21	
1977			5.84	
1976			5.02	
1975			4.92	
1974			3.62	
1973			3.23	
1972			3.17	
1971			3.01	
1970			2.90	
1969			na	

According to Barclay's, the Kuparuk pipeline tariff is $1.00 per barrel. Barclay's also estimated that the quality differential is $.50. For the years 1982 and 1983, these estimates are consistent with other sources. Therefore, the

Kuparuk price should be $1.50 per barrel less than the Prudhoe Bay price for 1982 and 1983. In 1984, the new Kuparuk pipeline was brought on stream and a new pipeline tariff established. *Petroleum Intelligence Weekly* (February 1988) and other sources indicate that the price difference between Prudhoe Bay and Kuparuk for 1982 and 1983 should equal $.95 per barrel. In later years the difference declines. The $.95 per barrel differential together with the average per barrel ANS price data were used to construct estimates of the price of crude oil for each field.

The formula for generating these estimates is developed as follows. For 1984 through 1987, Arco's average per barrel price:

$$\frac{P_{Kuparuk} \times (X - \$0.95) + P_{Prudhoe} \times X}{\text{Total Production}}$$

Where P = Production for each field and
X = Price for Prudhoe Bay

Using the formula for 1987, for example, gives the following price estimates:

$$\frac{122.0 \times (X - \$0.95) + 324.9\ X}{446.9} = 10.95$$

X (Prudhoe Bay Price) = 11.21

X - $ 0.95 (Kuparuk Price) = 10.26

Similar estimates are obtained for each other year when Kuparuk was in production.

The amounts reported in Table I-6 and the field prices obtained from the calculations discussed above provide a starting point for determining the final estimate. The per barrel revenue amounts for Arco are widely believed to be greater than for Sohio because a greater portion of Arco's ANS crude is disposed of on the U.S. West Coast and, therefore, avoids the extra cost of the longer marine voyage and trans-Panama shipment.[2] The realizations for Exxon are

[2]See Barclay's de Zoete Wedd (1988), *Petroleum Intelligence Weekly* (Feb. 1, 1988) and Salomon Brothers (1987) for discussions of the differences in dispositions.

also believed to be somewhat greater than for Sohio because Exxon's dispositions occur almost exclusively on the U.S. West Coast. For these reasons, the per barrel data given in Table I-6 probably understate actual realizations. This belief is confirmed by reports by financial analysts such as Salomon Brothers and *Petroleum Intelligence Weekly* who use higher realization prices for Arco's ANS crude.

As a result of all these factors, it appeared that the revenue number needed to be adjusted for the greater proportion of dispositions on the West Coast by producers other than Arco and Sohio. Examination of price differentials for West Coast and Gulf Coast dispositions as well as cost differences suggests that, conservatively, crude oil disposed of on the West Coast should have a value that is approximately $1 per barrel greater on the North Slope than crude oil disposed of elsewhere. Because public data are limited on the precise value of each North Slope company's crude oil, the revenue here is based on the assumption that Arco and Sohio's average disposition prices were as reported in their 10-K's and that other producers obtained an average of $1 more per barrel for their crude. The difference is presumed due to Arco's netback method. The results are more consistent with outside analysts' observations and tie more closely to the State's reported severance tax collections. The Alaska Department of Revenue's report of revenue sources states that severance tax collections totalled $10.2 billion over the period 1969 through 1987. The analysis in this report gives a total severance tax collection of $10.4 billion. The amounts are within a 2.3% margin of error.

Estimates of total revenue for Prudhoe Bay were calculated by using a weighted average price for Prudhoe Bay crude oil. It was assumed that 51% of Prudhoe Bay crude was sold at the price reported by Sohio and 21% at the price calculated for Arco. The remaining 28% of Prudhoe Bay production was

assumed to have been sold at a price that was $1 per barrel greater than that reported by Arco. This approximates the dispositions indicated in other information sources.[3] Data were available to make these calculations for the years 1980 through 1986. In 1987, Sohio was no longer in existence as a separate entity. Its successor, BP America, did not report weighted average ANS crude prices. Dividing BP America's Alaska revenues by its ANS production gives a substitute estimate. For 1978 and 1979, data limitations required use of Sohio's prices. The 1977 average price was based on the *U.S. Energy Statistics Sourcebook* because other data were not available. Comparing all of the different estimates across time, it does not appear that using different base estimates will have a significant effect on the results.

An alternate method for computing Prudhoe Bay revenue is to take Sohio's price per barrel times total production. This should provide a lower overall estimate since Sohio's price realizations are expected to be lower due to their additional transportation costs.[4] The weighted-average revenue estimate used in this report is 1.19% greater over the eleven-year production history. Given that Sohio's prices are expected to be lower, this lends further support to the assertion that the estimate used in this report is reasonably close, and probably somewhat conservative, relative to the actual revenue realized.[5]

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[3]It may be possible to derive more accurate estimates of revenue. Examination of public and private data sources indicated in the list of references suggests that the resulting revenue estimates will be somewhat greater than those reported here.

[4]The per barrel prices reported in the 10-K are different from what one would expect given that Sohio's transportation costs downstream of Valdez are higher than the costs for Arco. The reasons for this discrepancy are unknown. The *Sourcebook* data series and the Barclay's data suggest that the per barrel numbers used here are not consistently the highest nor the lowest. Moreover, the different series are usually within a few cents per barrel of each other. At best, it appears that the data are approximately consistent. It is not possible to obtain an exact estimate of these revenues.

[5]Indeed, on a weighted average basis over the life of ANS production, an estimate using Sohio's price alone should be approximately 7% lower than actual realizations.

Kuparuk revenue was based on the calculated Kuparuk price per barrel times the production estimate for Kuparuk. The Kuparuk price was estimated by taking the weighted average Prudhoe Bay price and deducting $0.95 per barrel for the years 1984 through 1987 and deducting $1.50 per barrel for 1982 and 1983. The results conform to the prices reported in such other sources as *Petroleum Intelligence Weekly*, Salomon Brothers and Barclays de Zoete Wedd (1988).

For 1977 through 1987, price data for non-ANS crude was obtained from DeGolyer and MacNaughton's *20th Century Petroleum Statistics* (1988), which is derived from U.S. Department of Energy statistics. The DeGolyer and MacNaughton data report Tier I and Tier II prices, but do not indicate how much crude was sold under either price level. For lack of any available data, it has been assumed that 1/2 was Tier I and 1/2 was Tier II. Prior to 1977, the composite published Alaska prices are directly available from the *U.S. Energy Sourcebook*. Other Alaska crude oil revenue was based on the AOGCC production data times the prices obtained from DeGolyer and MacNaughton for 1978 through 1987 and from the *Sourcebook* for prior years. There does not appear to be a substantial difference between the estimates obtained under other methods not described here.

A summary of the estimated revenues realized for Prudhoe Bay (including Lisburne), Kuparuk (including Milne Point) and all other Alaska crude oil production is provided in Table I-7. These revenue data are net of royalty. In Section III, an adjustment is made to add royalty to these revenues and then to deduct it as an expense.

Table I-7
Crude Oil Revenue Data
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Other Alaska*	*Total*
1987	$5,695	$ 942	$ 232	$6,869
1986	3,729	575	191	4,495
1985	8,600	1,145	343	10,088
1984	8,842	685	468	9,995
1983	8,823	631	539	9,993
1982	9,842	528	674	11,044
1981	11,665		873	12,538
1980	8,304		284	8,568
1979	5,136		285	5,421
1978	1,587		291	1,878
1977	631		262	893
1976			294	294
1975			329	329
1974			311	311
1973			232	232
1972			208	208
1971			218	218
1970			221	221
1969			189	189

Natural Gas. Natural gas price estimates were available for Arco for the years 1983 through 1987. Sohio presented natural gas price data for 1977 through 1986. These numbers were used to estimate revenues from natural gas on the North Slope for the years when Prudhoe Bay was in production. The numbers are relatively close in amount. A weighted average was used for the years when both Arco and Sohio published these data. The assumption was that the Arco price was attributable to 76% of the production, the Sohio price was attributable to 24%, and the missing data are proportional to these numbers. Separate data were not available for Kuparuk.

Other Alaska gas prices were based on the *U.S. Energy Sourcebook* unit prices and are shown in column 3 of Table I-8. All of the unit price data are given for comparative purposes in Table I-8.

Table I-8
Natural Gas Price Data
(dollars per thousand cubic feet)

Year	*Sohio*	*Arco*	*Sourcebook*
1987		$ 1.14	$ .50
1986	$ 1.06	1.16	.74
1985	1.06	1.28	.73
1984	1.06	1.10	.73
1983	1.97	1.03	.63
1982	2.20		.62
1981	2.08		.73
1980	1.96		.52
1979	2.00		.52
1978	2.02		.40
1977	na		.39
1976			.30
1975			.17
1974			.18
1973			.15
1972			.24
1971			.25
1970			.25
1969			.25

na. Not available.

Multiplying the unit price data from Table I-8 times the production data from Table I-5 gives an estimate of total revenues. The revenue estimates for natural gas are given in Table I-9.

A comparison of Table I-9 with Table I-7 shows that natural gas revenues are not significant in dollar terms for the Alaska North Slope. Hence, the inability to subdivide ANS natural gas revenues between Prudhoe Bay and Kuparuk will not have a meaningful effect on the analysis. By contrast, natural gas revenues are significant for the remainder of Alaska. In some years they account for more than one-half of the reported revenues.

Table I-9
Natural Gas Revenue Data
(millions of dollars)

Year	*Prudhoe*	*Other Alaska*	*Total*
1987	$ 91	$ 117	$ 208
1986	80	145	225
1985	68	165	233
1984	46	154	200
1983	49	128	177
1982	79	121	200
1981	69	131	200
1980	95	80	175
1979	51	87	138
1978	41	63	104
1977		61	61
1976		44	44
1975		24	24
1974		20	20
1973		17	17
1972		26	26
1971		27	27
1970		24	24
1969		11	11

Combining natural gas revenues from Table I-9 with the crude oil revenues reported in Table I-7 yields the total revenue estimates for each major area in Alaska. These estimates are shown in Table I-10. It is these revenue estimates that form the basis for the profit analysis which follows. To obtain profit, it is necessary to deduct expenses incurred to earn the revenues reported in this section. Estimation of these expenses is the next topic in this report.

Table I-10
Producers' Revenue Data
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Other Alaska*	*Total*
1987	$5,786	$ 942	$ 349	$7,077
1986	3,809	575	336	4,720
1985	8,668	1,145	508	10,321
1984	8,888	685	622	10,195
1983	8,872	631	667	10,170
1982	9,921	528	795	11,244
1981	11,734		1,004	12,738
1980	8,399		364	8,763
1979	5,187		372	5,559
1978	1,628		354	1,982
1977	631		323	923
1976			338	338
1975			353	353
1974			331	331
1973			249	249
1972			234	234
1971			245	245
1970			245	245
1969			200	200
Totals	**$73,523**	**$4,507**	**$ 7,889**	**$85,918**

II. PRODUCTION EXPENSES

Production expenses fall into nine major categories: depreciation, severance taxes, operating expenses, windfall profit taxes, exploration costs, overhead, interest, state and federal income taxes. Federal income taxes, severance taxes and depreciation are larger in amount relative to the other expenses. Overhead, interest and state income taxes are relatively low. The ability to estimate each of these cost categories accurately varies. The most difficult to estimate are overhead and interest. Fortunately, these are relatively small in amount. Severance taxes and depreciation are relatively easy to estimate. Federal income tax estimates depend on several assumptions. The effect of the assumptions on reported profit is tested later in this technical discussion.

Each of the expense categories and the method of determining the expense is discussed in this section.

DEPRECIATION

Depreciation represents a pro rata share of the initial cost of the investment in drilling, lease acquisition, production facilities and other similar costs over the periods or products that benefit from those investments. Depreciation expense also includes a provision for future dismantlement of the facilities and for restoration of the affected sites. Unlike most other expenses, depreciation does not require a current outlay of cash; it is a current accounting for a prior or an anticipated outlay.

There were three company sources for estimates of depreciation on the Alaska North Slope: (1) BP America's 1987 annual report, (2) Sohio's annual reports from 1977 to 1986, and (3) Arco's 10-K's. In addition, the public data reported here were compared to Alaska property tax information. The results

suggest that use of private data would tend to support the findings reported here. The data and the limitations of the data from each source is addressed in turn.

In its 1987 Annual Report, BP America provided an estimate of its 1986 and 1987 Alaska depreciation which, when divided by its Alaska production, gave a per barrel depreciation amount. However, when BP purchased the outstanding shares of Sohio, it paid a premium over the book value of the assets of Sohio. BP added this premium to its asset base and depreciated this premium along with the cost of the assets. As a result, BP America's Alaska depreciation reflects not only a portion of the costs actually incurred in Alaska, but an additional amount which reflects payments to Sohio shareholders. This latter amount was not part of the cost to acquire oil producing facilities in Alaska. Rather, it reflects BP's purchase of shares from Sohio stockholders. The amortization of this cost is not a cost of operating BP America's Alaska properties, but rather is a transfer payment.[6] As a result, BP America's depreciation numbers overstate amortization of the costs incurred in Alaska and would understate profit.

In its annual reports for 1981 to 1986, Sohio provided a per barrel total production cost amount with and without depreciation. Subtracting the reported production costs without depreciation from production costs with depreciation yields the depreciation per barrel for Alaska production.

Certain of Arco's 10-K reports stated its depreciation charge for Alaska production activities as a total dollar amount. Dividing these amounts by each year's Alaska production volumes gave an estimate of Arco's per barrel Alaska depreciation. This is referred to below as the Arco production-based estimate.

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[6]See Barclay's de Zoete Wedd 1988 report on British Petroleum, p. 4, for the reasons why BP was willing to pay a premium for the remaining outstanding shares of Sohio.

Arco's 10-K also gave its Alaska producing property plant and equipment. When these amounts were divided by Arco's proved reserves each year, an alternate estimate of per barrel depreciation was obtained. This is referred to as Arco's reserve-based estimate. These are composite estimates for all Alaska production, so that adjustments are necessary to obtain estimates for crude oil for each significant field. The alternate estimates are given in Table II-1.

Table II-1
Unit Depreciation Data
($ per equivalent barrel)

			Arco	
Year	*BP America*	*Sohio*	*Production*	*Reserves*
1987	$ 2.83		$ 2.21	2.49
1986	2.26	$ 2.15	2.56	2.62
1985		1.51	2.47	2.47
1984		1.34	1.65	2.17
1983		1.14	1.81	1.92
1982		1.11	1.56	1.73
1981		1.07	1.30	1.23
1980		1.05		.96
1979		.90		
1978		.84		

These depreciation numbers reflect a weighted average of both Kuparuk and Prudhoe Bay. It is generally recognized that Prudhoe Bay depreciation is lower than Kuparuk. For example, Barclay's de Zoete Wedd (1988) reported Prudhoe Bay depreciation in 1987 at $2.00 per barrel and Kuparuk at $3.80. If Barclay's estimates are correct, and assuming that Arco's depreciation is approximately equal to Sohio's, Arco's 1987 weighted average depreciation per barrel should equal:

$$\frac{\$3.80 \times 122 + \$2.00 \times 340}{122 + 340} = \$2.475$$

where 122 and 340 represent Arco's daily average production from Kuparuk and Prudhoe Bay (plus Lisburne) fields as shown in Table I-1, above. Based on this calculation, $2.475 should be the weighted average per barrel depreciation shown in Arco's annual reports. However, Table II-1 suggests that Arco's

weighted average depreciation is about $2.21 to $2.49. Averaging these two estimates gives $2.35, which is probably the best estimate of Arco's North Slope production depreciation available from Arco's financial statements.[7] This suggests that the $3.80/$2.00 estimates of depreciation for each field are too high.[8]

Given that Sohio's weighted average depreciation number for 1986 was $2.15 and that was an average of the lower-depreciation Prudhoe Bay and the higher-depreciation Kuparuk, it is likely that Arco's 1986 Prudhoe Bay depreciation was no more than $2.15 per barrel. This amount is slightly higher than the Barclay's estimate. Presumably, Sohio's depreciation for Prudhoe Bay alone would be lower than $2.15, so the basis used here could result in an understatement of profit. Assuming Prudhoe Bay depreciation is $2.15 per barrel, then we can solve for Kuparuk using the equation:

$$462 \times \$2.35 = 122\ X + 340 \times \$2.15$$

$$X = \underline{\$2.91}$$

This equation states that Arco's weighted average depreciation per barrel ($2.35) should equal the Kuparuk production times the unknown depreciation for Kuparuk plus the estimated $2.15 per barrel depreciation for Prudhoe Bay. The result suggests a $2.91 per barrel depreciation estimate for Kuparuk.

If Kuparuk depreciation is $2.91 per barrel, then Prudhoe Bay depreciation per barrel for the years when Kuparuk and Prudhoe Bay were both in production is as given in Table II-2, below. The numbers in Table II-2 should be compared

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[7]Salomon Brother's financial analysis of Arco's operations states that Arco's Alaska depreciation is lower than Sohio's. This is the opposite of the data from the financial statements. Public data are not available which would enable us to resolve this disparity. The data in this report are based on the higher estimate from the 10-K's, even though this may overstate depreciation and understate profit.

[8]Salomon Brothers Inc. reported an estimate of $1.60 per barrel 1985 depreciation for Prudhoe Bay and $1.75 for 1987. They reported 1985 Kuparuk depreciation at $3.75 per barrel and 1986 at $3.55 This confirms the suggestion that Barclay's Prudhoe Bay depreciation is too high. The effects of alternate depreciation estimates on the reported profit for each field are discussed in Section III.

with other sources. For example, *Petroleum Intelligence Weekly* estimated Prudhoe Bay depreciation at $2.25 in 1987, $2.17 in 1986 and $1.53 in 1985. Salomon Brothers estimated Arco's Prudhoe Bay depreciation at $1.80 in 1987, $1.75 in 1986 and $1.60 in 1985.

Table II-2
Estimated Prudhoe Bay Depreciation
($ per barrel)

Year	*Amount*
1987	$ 2.15
1986	2.25
1985	1.75
1984	1.44
1983	1.29
1982	1.19
1981	1.05
1980	.98
1979	.78
1978	.73
1977	.38

These data are higher than Sohio's reported weighted average depreciation charges, but appear more reasonable than the Barclay's numbers. The numbers are lower than Arco's weighted average, which is consistent with expectations. Moreover, they are higher than the Salomon Brothers numbers. In brief, depreciation based on these numbers is a "middle-of-the-road" approximation.

Since depreciation expense for each field was computed using a weighted average based on working interest production from each field, total depreciation for both fields taken together will be approximately the same. That is, Prudhoe Bay might be assigned too much depreciation as a result of this process, but that will be offset by lower depreciation charges to Kuparuk. The "bottom-line" effect of this is discussed in Section III.

Prior to the start of Kuparuk production, depreciation estimation is simplified. For each of the years 1978 through 1981, a weighted average of the reported per-barrel depreciation numbers for Arco and Sohio was used. There was one

estimate of Sohio's depreciation each year. There were three Arco estimates in 1981, two in 1980, and one for each of 1978 and 1979. It was assumed that Sohio's depreciation number was applicable to 72% of field production and Arco's to 28%. This ratio reflects Sohio's 53% of overall production to the total production for which depreciation data are available (53% Sohio; 21% Arco). It is assumed that the missing data equals a weighted average of the available data.

For 1977, the only depreciation estimate was that based on Arco's production. Lacking any alternate estimate, it was used for that year. Since production in that year was relatively low, it is unlikely that changing the estimate by a reasonable amount will have a substantial effect on the results.

Per-barrel depreciation estimates for Prudhoe Bay are reported in Table II-2, above. Kuparuk depreciation is estimated at $2.91 per barrel. Although this estimate of Kuparuk depreciation is lower than that reported by some of the financial analysts discussed above, Barclay's reports that Kuparuk had an original estimated 1.9 billion barrels of recoverable crude oil. Given estimated investment in Kuparuk of $4.3 billion a depreciation charge of $2.28 per barrel (i.e. $4.3 billion/1.9 billion) is indicated. The $2.91 per barrel estimate may result in understatement of Kuparuk profit.

Total depreciation for each field is the product of crude oil production times the per-barrel amount. For non-ANS production, gas is converted to equivalent barrels using the standard 6 mcf of gas = 1 bbl. crude oil energy content ratio. It was assumed that non-ANS depreciation per barrel was 1/3 of ANS per-barrel depreciation. Use of this assumption yields total depreciation amounts that are relatively close to what one would expect given non-ANS investment and production levels. Total depreciation amounts for each year are presented in

Table II-3. These data represent the depreciation expense numbers included in the production profit estimates in Section III.

Table II-3
Total Depreciation Expense
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Total Alaska*
1987	$1,074	$ 263	$ 1,394
1986	1,110	253	1,418
1985	873	204	1,123
1984	710	117	866
1983	632	112	779
1982	581	83	698
1981	510		540
1980	476		504
1979	320		345
1978	254		280
1977	38		53
1976			16
1975			16
1974			16
1973			16
1972			16
1971			16
1970			17
1969			14
Totals	**$6,579**	**$1,032**	**$8,127**

SEVERANCE TAXES

Severance taxes are levied on the gross value of production which accrues to producers (i.e., working interest production). In Alaska, prior to 1981 severance taxes were 12.25% of production. Subsequent to 1981, the amount was revised to 15% of production (except that it remained 12.25% for the first five years of a field's commercial production). An economic limit factor is applied to production from each field which causes the actual severance tax to be lower than the statutory rate. The 1981 Legislation suspended the application of the economic limit factor at Prudhoe Bay until mid-1987. Prior to 1981, it was estimated that the severance tax on Prudhoe Bay production averaged approximately 11%. From 1982 to mid-1987, the Prudhoe Bay severance tax was estimated at 15%. From the middle of 1987 on, the Prudhoe Bay severance

tax was estimated at 12.25%.[9] Severance taxes on Kuparuk production have been estimated to range between an effective rate of 8% and 9%. A 9% rate was used for this study for Kuparuk. Recent severance tax returns suggest that by 1987 the economic limit factor reduced severance taxes on non-ANS Alaska production to close to zero. The effect of changes in the non-ANS depreciation amounts does not have a meaningful impact on reported profit.

To determine profit from oil producing activities, it is necessary to deduct severance taxes from revenues. Severance taxes are not reported separately for Alaska production in the annual reports of the producers. Therefore, the effective severance tax rates were applied to revenues reported here to obtain estimated severance tax expense for 1977 through 1987 for each field. For prior years, Alaska Department of Revenue reported collections were used as the severance tax expense. This amount corresponds closely to the expense that would be estimated if the statutory rate were applied to the production values.

The Alaska Department of Revenue reports severance tax collections from oil production in Alaska. Over time, severance tax expense as deducted to compute profit should tend to equal severance tax collections by the state. There is one significant wrinkle in this comparison. In 1975, the State levied a reserves tax which was allowed as a later credit against severance tax due later. The amount of the reserves tax was $493.7 million. This tax was considered a credit against severance tax payments due. Thus, when comparing severance tax collections to recorded expense, it is necessary to include this $493.7 million as a collection.

The estimated severance taxes for Prudhoe Bay, Kuparuk, non-ANS, and the total expense are summarized in Table II-4. These amounts are compared to

[9]Effective severance tax rates are based on *Petroleum Intelligence Weekly* (February 1, 1988).

severance tax collections, including the reserves tax, as reported by the Department of Revenue. The results of the comparison indicate that the estimates are quite close to collections as they should be over time.[10]

Table II-4
Severance Taxes
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Non-ANS Alaska*	*Total Expense*	*Revenue Collections#*	
1987	$ 787	$ 85	$ 0	$ 871	$ 649	
1986	571	52	0	623	1,108	
1985	1,300	103	0	1,403	1,389	
1984	1,333	62	0	1,395	1,393	
1983	1,331	57	0	1,388	1,494	
1982	1,488	48	0	1,535	1,572	
1981	1,291		0	1,291	1,170	
1980	924		0	924	507	*
1979	622		0	622	174	*
1978	195		0	195	108	*
1977	76		0	76	295	*
1976			28	28	251	*
1975			27	27	27	
1974			22	22	22	
1973			11	11	11	
1972			11	11	11	
1971			11	11	11	
1970			8	8	8	
1969			6	6	6	
Totals	**$9,918**	**$ 406**	**$ 124**	**$10,441**	**$10,206**	

* Reflects differences due to reserves tax included in 1976 and 1977 collections but credited against later liabilities.

#Alaska revenue data are reported on a fiscal year basis. Company expense data are reported on a calendar year basis. This difference can affect some of the comparisons.

It is likely that some of non-ANS production during 1977 through 1987 incurred a severance tax liability. However, the amounts are too low to affect the analysis. Total severance tax expense reported in the analysis of profit is $10,441 million. Total actual tax collections amount to $10,206 million. The difference is 2.3%. It is possible that this difference is due to overstatement of effective severance tax rates or the delay between the time when severance

[10]Expense should exceed collections because collections are reported when received by the Alaska Department of Revenue and expenses are reported when the related production occurs.

taxes are due and when they are collected. The difference may also be due to the revenue estimates used. In any event, it is unlikely that the differences will have a significant effect on the results of the analysis.

OPERATING EXPENSES

Operating expenses are those costs which are necessary to continue production from an oil or gas field. They include well workover costs, fuel, maintenance and similar items. Information on these costs for the years 1980 to 1986 is available in the corporate annual reports of Sohio. Financial analyst reports include estimates of operating expenses as determined through meetings with company officials as well as based on their evaluation of operating costs.

For this report, operating expenses reported by Sohio were analyzed first. Sohio reports operating expenses combined with production taxes, windfall profit taxes and its net profits interest payments to BP America. It was necessary to separate production and windfall profit taxes from Sohio's reported data since these taxes are reported on another line in this income statement. The net profits interest payments to BP America would be an expense to Sohio, but a revenue item to BP America. This is a transfer payment between two field owners. The transfer payment needs to be cancelled when estimating income for the total project.

Net profits interest payments were reported in the notes to Sohio's financial statements. Severance taxes were estimated using the effective severance tax rates times the reported revenues. Windfall profit taxes were reported on a per-barrel basis in Arco's annual reports. These estimates were used to obtain an estimate of Sohio's windfall profit taxes. As described below, the resulting estimated windfall profit tax expense was lower than the reported windfall profit

tax collections by the U.S. Internal Revenue Service. As a result, the estimates of operating expenses may be higher than actual.

Table II-5 summarizes Sohio's reported production expenses, the computed estimates of severance and windfall profit taxes and the net profits interest payments to BP. The last column of Table II-5 is estimated operating expenses for the ANS based on the Sohio data.

Table II-5
Sohio's Operating Expenses
(millions of dollars)

Year	*Production Costs*	*Severance and Windfall Profit Taxes*	*Net Profits Interest*	*Operating Expenses*
1986	$ 727	$ 271	$ 44	$ 412
1985	1,216	680	108	428
1984	1,113	649	36	428
1983	1,021	699	0	322
1982	1,685	1,199	92	394
1981	2,550	2,030	153	367
1980	1,181	862	145	174

The resulting operating expenses were analyzed to see if they were mathematically related to revenues or production. It appeared that the operating expenses were not related to revenues and were only weakly related to production levels. Regression analysis, a statistical technique used to compare two sets of data (such as operating expenses and revenues), found no relationship between the numbers. This leads to the suggestion that these expenses are fixed costs. Further study of the expenses showed that they increased when the Prudhoe Bay waterflood project was installed and when the gas reinjection recovery program was installed. This further supports the suggestion that these costs are fixed with respect to annual production and revenues.

The best available overall estimate of production costs, then, is based on the relationship of Sohio's interest in Prudhoe Bay field. Thus, total ANS operating

expenses are estimated as equal to Sohio's operating expenses divided by Sohio's interest in Prudhoe Bay field. These expenses were subdivided between Prudhoe Bay and Kuparuk based on relative revenues from each field. Admittedly, this may misstate the precise relationship since operating expenses are not a function of annual revenues. However, there are no other direct operating expense data sources available publicly from the companies. The results of the calculations used for this estimate are presented in Table II-6.

Table II-6
Estimated Total Operating Expenses
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Total*
1987	$ 890	$ 218	$1,137
1986	662	152	845
1985	685	160	867
1984	726	120	850
1983	541	96	659
1982	651	92	771
1981	692		722
1980	328		335
1979	307		318
1978	261		289
1977	76		95
1976			28
1975			27
1974			23
1973			16
1972			14
1971			15
1970			15
1969			12
Totals	**$5,820**	**$ 837**	**$7,038**

Production costs for 1987 and for 1977 through 1979 were estimated based on an approximate relationship between revenues and these costs. Given the lack of other company data on these costs, reliance on revenues is one way available to approximate the operating expenses for the missing years.[11] There is a significant increase in the estimated operating expenses between 1980 and

[11] Although production costs are not related to revenues mathematically, there are relatively few options available for estimating costs attributable to each field. Since production costs are low relative to revenues, it is probable that the effect on reported profit is minor.

1981. This is probably due to the differences in windfall profit taxes included in the Arco data used to derive the windfall profit tax number and the Sohio data used as a basis for operating costs before deducting windfall profit taxes. As noted in the section on windfall profit taxes, Arco-based windfall profit tax numbers result in an expense that is lower than when using the I.R.S. collection data. It is possible that the use of Arco windfall profit tax numbers in the operating cost computation overstates operating costs with a resulting understatement of profit.

Other analysts such as *Petroleum Intelligence Weekly* and Salomon Brothers estimate that operating costs amount to an average of $1 per barrel of ANS crude oil production. *International Petroleum Finance* estimates operating costs at $.91 per barrel. The results here average $1.08 per barrel. Therefore, even though the expense number is calculated based on a number of assumptions, the outcome of the calculations follows closely, and conservatively, the costs indicated by other observers.

For 1984 to 1986, the operating costs per barrel for the Prudhoe Bay field should be greater than in prior years due to installation of the waterflood program. Since the method used here is based on a combined operating cost for Prudhoe Bay and for Kuparuk, it is probable that the costs for Kuparuk are somewhat overstated during 1984 to 1986 and the costs for Prudhoe Bay are understated by a like amount. The results could be a shifting of profit from Kuparuk to Prudhoe Bay in the amount of up to $100 million over the six-year period of Kuparuk operations. It does not appear that this is a significant amount relative to the profit for each field.

Production costs also include property taxes. Company data do not show the property taxes in Alaska separate from other production costs. Therefore, it is necessary to use alternate sources. Barclay's estimated Prudhoe Bay property

taxes at $.50 per barrel and Kuparuk at $.30. Non-ANS was estimated at $.25. The results were compared to Department of Revenue data and are comparable.

Production costs, net of property taxes, are obtained by deducting the property tax collections from the production costs reported in Table II6. Table II-7 shows the Alaska and municipal property taxes for the areas covered in this report. Table II-8 gives the production expenses net of property taxes.

Table II-7
Property Taxes
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Total*
1987	$ 150	$ 44	$ 197
1986	148	41	192
1985	150	35	188
1984	148	20	172
1983	147	17	159
1982	147	14	165
1981	146		151
1980	146		152
1979	123		130
1978	104		113
1977	30		31
1976			12
1975			13
1974			13
1973			13
1972			13
1971			13
1970			14
1969			13
Totals	**$1,438**	**$ 171**	**$1,754**

Table II-8
Operating Expenses
Net of Property Tax
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Total*
1987	$ 740	$ 174	$ 940
1986	514	110	653
1985	535	125	679
1984	578	100	678
1983	394	77	500
1982	504	78	606
1981	546		571
1980	182		183
1979	184		188
1978	157		176
1977	46		63
1976			14
1975			15
1974			10
1973			3
1972			1
1971			2
1970			1
1969			1
Totals	**$4,382**	**$ 666**	**$5,284**

WINDFALL PROFIT TAXES

The Crude Oil Windfall Profit Tax Act of 1980 levied a tax on the "windfall profit from a barrel of crude oil." The windfall profit was defined as the difference between the base price (essentially the price before oil price decontrol) and the selling price. The tax was in effect until 1988 although crude oil price declines rendered the effective amount of the tax at zero for years after 1985. In addition, ANS fields outside the Sadlerochit reservoir were exempt from the tax.

There are two primary sources of data concerning the windfall profit tax on Alaska crude oil production. The first is Arco's reported windfall profit tax per barrel of Alaska crude oil production. The second is the U.S. Internal Revenue Service *Statistics of Income Bulletin* which reported the aggregate windfall profit tax collections on ANS crude oil as a separate line item. Arco's per barrel windfall profit tax statistics are reproduced in Table II-9.

Table II-9
Windfall Profit Tax per Barrel
Arco Annual Report Data
($ per barrel)

Year	*Amount*
1985	$ .05
1984	.11
1983	.42
1982	1.59
1981	4.80
1980	2.03

To obtain the total windfall profit tax attributable to Prudhoe Bay, the Arco per barrel numbers were multiplied by field production. In addition, the Arco per barrel numbers were multiplied by the ratio of the all-company average field price to the Arco reported field price. This latter adjustment is designed to reflect the fact that other producers sold their ANS crude for a price that was different than that reported by Arco.[12]

Estimates of non-ANS crude windfall profit taxes were constructed by estimating the windfall profit on this crude and multiplying by a composite windfall profit tax rate. It was assumed that 1/2 of the crude was taxed at the 70% rate for old oil and 1/2 was taxed at a 30% rate. The base price was estimated as equal to the 1979 Cook Inlet price reported by DeGolyer and MacNaughton, adjusted for inflation for 1980 through 1985. The per barrel numbers obtained by this method were as follows in Table II-10:

Table II-10
Non-ANS Windfall Profit Tax
($ per barrel)

1985	$ 0.00
1984	1.42
1983	2.58
1982	5.46
1981	9.42
1980	1.91

[12]See Production Revenue section for further detail on this issue.

These per barrel amounts were multiplied by reported non-ANS production from column 1 of Table I-4 to obtain total windfall profit taxes for other Alaska production.

Estimated windfall profit taxes for Prudhoe Bay field and for all of Alaska are reproduced in column 1 of Table II-11. The computed amounts were compared to the reported collections from the *Statistics of Income Bulletins* shown in column 2 of Table II-11.

Table II-11
Windfall Profit Tax Expense
(millions of dollars)

Year	*Estimated for Prudhoe Bay*	*U.S. Internal Revenue Service ANS Collections*	*All Alaska*
1985	$ 26	$ 39	$ 39
1984	57	211	235
1983	215	426	475
1982	827	1,375	1,491
1981	2,487	3,089	3,314
1980	1,006	797	861
Totals	**$4,618**	**$5,937**	**$6,415**

Table II-11 shows that the U.S. Internal Revenue Service reported higher ANS windfall profit tax collections than those obtained using the Arco data adjusted for estimated price differences among the producers. The possibilities for these discrepancies are two-fold. First, the Arco-based revenue estimates may be too low as noted in the section on Production Revenue. Second, Arco may have had available to it adjustments to the windfall profit tax arising from the net income limitation provisions of the tax act. This part of the Act stated that windfall profit should not exceed 90% of the net income per barrel based on statutory computational rules. The net income limitation provision would not have been captured in the Internal Revenue Service data.

Column 3 of Table II-11 is the sum of the U.S. Internal Revenue Service reported ANS windfall profit tax collections plus the windfall profit taxes estimated for non-ANS production.

The difference between the two data sources is $1.3 billion. In the interest of providing a more conservative estimate of profit from Alaska oil operations, the higher figures of the Internal Revenue Service are used as the basis for Alaska windfall profit taxes.

EXPLORATION EXPENSES

Exploration expenses represent the costs incurred in finding new oil and gas deposits as well as certain costs incurred in defining an existing deposit. Data were not available to assign exploration costs to specific fields during this period. Moreover, there are few data series which overlap, so comparisons across estimates are not possible.

The U.S. Bureau of the Census provides data on Alaska oil industry exploration expenditures for 1978 to 1982 through its *Current Industrial Surveys*. The American Petroleum Institute *Joint Association Survey* provided the 1984 estimate of exploration expenditures. Both of these sources separated offshore expenditures from onshore. Presumably, the offshore expenditures were in Federal waters. These are the best sources of exploration expenditure data available, but they only were available for the years indicated.

For years prior to 1978, it was estimated that exploration expenditures totalled $25 million per year. This amount was compared to exploration drilling data obtained from the Alaska Oil and Gas Conservation Commission. The AOGCC provides numbers of wells drilled. The estimated exploration expenditures in 1969 to 1977 provided here would have financed the levels of drilling indicated by the AOGCC.

For 1983 and for 1985 to 1986 it was assumed that exploration costs equalled double the amount that Sohio reported as Alaska exploration expenses. It was assumed that 1987 exploration equaled 1986, although this is a conservative estimate. Comparing the amounts provided to the AOGCC drilling statistics indicates that these amounts would have easily financed the exploration activities reported by the AOGCC. Table II-12 shows the estimates of exploration expenses included in determining Alaska oil industry profit.

Table II-12
Exploration Expenses
(millions of dollars)

Year	*Amount*	
1987	$ 288	
1986	288	
1985	514	
1984	258	
1983	818	
1982	647	
1981	419	
1980	176	
1979	174	
1978	274	
1969 - 1977	25	annually
Total	**$ 4,081**	

OVERHEAD AND INTEREST EXPENSES

Overhead expenses are those that by their very nature cannot be traced directly to a particular activity. These costs are common to all activities in the company. The generally accepted accounting procedure is to allocate these costs to each activity that benefits from the cost on some basis that reflects either benefits received or cause-and-effect.[13] Frequently, as here, allocations are made in more than one step. Here, the first step is to allocate company overhead to Alaska operations. The second step is to allocate overhead to each field in Alaska.

[13]See, for example, E. Deakin and M. Maher, *Cost Accounting 2nd. ed.* (1987), pp. 96 - 101. This topic has been addressed in detail by the former U.S. Cost Accounting Standards Board. The Cost Accounting Standards Board methodology is followed as closely as possible based on available data.

Sohio is the only producing company operating in Alaska from which sufficient data were available to make an allocation of overhead to Alaska activities based on assets and on revenues. In its corporate annual reports, Sohio presents segment information which, among other things, states Sohio's "Corporate and other" expenses. This line item was used as a proxy for the overhead cost.

To allocate this overhead, a two-factor formula was used. The two factors are value of crude production in Alaska to all company sales, and oil and gas property in Alaska to all Sohio property plant and equipment other than property plant and equipment related to the company's "corporate and other" activities.

Sohio data were available for 1977 through 1986. In 1987, BP America succeeded Sohio as a result of BP's buyout of the minority interest in Sohio. This purchase was accounted for by adding the extra funds paid to Sohio shareholders in excess of the book value of the assets received being attributed to the book values of the Sohio assets acquired. In effect, BP increased the accounting-based cost of its Alaska assets by a proportional amount of its payment to Sohio shareholders. This payment did not increase the actual costs expended in Alaska. Rather, it represented a transfer from BP to the former Sohio shareholders. As a result, the 1987 data necessary to perform the allocation would be affected by the amount of this transfer payment. Since this payment would result in attributing costs disproportionately to the actual costs incurred in Alaska, 1987 overhead was estimated by taking 1986 overhead and adding 4.5% for inflation.

A third factor commonly used in these formulas is payroll. These data are not publicly available. If the payroll data were available, the resulting allocation would be lower than that reported here because Sohio has proportionately fewer

employees in Alaska than the average of its assets and sales. The allocation method here used the value of Alaska production relative to total company sales. This ratio includes sales that have not been made to third parties. If third-party sales only were included, the allocation of overhead to Alaska operations would be lower than that reported here.

The result of this calculation is the first step in the allocation of Sohio overhead to all Alaska operations. Dividing the resulting allocation by Sohio's proportionate share in the Prudhoe Bay field yields an estimate of the total overhead attributable to Alaska by all producers. This is based on the assumption that other producers have a similar overhead structure to Sohio's and that the Prudhoe Bay ratio is a reasonable basis for estimating overall overhead. More complex allocations which include estimates of Kuparuk production have insignificant effects on the reported allocation.

To allocate to Prudhoe Bay and Kuparuk, overhead allocated to Alaska was subdivided in proportion to the revenues reported for Prudhoe Bay and Kuparuk. The original data used for the allocations and the results are give in Table II-13.

Table II-13
Overhead Allocations
(millions of dollars)

	----*Sohio Total*----			----*Allocated to*----		
Year	*Overhead*	*Assets*	*Revenues*	*Prudhoe*	*Kuparuk*	*Total*
1987				$ 109	$ 20	$ 139
1986	$ 234	$ 14,006	$ 10,022	105	20	133
1985	270	16,468	13,818	139	25	173
1984	160	16,421	12,251	89	11	106
1983	172	15,181	12,067	93	11	111
1982	132	14,347	13,529	77	8	91
1981	86	13,096	14,140	51		55
1980	24	8,506	11,346	15		16
1979	4	7,927	11,346	2		2
1978	-1	8,107	8,222	-		-1
1977	6	7,578	3,523	2		3
Totals				**$ 681**	**$ 94**	**$ 830**

This allocation assumes that overhead is proportional between Kuparuk and Prudhoe Bay. Such an assumption would usually be consistent with general accounting practices.

For lack of any data on the subject it was assumed that overhead for non-ANS activities was proportional to the revenues for those activities.[14] To obtain total overhead attributable to Alaska, the Prudhoe Bay and Kuparuk overhead were increased proportionately by the ratio of total Alaska production revenues to Prudhoe Bay and Kuparuk revenues. For years prior to 1977, overhead was estimated as a percentage of revenues based on the revenue percentage over the years 1977 through 1987. Overhead in each of the years prior to 1977 averaged less than $150,000.

Although these allocations are subjective and complex, they suggest that the overhead amounts are not so highly significant as to have a material effect on estimated profit. Aggregate overhead over the period of ANS production is estimated at $830 million. This is on the order of 2% of total profit. Even major changes in this number will have a minor effect on total profit.

To test one aspect of a source of variation in the overhead allocations, a composite estimate based on Arco's reported corporate and other expense using a two-factor formula was calculated. For most of the period at issue, Arco did not report its Alaska assets separately in its annual reports. These data were obtained from its SEC Form 10-K, Schedule VI.[15] Arco's total assets were obtained from its annual report segment disclosures. Total revenues were

[14]Non-ANS overhead accounts for approximately 10% of the total overhead reported here. Similarly, non-ANS production is a small portion of total production in Alaska. In addition, as noted for the ANS, overhead is a small portion of overall costs and revenues. The effect of misstatements of the overhead will not have a significant impact on this analysis.

[15]In 1980 and 1981, Arco reported Alaska producing property plant and equipment in its annual report. The amounts were $1,087.7 million and $1,451.1 million respectively. The company reported Alaska property in its 10-K schedule for the same years as $1,789.2 million and $2,273.5 million respectively. The differences are substantial which suggests that the two series may not be comparable.

obtained from the annual report, but Alaska revenues had to be estimated by multiplying reported per barrel prices by reported Alaska production. Assuming that Arco accounted for 21% of Alaska activities and Sohio 51%, weighting the two overhead estimates gave a composite amount of $1,233 million over the period 1977 - 1987.

A second test of overhead variation is to construct an estimate using a payroll factor in the allocation formula. If Alaska payroll is assumed equal to 5% of each company's payroll, estimated overhead attributable to Alaska is $357 million over the period 1977 through 1987. The overhead amount included in the reported profit estimate is midway between these two numbers. Over the same period, the overhead estimate in this report averages 16.1¢ per barrel.

Interest expense was handled in a similar manner. Again, interest costs were based on data from Sohio's corporate annual reports because that was the only readily available source.[16]

Net interest expense for Sohio was reported in Sohio's segment disclosures in its annual reports or on the face of its income statements for 1977 through 1986. Since interest costs are related to the investment in assets rather than to sales, allocations of interest to Alaska were based on the ratio of property plant and equipment in Alaska to total company property plant and equipment. The result of this apportionment was the estimated interest expense attributable to Alaska.

The second step of the interest allocation required producing an estimate of interest attributable to Alaska by all producers. This was based on dividing

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[16]Arco reports some of the data required for this calculation, but the data are reported in different places which may not be consistent as noted in the overhead allocation discussion. It appears that Arco and Exxon experienced a lower overall rate of interest than Sohio. Therefore, Arco's and Exxon's interest costs should be lower than Sohio's. The amounts involved are small relative to the total reported income.

Sohio's assumed Alaska interest expense by its proportional interest in the Prudhoe Bay field. As with the overhead allocation, the results were not particularly sensitive to further refinement. The estimated total Alaska interest expense was subdivided between properties based on depreciation expense. This is more appropriate than sales because depreciation is considered more closely related to assets than to sales. Sohio's total company interest and assets and the resulting estimated interest allocations to the Kuparuk and Prudhoe Bay fields are given in Table II-14.

Table II-14
Interest Allocations
(millions of dollars)

	—Sohio Data—		—Allocated to—		
Year	*Net Interest*	*Assets*	*Prudhoe*	*Kuparuk*	*Total*
1987			$ 146	$ 32	$ 192
1986	$ 242	$14,006	139	32	183
1985	299	16,468	141	33	183
1984	242	16,421	119	20	148
1983	254	15,181	119	21	150
1982	300	14,347	139	20	171
1981	46	13,096	17		18
1980	22	8,306	10		11
1979	357	7,927	156		167
1978	458	8,107	203		247
1977	246	7,578	117		177
Totals			**$ 1,306**	**$ 159**	**$ 1,675**

The "net interest" column is Sohio's total corporate interest expense net of interest income. The "assets" column is Sohio's total assets less those designated as assets devoted to "corporate" (i.e., overhead) activities. Sohio's portion of net interest expense was allocated to Alaska based on the formula apportionment. The result was "factored up" to reflect an approximation of the total interest expense incurred by all Alaska producers.

For years prior to 1977, average estimated interest expense allocable to Alaska was less than $200,000 per year.

STATE INCOME TAXES

The State of Alaska levies an income tax on the income derived from oil and gas production operations in the State. During the 1977 - 1981 period, this tax was based on a direct measure of the income earned in the state. The statutory tax rate was 9.4% until 1981 when it rose to 11% for that year. Subsequent to 1981, the tax was levied using an indirect method referred to as modified formula apportionment. The latter tax is based not on a direct computation of the revenues accrued less expenses attributable to Alaska, but rather is based on a measure of the proportion of certain Alaska activities to overall company activities. The computed proportion is multiplied by overall company income to derive an estimate of income attributable to Alaska. *Petroleum Intelligence Weekly* suggests that the effective tax rate under this methodology is approximately 3%. As shown in Table II-15, a comparison of tax expense computed at the 3% rate is reasonably close to tax collections.

Individual company data on the Alaska income tax liability is not publicly available. The estimate of Alaska income tax is obtained by multiplying computed Alaska income by the effective tax rates for the periods at issue. The results are reported in Table II-15.

Table II-15
State Income Taxes
(millions of dollars)

Year	*Prudhoe Bay*	*Kuparuk*	*Total**	*Reported Collections**
1987	$ 83	$ 10	$ 92	$ 128
1986	37	2	37	134
1985	165	19	182	169
1984	171	11	189	265
1983	172	10	174	236
1982	168	8	175	669
1981	669		702	860
1980	550		556	548
1979	367		369	233
1978	67		66	33
1977	30		49	36
Prior to 1977			150	150
Totals	**$2,479**	**$ 60**	**$ 2,741**	**3,461**

***Alaska revenue data are reported on a fiscal year basis. Company expense data are reported on a calendar year basis. This difference can affect some of the comparisons. The collections include TAPS income taxes which are estimated to total $900 million.**

The estimates differ from collections in part because of differences in the timing of when receipts are received by the State and when the expenses are reported on the income statements. Over the period 1969 through 1987, reported collections totalled $3.5 billion. The income statements here indicate total expenses of $3.6 billion, including the $.9 billion for TAPS. The differences are within a 5% margin of error.

FEDERAL INCOME TAXES

The U.S. government levies taxes on corporate income at statutory rates that ranged from 34% to 48% over the period 1969 through 1987. Under Federal rules, taxable income is net of state income taxes. Certain credits and deductions are allowed in the Federal taxing scheme which reduce the effective tax rates. It has been estimated that during the 1969 through 1980 period, the effective tax rates for oil companies averaged on the order of 29% (*Oil and Gas Journal*, (September 16, 1985), p. 76). This estimate was used for the 1969 to 1976 period.

For Alaska oil income after the start-up of Prudhoe Bay, this estimated Federal rate is unlikely to reflect actual Federal taxes. The taxes currently payable divided by estimated taxable income gives a number referred to as the effective tax rate. One important factor which results in a difference between statutory rates and effective rates is the Federal tax rules designed to provide an incentive to new investment like TAPS and tangible equipment on the North Slope. For example, an investment tax credit equal to 10% of the cost of tangible equipment was in effect during most of this period. This credit would serve to reduce Federal taxable income. That the effective tax rates were lower for Alaska producers may be seen by examining effective tax rates for these producers during the 1977 through 1986 period.

Effective tax rates for the major ANS producers were obtained from their corporate annual reports. The effective rate is the current Federal tax payments divided by reported net income. This information, as available, is reproduced in Table II-16.

Table II-16
Effective Federal Tax Rates

Year	*Arco*	*Sohio*	*Exxon*
1986	-55.49	-52.44	na
1985	40.94	41.53	23.18
1984	33.22	26.56	29.16
1983	19.68	31.60	33.81
1982	17.08	39.06	25.38
1981	16.23	36.41	23.93
1980	16.16	39.37	33.35
1979	12.30	11.22	35.29
1978	6.34	1.34	38.28
1977	na	10.19	na

It is widely presumed that Sohio's financial data was driven almost exclusively by its Alaska operations.[17] For this reason, Sohio's effective tax rates would tend to reflect the actual tax liability for Alaska oil operations during

[17] A review of Sohio's corporate annual reports from 1978 through 1986 indicate that over 90% of its profit arose from its Alaska activities.

the 1977 - 1986 period. Many oil companies, including the ANS producers, wrote-off substantial amounts from losing operations. The significant write-offs taken in 1986 resulted in negative Federal taxes for Alaska oil producers who accounted for most Alaska activities. Therefore, a zero effective Federal rate was used in 1986.

Although financial accounting standards for a company require that recognition be given currently to the possibility that some income tax benefits may need to be paid back to the government in the future, it appears from a review of the effective tax rates in Table II-16 that in this industry, the payback period continues to be deferred indefinitely. Use of current effective tax rates for the purposes of this study reflects better the economic consequences to the company of these investments than the use of statutory rates. In future years as tax benefits decline, these producers may be required to pay taxes in excess of the statutory rate.

With the merger of Sohio into BP, the assumption that Sohio's activities reflect Alaska closely would no longer hold. In addition, beginning in 1987, the tax law reduced many of the incentives for new investment. As a result, actual taxes are probably closer to the statutory rate. Therefore, the 34% statutory rate was used for 1987.

The Federal income tax expense used to estimate Alaska oil production income is reproduced in Table II-17.

These data were obtained by multiplying revenues from Table I-10 less expenses (covered in Tables II-3 (depreciation), II4 (severance taxes), II-6 (operating expenses), II-11 (windfall profit tax), II-12 (exploration expenses), II-13 (allocated overhead), II-14 (allocated interest), and II-15 (state income taxes)) by the related effective tax rates.

Over the entire period 1969 through 1987, Federal income taxes as shown in this report are 32.0% of estimated taxable income. This is higher than the 29% effective rates in the *Oil and Gas Journal* study. The net effect is that the estimates in this report are conservative and may tend to understate actual income.

Table II-17
Federal Income Taxes
(millions of dollars)

Year	*Prudhoe*	*Kuparuk*	*Total*
1987	$ 917	$ 105	$1,007
1986	0	0	0
1985	2,212	247	2,424
1984	1,469	91	1,627
1983	1,756	102	1,774
1982	2,125	104	2,212
1981	1,971		2,067
1980	2,086		2,110
1979	383		399
1978	9		8
1977	32		52
1976			63
1975			68
1974			66
1973			47
1972			44
1971			47
1970			47
1969			37
Totals	**$ 12,960**	**$ 651**	**$ 14,099**

III. PRODUCTION PROFIT

The result of all of the calculations in Sections I and II is to generate a statement which indicates the profit earned from oil and gas production in Alaska. This part of the report is divided into three parts: (1) profit for Prudhoe Bay, (2) Kuparuk and (3) all production in Alaska.

Table III-1
Profit from Prudhoe Bay Production
(millions of dollars)

1983 - 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Production Revenue	$6,573	$4,327	$9,847	$10,097	$10,079
Expenses:					
Depreciation	1,074	1,110	873	710	632
Operating Expenses	740	514	535	578	394
Overhead	109	104	139	89	93
Interest	146	139	141	119	119
Royalty	787	518	1,179	1,209	1,207
Severance Taxes	787	571	1,300	1,333	1,331
Property Taxes	150	148	150	148	147
State Income Tax	83	37	165	171	172
Windfall Profit Tax			39	211	426
Federal Income Tax	917	0	2,212	1,469	1,756
Profit	**$1,780**	**$1,186**	**$3,114**	**$4,061**	**$3,801**
Profit per barrel	**$3.55**	**$2.40**	**$6.25**	**$8.26**	**$7.75**

1977 - 1982:

	1982	*1981*	*1980*	*1979*	*1978*	*1977*
Revenue	$11,271	$13,330	$9,541	$5,892	$1,849	$ 717
Expenses:						
Depreciation	581	510	476	320	254	38
Operating Expenses	504	546	182	184	157	46
Overhead	77	51	15	2	0	2
Interest	139	17	10	156	203	117
Royalty	1,350	1,596	1,143	706	221	86
Severance Taxes	1,488	1,291	924	622	195	76
Property Taxes	147	146	146	123	104	30
State Income Tax	168	669	550	367	67	30
Windfall Profit Taxes	1,375	3,089	797			
Federal Income Tax	2,125	1,971	2,086	383	9	32
Profit	**$3,315**	**$3,443**	**$3,212**	**$3,030**	**$ 639**	**$ 260**
Profit per barrel	**$6.78**	**$7.09**	**$6.61**	**$7.39**	**$1.84**	**$2.58**

Total profit over the eleven year production history of the Prudhoe Bay field are estimated as shown in Table III-2. The profit statements in Table III-1 are based on the producers' interest in the production. This is standard accounting practice, but the methodology excludes royalty interests which are important for the State of Alaska. Royalty interests have been estimated as equal to 1/7 of the producers' working interest less a gathering charge of $.63 per barrel. The state royalty is added to the producers' revenue to obtain revenues before royalty as shown in Table III-2.

Table III-2
Total Prudhoe Bay Production Profit
1977 through 1987
(billions of dollars)

Production Revenue	$ 83.5
Less Expenses:	
Depreciation	6.6
Operating Expenses	4.4
Overhead	.7
Interest	1.3
Royalty	10.0
Severance Taxes	9.9
Property Taxes	1.4
State Income Taxes	2.5
Windfall Profit Tax	5.9
Federal Income Taxes	13.0
Profit	**$ 27.8 Billion**
Profit per barrel: $5.81	

The estimate of profit from the Kuparuk field is also based on the combination of the data from Sections I and II of this report and is reproduced in Table III-3.

Table III-3
Annual Kuparuk Production Profit
1982 through 1987
(billions of dollars)

	1987	*1986*	*1985*	*1984*	*1983*	*1982*
Production Revenue	$1,055	$ 644	$1,282	$ 767	$ 707	$ 591
Expenses:						
Depreciation	263	254	204	117	112	83
Operating Expenses	174	110	125	100	77	78
Overhead	20	20	25	11	11	7
Interest	32	32	33	20	21	20
Royalty	113	69	137	82	76	63
Severance Taxes	85	52	103	62	57	48
Property Taxes	44	41	35	20	17	14
State Income Taxes	10	2	19	11	10	8
Federal Income Taxes	105	0	247	91	102	104
Profit	**$ 207**	**$ 65**	**$ 351**	**$ 254**	**$ 222**	**$ 165**
Profit per barrel:	**$2.31**	**$.79**	**$5.04**	**$6.28**	**$6.37**	**$5.80**

Combining the data for the six years of Kuparuk production gives overall Kuparuk profit as shown in Table III-4. State royalty was computed for Kuparuk in the same manner as for Prudhoe Bay.

Table III-4
Total Kuparuk Production Profit
1982 through 1987
(billions of dollars)

Production Revenue	$ 5.1
Less Expenses:	
Depreciation	1.0
Operating Expenses	.7
Overhead	.1
Interest	.2
Royalty	.5
Severance Taxes	.4
Property Taxes	.2
State Income Taxes	.1
Federal Income Taxes	.6
Profit	**$ 1.3 Billion**
Profit per barrel:	**$3.66**

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Oil industry profit from production activities in Alaska are shown on a year-by-year basis in Table III-5.

Table III-5
Total Alaska Production Profit
1969 through 1987
(millions of dollars)

1983 - 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Production Revenue	$8,046	$5,367	$11,735	$11,592	$11,564
Depreciation	1,394	1,418	1,123	866	779
Operating Expenses	940	653	679	678	500
Exploration Expenses	288	288	514	258	818
Overhead	139	133	173	106	111
Interest	192	183	183	148	150
Royalty	970	647	1,414	1,397	1,393
Severance Taxes	871	623	1,403	1,395	1,388
Property Taxes	197	192	188	172	159
State Income Tax	92	37	182	189	174
Windfall Profit Tax			39	235	475
Federal Income Tax	1,007	0	2,424	1,627	1774
Profit	**$1,956**	**$1,192**	**$3,413**	**$4,521**	**$3,841**
Profit per barrel:	**$3.18**	**$2.01**	**$5.83**	**$8.15**	**$6.97**

1978 - 1982:

	1982	*1981*	*1980*	*1979*	*1978*
Revenue	$12,785	$14,484	$9,961	$6,321	$2,254
Expenses:					
Depreciation	698	540	504	345	280
Operating Expenses	506	571	183	188	176
Exploration Expenses	647	419	176	174	274
Overhead	91	55	16	2	a
Interest	171	18	10	167	247
Royalty	1,641	1,745	1,198	762	272
Severance Taxes	1,536	1,291	923	622	195
Property Taxes	165	151	152	130	113
State Income Tax	175	702	556	369	66
Windfall Profit Tax	1,491	3,314	861		
Federal Income Tax	2,212	2,067	2,110	399	8
Profit	**$3,452**	**$3,610**	**$3,270**	**$3,161**	**$ 623**
Profit per barrel:	**$6.33**	**$6.96**	**$6.21**	**$6.97**	**$1.56**

Table III-5 (continued)
Total Alaska Production Profit
1969 through 1987
(millions of dollars)

1973 - 1977:

	1977	*1976*	*1975*	*1974*	*1973*
Revenue	$ 1,054	$ 380	$ 396	$ 372	$ 377
Expenses:					
Depreciation	53	16	16	16	16
Operating Expenses	64	16	15	10	3
Exploration Expenses	25	25	25	25	25
Overhead	3	a	a	a	a
Interest	177	1	1	a	a
Royalty	131	46	48	45	45
Severance Taxes	76	28	27	15	15
Property Taxes	31	12	13	13	13
State Income Tax	49	23	24	24	24
Federal Income Tax	52	85	91	89	89
Profit	**$ 394**	**$ 133**	**$ 142**	**$ 140**	**$ 140**
Profit per barrel:	**$2.49**	**$1.94**	**$1.94**	**$1.89**	**$1.33**

1969 - 1972:

	1972	*1971*	*1970*	*1969*
Revenue	$ 283	$ 279	$ 278	$ 227
Expenses:				
Depreciation	16	16	17	14
Operating Expenses	3	2	1	1
Exploration Expenses	25	25	25	25
Overhead	a	a	a	a
Interest	a	a	a	a
Royalty	34	34	34	27
Severance Taxes	12	11	8	6
Property Taxes	13	10	14	13
State Income Tax	17	17	17	13
Federal Income Tax	63	63	64	50
Profit	**$ 99**	**$ 98**	**$ 100**	**$ 79**
Profit per barrel:	**$1.23**	**$1.22**	**$1.17**	**$1.04**

a. Less than $1 million

Total industry profit from production for the years 1969 through 1987 are shown in Table III-6, below. State royalty was computed in the same manner as for the Prudhoe Bay field.

Table III-6
Total Alaska Production Profit
1969 through 1987
(billions of dollars)

Production Revenue	$ 97.6
Less Expenses:	
Depreciation	8.1
Operating Expenses	5.3
Exploration Expenses	4.1
Overhead	.8
Interest	1.7
Royalty	11.8
Severance Taxes	10.4
Property Taxes	1.8
State Income Taxes	2.7
Windfall Profit Tax	6.4
Federal Income Taxes	14.3
Profit	**$ 30.2 Billion**

Profit per barrel: $4.96

As stated throughout the report, this is the best estimate available of Alaska oil industry production profit. There are, however, some questions concerning the profit numbers which are necessary to understand the possible range within which the actual profit number might fall.

Revenue Issues. As noted in Section I, revenues have been estimated based on a weighted average of all producers. The resulting revenue amount is 1.19% greater than that which would be obtained using Sohio's data alone. The question is what effect would using estimated realizations have on the reported profit numbers. Over the production history of the Alaska North Slope, approximately 50% of ANS crude was sold on the U.S. West Coast where net realizations are approximately $1.40 greater than sales on the Gulf Coast

(Barclay's, 1988, p. 3). West Coast sales have been made almost entirely by producers other than Sohio. Under this assumption, revenues would increase by $1.8 billion with a resulting increase in after-tax profit of $ 1.0 billion. This was determined by taking the estimated average realization of $17.68 for Sohio and adding the extra value of West Coast sales for 50% of production. This step indicates that this approach would yield an additional average realization of $.37 per barrel over all 4.8 billion barrels of working interest production.

A second issue related to revenues is the 1986 Arco severance tax settlement. Arco paid $243 million in this settlement. Assuming that Arco's annual report data were based on its original pricing methodology, and that the severance tax rate was 15%, this would imply that the Arco revenue data which was used in this analysis understated revenues by $1.6 billion. After allowing for 15% severance tax, 3% Alaska income tax and 34% effective Federal income tax, the net profit effect is a $.8 billion increase. Part of the settlement may have been interest, but it is also likely that the settlement rate was less than 15%. If the net effect of these two factors is to offset each other, as expected, the profit increase suggested here is supported.

An additional revenue issue is the 1988 $171 million settlement on income taxes by Arco. The extent to which this settlement affected revenues and expenses is not public information. Presumably there would be an addition to the relevant items in the Arco income statements if those statements had been prepared on the basis which Arco used for its Alaska income tax. To the extent that the financial statements relied on here are the same as that used in the tax return, profit would be understated.

It should be noted with respect to both of these settlements with Arco that they are not final settlements. The outcome of ongoing litigation and its effect on profit estimates cannot be ascertained at this time.

Depreciation Expense. For the Prudhoe Bay field, the per barrel depreciation estimates used amounted to $2.15 in 1987, $2.25 in 1986 and $1.75 in 1985. *Petroleum Intelligence Weekly* (February 1, 1988) estimates Prudhoe Bay depreciation at $2.25, $2.17 and $1.53 for those years, respectively. On average for those years, this suggests that the depreciation estimates reported here may be too high by approximately $.07 per barrel. If this is the case, depreciation for Prudhoe Bay may be overstated by $336 million over the eleven-year production history. After a 3% Alaska income tax and a 34% estimated Federal income tax, this would imply that profit is understated by $217 million.

As noted in Section II, other sources have estimated Kuparuk depreciation at up to $3.80 per barrel, which is $.89 per barrel more than the average estimate included in this report. If these other estimates are correct, this would imply that Kuparuk depreciation needs to be increased by $307 million. This would decrease Kuparuk after-tax profit by approximately $198 million.

Operating Costs. This report indicates that operating costs, including property taxes were $1.08 per barrel over the life of Prudhoe Bay field. *International Petroleum Finance* estimates these costs at $.91 per barrel. *Petroleum Intelligence Weekly* estimates the costs at approximately $1.03 per barrel. This suggests that the estimate in this report may be between $.05 and $.17 per barrel greater than other estimates. At $.05 per barrel, after-tax profit would increase by $153 million and at $.17 the effect would be a $522 million increase in profit.

Windfall Profit Taxes. Based on Arco's estimates, total Prudhoe Bay windfall profit tax would equal $4.6 billion. Using the U.S. Internal Revenue Service data, windfall profit tax collections for the ANS totalled $5.9 billion. The latter number was used even though the net income limitation provisions of the tax act may have served to reduce the expense. On the other hand, the data reported by Arco would have been before any settlement of audit differences. The indicated range for windfall profit tax expense is, therefore, $1.3 billion before tax and an estimated $ .8 billion after tax, subject to possible adjustments as a result of settlements. Profit reported here may, therefore, be too low by up to $ .8 billion.

Overhead. As noted in Section II, overhead included in this report was estimated at $ .8 billion for the period of Prudhoe Bay production. Had a weighted average based on Arco's and Sohio's data been used in a two-factor allocation, overhead would have increased by $ .4 billion, which translates into an approximately $ .3 billion after tax decrease in profit compared to the amounts reported here.

On the other hand, using a three-factor formula for estimating overhead based on the Arco/Sohio composite results in overhead of $ .4 billion, which is $ .4 billion less than the amount used in this report. This would imply that profit had been understated by $.3 billion after tax.

Interest Expense. Analysis of the interest costs of Arco and Sohio suggests that the differences attributable to this factor amount to less than $50 million. Since adequate data are not available and since the amount is low relative to the total profit, this analysis has not been pursued further.

Federal Income Taxes. The estimated effective tax rate for Alaska oil production for this report is 32.1%. This is equal to the $14.2 billion in income taxes divided by pre-tax income of $44.3 billion. If the Federal income taxes had

been based on the estimated 29% effective tax rate for the industry, income taxes would have decreased by $1.0 billion, with a corresponding decrease in reported profit to producers.

Using the effective tax rates for the primary Alaska oil producers given in Table II-16, the unweighted average current effective tax rate is 26.3% for 1978 to 1985. The rate is negative in 1986. Had the Federal income taxes in this report been based on the average effective rate for the producers over this eight-year period, the amount would have been $11.5 billion, which is $2.7 billion less than that included in this report. This amount would pass directly through as an increase in profit of $2.7 billion.

Summary. The questions raised in this section cannot be resolved without additional data. For this reason, the effect of the different assumptions on profit are summarized so that one can adjust the results according to their own interpretation of the data. The effect of each assumption is given in Table III-7.

Table III-7
Effect of Assumptions on Profit
(billions of dollars)

Item	Increase in Profit	Decrease in Profit
Use of West Coast prices	$ 1.0	
Arco severance tax settlement	.8	
Outside Prudhoe depreciation estimates	.2	
Outside Kuparuk depreciation estimates		$ .3
Use of *Petroleum Intelligence Weekly* operating costs	.2	
Use of *Petroleum Finance* operating costs	.5	
Use of Arco windfall profit tax data	.8	
Composite two-factor overhead		.3
Three-factor overhead	.3	
39% Federal tax rate	1.0	
Composite company rate	2.7	
Total increases	$ 7.5	
Total decreases		$ 0.6

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A review of these alternative estimates indicates that the profit reported here is within a reasonable range of actual profit and is probably on the conservative side.

IV. TAPS PROFIT

GENERAL METHODOLOGY

A review of data sources on the Trans Alaska Pipeline System indicates that the annual reports filed by Sohio Pipeline Company reflect quite closely a .3334 interest in pipeline revenues and expenses. This occurs in part because nearly 100% of Sohio Pipeline Company's activities are related to TAPS. Effective tax rates were used to estimate Federal income taxes for the reasons stated above. Sohio Pipeline Company reports were available for 1978 through 1987. Due to the short production period in 1977, the pipeline probably broke even or had such a small profit or loss that it would not affect the results.[18] For 1985 through 1987, Sohio Pipeline Company provided a separate statement of TAPS revenues, costs and profit. Most of the costs were incurred jointly through Alyeska and, thus, would be shared by all pipeline owners *pro rata*. The remaining expenses appear quite close to those indicated by other observers as appropriate for TAPS in total. Operating data in Table IV-1 represent the information reported in the Sohio Pipeline Company annual reports divided by .3334. Alaska income tax estimates were based on an effective rate of 9.4% during 1978 to 1981 and an effective rate of 3% thereafter. The Federal rate was estimated in the same manner as for production.

The amounts reported in Table IV-1 were compared to other sources. Property taxes were compared to the Alaska Department of Revenue's *Revenue Sources* reference. The amounts are quite similar.

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[18] 1977 throughput would have been approximately 28% of 1978 throughput. This would imply revenues of $690 million. Operating and administrative expenses are estimated at one-half of 1978. Depreciation would probably have been proportional to throughput. Property taxes would have been the same as in 1978. Interest expense would be approximately $236 million for an estimated before-tax loss of $20 million, which is not significant relative to other revenues and expenses.

Table IV-1
TAPS Profit Projected from Sohio Pipeline Co.
(millions of dollars)

1983 through 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Revenues	$2,765	$3,080	$3,578	$3,926	$3,899
Expenses:					
Operating and Administrative	255	343	247	387	483
Depreciation	351	364	363	507	558
Property Taxes	147	164	168	171	165
Interest	150	440	411	570	579
Alaska Income Taxes	56	53	72	69	63
Federal Income Taxes	633	0	993	609	669
Profit	**$1,174**	**$1,716**	**$1,325**	**$1,614**	**$1,382**

1978 to 1982:

	1982	*1981*	*1980*	*1979*	*1978*
Revenues	$3,896	$3,605	$3,554	$2,963	$2,394
Expenses:					
Operating and Administrative	498	474	435	330	381
Depreciation	549	507	591	495	417
Property Taxes	168	171	168	174	174
Interest	648	681	720	771	846
Alaska Income Taxes	61	167	154	112	54
Federal Income Taxes	795	645	645	102	9
Profit	**$1,178**	**$ 961**	**$ 842**	**$ 980**	**$ 513**

Arco reported TAPS depreciation in its 10-K's for 1981 through 1987. The amounts were factored to reflect 100% depreciation for TAPS as shown in Table IV-2. The amounts for depreciation obtained in this manner were 38% lower than the amounts obtained from the Sohio analysis. Over the life of TAPS, the depreciation estimate is based on a weighted average of the Sohio and Arco depreciation data. The weighted average is based on Arco's 22% interest in TAPS and Sohio's 33% interest. The method assumes that the missing data are equivalent to the weighted average of the data that are available. The resulting depreciation expense number is $700 million lower than it would have been using the Sohio data alone.

Table IV-2
Arco-based TAPS Depreciation Estimates
(millions of dollars)

Year	*Arco 10-K*	*Estimated Total*
1987	$ 60.0	$ 272.3
1986	60.0	272.3
1985	60.0	272.3
1984	60.0	272.3
1983	58.9	267.7
1982	57.3	260.5
1981	80.4	365.5

Reducing the depreciation estimate increases taxable profit and income taxes. Alaska income tax was increased by $34 million based over the life of TAPS. Federal income tax was increased by $204 million over the same period. Apportioning the depreciation adjustment over the life of TAPS to date results in the schedule of TAPS profit shown in Table IV-3.

Table IV-3
TAPS Profit
(millions of dollars)

1983 through 1987:

	1987	*1986*	*1985*	*1984*	*1983*
Revenues	$2,765	$3,080	$3,578	$3,926	$3,899
Expenses:					
Operating and Administrative	255	343	247	387	483
Depreciation	299	310	309	431	475
Property Taxes	147	164	168	171	165
Interest	150	440	411	570	579
Alaska Income Taxes	57	55	73	71	66
Federal Income Taxes	631	0	984	610	674
Net Profit	**$1,226**	**$1,768**	**$1,386**	**$1,686**	**$1,457**
Profit per barrel:	**$2.08**	**$3.07**	**$2.44**	**$3.17**	**$2.77**

Table IV-3 (continued)
TAPS Profit
(millions of dollars)

1978 to 1982:	*1982*	*1981*	*1980*	*1979*	*1978*
Revenues	$3,896	$3,605	$3,554	$2,963	$2,394
Expenses:					
Operating and Administrative	498	474	435	330	381
Depreciation	467	431	503	421	355
Property Taxes	168	171	168	174	174
Interest	648	681	720	771	846
Alaska Income Taxes	63	203	162	119	60
Federal Income Taxes	802	599	617	129	8
Net Profit	**$1,250**	**$1,046**	**$ 949**	**$1,019**	**$ 570**
Profit per barrel	**$2.42**	**$2.15**	**$1.95**	**$2.49**	**$1.64**

Estimates of revenues and expenses included in this report were compared to information provided in connection with the TAPS settlement methodology. It appears from comparison with the data available to us that the revenue estimates here are approximately $400 million greater than indicated by the TAPS settlement data. The alternate estimates of operating and administrative expenses for 1978 to 1984 are within approximately $50 million. The estimates of Federal income taxes are lower in this report because the other sources used the statutory rate for tax expense purposes. Since the long-run relationship between before-tax profit and tax expense shows that the statutory rate overstates actual tax outlays, the effective rate is used in this income computations.

TAPS settlement data from Deloitte Haskins and Sells indicate that operating expenses average $.58 per barrel. The estimate in this report is $.64 per barrel. The Deloitte Haskins and Sells data indicate depreciation of $.59 per barrel. Before the Arco adjustment, the estimate in this report was $.80 per barrel. After the Arco adjustment, the estimate here is $.68 per barrel. The Federal income

tax allowance indicated from the Deloitte Haskins and Sells (DH&S) analysis of TAPS costs is $.75 per barrel. The estimate in this report is $.86 per barrel. The expense estimates used in the profit estimates reported here are consistently higher than those indicated by DH&S. Thus, profit reported here is lower than would be indicated using the DH&S data.

Barclay's de Zoete Wedd (1988) estimate cash costs of $.65 per barrel for TAPS. This would include operating and administrative costs plus property taxes. The estimate of these costs in this report is $.92 per barrel. Barclay's de Zoete Wedd estimates depreciation at $.80 per barrel, which is the same as used here after accounting for the Arco adjustment.

Petroleum Intelligence Weekly estimated that pipeline profit was $2.18 per barrel in 1985, $.64 per barrel in 1986 and $.53 per barrel in 1987. The estimates used in this report are $.75, $.94 and $.60 for each of those years respectively. Over the three-year period, they estimate a total profit of $6.1 billion. The profit reported here is $4.2 billion before the depreciation adjustment.

For the years 1983 through 1987, Arco reported the net income after tax of Arco Pipeline Inc., which holds Arco's interest in TAPS. Assuming that all of the income of Arco Pipeline is related to TAPS (which appears to be the case),[19] TAPS income for each of these years projected from the Arco Pipeline data would be $1.3 billion, $1.3 billion, $1.5 billion, $1.4 billion and $1.4 billion for a total over the five-year period of $6.9 billion. The estimate based on Sohio data is $7.2 billion. A weighted average estimate of profit based on 21.4% Arco ownership and 33.34% Sohio ownership gives a profit estimate for the four-year period for which both data series are available of $7.1 billion, which is within 2% of the estimate reported here.

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[19] TAPS income so completely dwarfs income from other pipelines that substantially all the income is attributable to TAPS.

Each of the sources which has looked into TAPS revenues, profit and costs has developed varying profit estimates. It appears that the adjusted profit indicated in Table IV-3 represent a "middle-of-the-road" estimate. Over the period of TAPS operation, estimated total profit is as follows in Table IV-4:

Table IV-4
Total Estimated TAPS Profit
(billions of dollars)

Revenues	$ 33.7
Expenses:	
Depreciation	4.0
Operating and Administrative	3.8
Interest	5.8
Property Taxes	1.7
Alaska Income Tax	.9
Federal Income Tax	5.1
Profit	**$12.4 Billion**

V. OTHER INFORMATION

Downstream Profit. The profit data which have been developed in this report do not include any profits earned beyond Valdez. It has been reported elsewhere that producers may earn between $.25 and $1.00 per barrel in profits on tanker and trans-Panama canal shipping operations. These profits serve to reduce the net cost of Alaska oil landed on the U.S. West and Gulf Coasts.

There is some evidence that U.S. West Coast prices are lower because of Alaska oil production than they would be without Alaska production. This occurs because prices of crude oil on the U.S. West Coast tend to average $1.00 per barrel less than prices on the U.S. Gulf Coast. If imported crude oil had to be substituted for Alaska crude on the U.S. West Coast, prices there would be at least equal to prices on the U.S. Gulf Coast. Indeed, a substantial argument can be made that prices on the U.S. West Coast would be greater than Gulf Coast prices because shipping costs for imported crude oil would be greater f.o.b. the West Coast than the Gulf Coast. Thus, there can be additional refining profits from Alaska crude which have not been included in this analysis.

These downstream profit issues are beyond the scope of this project. They do indicate, however, that the producer's economic benefits of Alaska oil production extend beyond the profit obtained within the boundaries of the State of Alaska.

Shares. The revenues from Alaska oil and gas production and transportation go to pay for costs incurred in those activities, state taxes and royalties, federal taxes and profit to the producers. The shares of revenues received by the producers, state and federal governments are itemized in Table V-1.

Table V-1
Shares
(billions of dollars)

	Producers	*State*	*Federal Government*
Royalties		$ 11.8	
Severance taxes		10.4	
Property taxes*		3.5	
Income taxes		3.6	$ 19.4
Windfall profit taxes			6.4
Production profit	$ 30.2		
TAPS profit	12.4		
Totals	**$ 42.6**	**$ 29.3**	**$ 25.8**
Percentages	**43.6%**	**30.0%**	**26.4%**

* Includes local property taxes.

Profit as an Hourly Rate. Forty-two billion dollars is a significant number and one that is difficult to put in perspective. Relating the number to an hourly rate over 10.5 years of production (91,980 hours at 24 hours per day, 365 days per year) gives a rate of $463,144 profit received after tax.

Return on Investment. It is also possible to relate profit received by Alaska producers to the investment made in TAPS and production activities. This analysis is referred to as return on investment. The analysis compares cash flows to investments.

Investment in TAPS was an estimated $9,400 million in 1975 to 1977. The initial investment in Prudhoe Bay was an estimated $3,700 million.[20] Over time, this investment was increased as a result of infield drilling, the waterflood project and the gas miscible fluid project. The estimated total accumulated investment in Prudhoe Bay is $8,700 million. As of 1987, the investment in Kuparuk is estimated to total $4.3 billion. This includes a portion of the waterflood project which was being installed in 1987 - 1988. The investment is Milne Point was

[20]Some of these expenditures were made as early as 1969. However, more precise dates are not available for these outlays. If the $900 million in 1969 lease bonuses is accounted for as a 1969 outlay, the rate of return (assuming no debt) drops to 28.1%. Alternatively, this analysis placed no value on the ANS properties for cash flows received after 1987. Assuming that these cash flows are worth $10 billion, the rate of return (assuming no debt) increases to 31.1%. Similary adjustments would be required to the returns assuming debt.

$575 million. Lisburne had an estimated investment cost of $1,000 million and Endicott an estimated project cost of $1,000 million. A summary of the estimated investments in the ANS is given in Table V-2. These amounts are based on estimates in Arco's and Sohio's annual reports and compared to other estimates.

Table V-2
Investment Schedule
(millions of dollars)

Year	*Prudhoe*	*TAPS*	*Other ANS*	*Total*
1987	$ 720		$1,900	$2,620
1986			1,000	1,000
1985	720			720
1984			570	570
1983	2,000			2,000
1982				0
1981	1,100		3,400	4,500
1980	250			250
1979	250			250
1978				0
1977	1,850	4,700		6,550
1976	1,850	4,700		6,550

Assuming 100% equity investment, cash returns on these investments would be equal to the reported profit numbers plus depreciation and interest. This is based on the fact that if one invested 100% equity, one would incur no interest costs. Column 1 of Table V-3 shows the production profit from Table III-5. Column 2 of Table V-3 is the depreciation on production. Column 3 is the sum of profit plus depreciation. Column 4 is the interest costs. Adding the profit plus depreciation from column 3 and the interest from column 4 gives the "all-equity cash flows" from production shown in column 5 of Table V-3.

The same process was followed for TAPS which yields the data in the fifth column of Table V-4.

Table V-3
Production Cash Flows
(millions of dollars)

Year	Profit	Deprec-iation	Profit plus Deprec.	Interest	Profit, Deprec. & Interest	Explor-ation	Profit, Deprec. & Explor.
1987	$1,956	$1,394	$3,350	$192	$3,542	$288	3,638
1986	1,192	1,418	2,610	183	2,793	288	2,898
1985	3,413	1,123	4,536	183	4,719	514	5,050
1984	4,498	866	5,364	148	5,512	258	5,622
1983	3,841	779	4,620	150	4,770	818	5,438
1982	3,452	698	4,150	171	4,321	647	4,797
1981	3,610	540	4,150	18	4,168	419	4,569
1980	3,250	504	3,754	10	3,764	176	3,930
1979	3,161	345	3,506	167	3,673	174	3,680
1978	623	280	903	248	1,151	274	1,177
1977	425	53	478	177	655	25	503

Table V-4
TAPS Cash Flows
(millions of dollars)

Year	Profit	Depreciation	Profit & Deprec.	Interest	Profit, Deprec. & Interest
1987	$1,226	$ 299	$1,525	$ 150	$1,675
1986	1,768	310	2,078	440	2,518
1985	1,386	309	1,695	411	2,106
1984	1,686	431	2,117	570	2,687
1983	1,457	475	1,932	579	2,511
1982	1,250	467	1,717	648	2,365
1981	1,046	431	1,477	681	2,158
1980	949	503	1,452	720	2,172
1979	1,019	421	1,440	771	2,211
1978	570	355	925	846	1,771

The total all-equity cash flows are shown in Table V-5. The first column is the investment flow from Table V-2. The second column is the production cash flow plus interest and depreciation from Table V-3. The third column is the TAPS cash flow plus interest and depreciation from Table V-4. The last column is the sum of the production and TAPS cash flows minus the investment flows.

Table V-5
All-equity Cash Flows
(millions of dollars)

		---Cash Flows---Net		
Year	*Investment*	*Production*	*TAPS*	*Cash Flow*
1987	$2,620	$3,542	$1,675	$2,597
1986	1,000	2,793	2,518	4,311
1985	720	4,719	2,106	6,105
1984	570	5,512	2,687	7,629
1983	2,000	4,770	2,511	5,281
1982	0	4,321	2,365	6,686
1981	4,500	4,168	2,158	1,826
1980	250	3,764	2,172	5,686
1979	250	3,673	2,211	5,634
1978	0	1,151	1,771	2,922
1977	6,550	655	0	-5,895
1976	6,550	0	0	-6,550

The equivalent rate of return earned on this stream of cash flows after tax is 29.7%.

According to the Sohio annual report of 1978, approximately 75% of the investment was financed with debt. In this case, the investments in 1976 and 1977 as shown in Table V-2 would be $1,638 million net each year. This is 25% of the investment outflows in those years. The remainder would have been financed with debt. Interest expense would be incurred on this debt and the debt would have to be repaid. The cash flow data from columns 3 of Tables V-3 and V-4 is the profit plus depreciation. These cash flows include a deduction for interest expense. These cash flow numbers are shown in column 2 and 3 of Table V-6. Assuming that all of the cash flows were used to pay off the debt as quickly as possible, the loan repayment would have consumed all of the cash flows in 1978 through 1979 and all but $2,131 million in 1980. The net cash flows in each year are shown in column 4 of Table V-6.

Table V-6
Cash Flows with 25% Equity
(millions of dollars)

		----Cash Flow----		Net Cash
	Investment	*Production*	*TAPS*	*Flow*
1987	$2,620	$3,350	$1,525	$2,255
1986	1,000	2,610	2,078	3,688
1985	720	4,536	1,695	5,511
1984	570	5,364	2,117	6,911
1983	2,000	4,620	1,932	4,552
1982	0	4,150	1,717	5,867
1981	4,500	4,150	1,477	1,127
1980	250	3,754	1,452	2,131
1979	250	3,506	1,440	0
1978	0	903	925	0
1977	6,550	478	0	-1,160
1976	6,550	0	0	-1,637

The rate of return implied from the stream of cash flows shown in Table V-6 is 43.7%.

REINVESTMENT RATIOS

A question of interest is the extent to which cash flows from Alaska oil and gas operations are reinvested in Alaska. Reinvestment is defined as investments in ANS projects subsequent to the initial investment in Prudhoe Bay and TAPS plus exploration costs. These amounts are shown in column 1 of Table V-7. The relevant cash flows for reinvestment analysis are the production cash flows plus exploration costs and the cash flows from TAPS. Interest costs are deducted in determining these cash flows. The production amounts are shown in the last column of Table V-3. The production cash flows are shown in column 2 of Table V-7 and the TAPS cash flows are shown in column 3 of Table V-7. The total cash flows are shown in column 4 of Table V-7. The last column of Table V-7 is the ratio of reinvestment to the cash flows.

Table V-7
Reinvestment Ratios
(millions of dollars)

Year	*Re-investment*	*Production*	*TAPS*	*Total*	*Reinvestment Ratio*
		---Cash Flows---			
1987	$2,908	$3,638	$1,525	$5,163	56.32%
1986	1,288	2,898	2,078	4,976	25.88%
1985	1,234	5,050	1,695	6,745	18.30%
1984	828	5,622	2,117	7,739	10.70%
1983	2,818	5,438	1,932	7,370	38.24%
1982	647	4,797	1,717	6,514	9.93%
1981	4,919	4,569	1,477	6,046	81.36%
1980	426	3,930	1,452	5,382	7.92%
1979	424	3,680	1,440	5,120	8.28%
1978	274	1,177	925	2,102	13.04%
Totals	**$15,766**			**$57,157**	

The data from Table V-7 indicate that the ANS producers are reinvesting approximately 27.8% of their cash flows in Alaska.

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Appendix A
Sohio's 1982 Annual Report Disclosure

Supplementary Information on Oil and Gas Exploration, Development and Production Activities

This section provides information required by Statement of Financial Accounting Standards No. 69 (FASB 69), "Disclosures about Oil and Gas Producing Activities," which was issued in November 1982. FASB 69 aims to establish a comprehensive set of disclosures for oil and gas producing activities that replaces disclosures formerly required by either the Financial Accounting Standards Board (FASB) or the Securities and Exchange Commission (SEC), or both.

Three general disclosure areas comprise the information in this section. The first area provides historical information about costs and revenues, including the Company's aggregate recorded investment in oil and gas properties, annual costs incurred and a separate statement of the results of operations for producing activities. The second area contains the Company's petroleum engineers' quantity estimates for proved oil and gas reserves and the major factors causing changes in these reserve estimates. The final area of disclosure represents our compliance with the FASB's requirement to assign a monetary value to proved reserve quantities and changes therein using a standardized formula.

The Company has provided additional commentary throughout this section that is important for a proper understanding of the nature of the data provided and its inherent limitations.

Historical Information

Millions of Dollars	1982			1981			1980		
	Total	Alaska	Lower 48 States	Total	Alaska	Lower 48 States	Total	Alaska	Lower 48 States
Capitalized Costs as of December 31									
Proved properties	$5,219	$4,1[illegible]	$1,0[illegible]	$3,846	$3,387	$ 461	$2,[illegible]	$2,[illegible]	$321
Unproved properties	1,2[illegible]	[illegible]	7[illegible]	8[illegible]	13[illegible]	[illegible]	4[illegible]	[illegible]	4[illegible]
	6,414	4,7[illegible]	1,7[illegible]	4,673	3,523	1,150	3,404	2,677	727
Accumulated depreciation, depletion and amortization	1,747	1,[illegible]	[illegible]	1,320	[illegible]	364	[illegible]	717	2[illegible]
	$4,767	$3,573	$1,194	$3,353	$2,567	$ 786	$2,418	$1,9[illegible]	$4[illegible]
Costs Incurred (capitalized or expensed)									
Acquisition of properties	$ 6[illegible]	$ 4[illegible]	$ 2[illegible]	$ 393	$ —	$ 393	$ 190	$ 2	$188
Exploration	416	84	33[illegible]	353	68	285	148	30	118
Development	1,14[illegible]	[illegible]	24[illegible]	[illegible]	80[illegible]	61	3[illegible]	3[illegible]	32

Results of Operations for Producing Activities

The following summarizes the "Results of Operations for Producing Activities," as defined by FASB 69, for the years ended December 31, 1982, 1981 and 1980. As required, financing costs are not included in this statement. Income taxes are included in the results, but were computed under FASB guidelines using statutory tax rates, while considering the effects of permanent differences and tax credits relating to oil and gas producing activities.

Millions of Dollars	1982			1981			1980		
	Total	Alaska	Lower 48 States	Total	Alaska	Lower 48 States	Total	Alaska	Lower 48 States
Revenues	$6,487	$6,13[illegible]	$ 3[illegible]	$6,3[illegible]	$6,116	$ 276	$4,4[illegible]	$4,318	$181
Production costs	1,[illegible]	1,[illegible]	110	2,070	2,[illegible]	130	1,247	1,181	66
Depreciation and depletion	3[illegible]	276	40	28[illegible]	272	17	28[illegible]	270	16
Exploration expenses									
Geophysical and geological	13[illegible]	3[illegible]	9[illegible]	107	22	8[illegible]	37	2	3[illegible]
Amortization of unproved properties	163	7	156	7[illegible]	8	70	6[illegible]	16	5[illegible]
Dry hole costs	[illegible]	6	[illegible]	174	14	110	4[illegible]	13	27
Other	10[illegible]	12	9[illegible]	[illegible]	4	[illegible]	31	8	23
	4[illegible]	67	431	370	46	324	17[illegible]	3[illegible]	13[illegible]
	3,013	2,017	[illegible]	3,33[illegible]	2,[illegible]	470	1,7[illegible]	1,4[illegible]	218
Income before interest and income taxes	3,704	3,1[illegible]	(3[illegible])	3,1[illegible]	3,24[illegible]	(1[illegible])	2,7[illegible]	2,828	(3[illegible])
Income taxes	1,3[illegible]	1,[illegible]	(1[illegible])	1,676	1,770	(91)	1,3[illegible]	1,574	(1[illegible])
	$1,432	$1,[illegible]	$(1[illegible])	$1,176	$1,470	$(1[illegible])	$1,232	$1,252	$(20)

Appendix B
Barclay's de Zoete Wedd Prudhoe Bay Model (1988)

PROFITABILITY MODEL FOR PRUDHOE BAY FIELD

($/Barrel)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Alaskan Crude Price*	28.48	14.07	17.37	14.01	14.50	15.23	15.98	16.79	17.62	18.51	21.28
Less:											
Tanker Freight+	(3.24)	(2.71)	(2.60)	(2.70)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)
TAPS charge	(5.31)	(4.50)	(3.93)	(3.11)	(2.80)	(2.25)	(2.25)	(2.45)	(2.85)	(2.90)	(3.15)
Pipeline Loss	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Value at Pump Station One	17.83	6.76	10.74	8.10	8.80	9.88	10.64	11.24	11.87	12.51	15.03
Severance Tax	(2.59)	(0.88)	(1.29)	(0.97)	(1.06)	(1.19)	(1.28)	(1.35)	(1.42)	(1.50)	(1.80)
Field Operating Costs	(1.00)	(0.90)	(0.90)	(0.90)	(0.95)	(0.95)	(1.00)	(1.05)	(1.10)	(1.15)	(1.20)
Field Overheads	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.25)	(0.25)	(0.25)	(0.30)	(0.30)	(0.30)
Depreciation & Depletion	(1.60)	(2.00)	(2.00)	(2.10)	(2.20)	(2.20)	(2.30)	(2.40)	(2.40)	(2.45)	(2.45)
Ad Valorem Tax	(0.30)	(0.30)	(0.30)	(0.30)	(0.31)	(0.32)	(0.34)	(0.35)	(0.36)	(0.38)	(0.39)
Pre-tax Earnings Per Barrel	12.14	2.48	6.05	3.83	4.08	4.87	5.47	5.84	6.28	6.73	8.38
Operating Profit ($m)	3015	617	1539	934	1058	1269	1278	1257	1282	1277	1621

NOTES:

* *The Alaskan crude price is a weighted average of the prices received for sales on the West and Gulf Coasts; Gulf Coast sales normally fetch around $1/barrel more than those on the West Coast. We assume 1/3 of sales are made on the West Coast with the balance on the Gulf.*

\+ *Tanker freight is again a weighted average of the rate for deliveries from Valdez to the West and Gulf Coasts. Because shipping costs to the Gulf Coast are normally some $2.40/barrel higher, sales on the West Coast are more profitable to BP despite the fact that the crude oil commands a lower price than on the Gulf (see Section 5 below). In 1989 we have assumed that tanker costs rise by around $0.6/barrel due to an increase in the use of expensive to operate Jones Act vessels (see Section 5), partly offset by a 70,000 barrel/day increase in shipments by pipeline from the West to Gulf Coasts (which is some 60¢/barrel cheaper than transport by ship via Panama).*

Appendix C
Salomon Brothers' Arco Alaska Profits Model (1987)

Figure 5. Atlantic Richfield Company — Actual and Projected Alaskan Production Earnings, 1985-92E
(Dollars Per Barrel, Unless Otherwise Indicated)

	1985	1986	1987E	1988E	1989E	1990E	1991E	1992E
Prudhoe Bay Field								
Selling Price — West Texas Intermediate Crude	$28.00	$15.75	$17.50	$20.00	$22.00	$24.00	$25.00	$26.00
Prudhoe Bay Field Crude Price[a]	26.80	15.20	16.90	19.30	21.25	23.15	24.15	25.10
Transportation Deductions								
Valdez to U.S. Gulf Coast	$4.50	$3.80	$3.85	$4.10	$4.25	$4.40	$4.50	$4.60
TransAlaska Pipeline Charge	5.28	4.75	3.90	3.50	3.25	3.00	3.00	3.00
Equals: Prudhoe Bay Field Wellhead Price	$17.02	$6.65	$9.15	$11.70	$13.75	$15.75	$16.65	$17.50
Production Expenses								
Severance Tax	$2.30	$1.50	$1.50	$1.58	$1.86	$2.13	$2.25	$2.36
Windfall Profit Tax	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field Operating Expenses	0.90	0.75	0.80	0.85	0.90	0.95	0.95	1.00
Depreciation and Depletion	1.60	1.75	1.80	1.85	1.90	1.95	2.00	2.05
Unit Operating Profit	$12.15	$2.65	$5.05	$7.42	$9.09	$10.72	$11.45	$12.09
Prudhoe Net Production (mb/d)	308.5	307.3	307.0	308.0	308.0	285.0	266.0	245.0
Prudhoe Operating Profit (Dollars in Millions)	$1,368	$297	$566	$834	$1,022	$1,116	$1,112	$1,081
Kuparuk River Field								
Kuparuk River Field Crude Price in U.S. Gulf[a]	$26.80	$15.05	$16.70	$19.10	$21.00	$22.90	$23.90	$24.85
Transportation Deductions								
Valdez to U.S. Gulf Coast	$4.50	$3.80	$3.85	$4.10	$4.25	$4.40	$4.50	$4.60
TransAlaska Pipeline Charge	5.28	4.75	3.90	3.50	3.25	3.00	3.00	3.00
Kuparuk River Spur Line Charge	0.87	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Equals: Kuparuk Field Wellhead Price	16.15	5.85	8.30	10.85	12.85	14.85	15.75	16.60
Production Expenses								
Severance Tax	$1.30	$0.45	$0.65	$0.85	$1.05	$1.20	$1.25	$1.35
Field Operating Expenses	2.50	1.65	1.65	1.80	1.85	1.90	1.95	2.00
Depreciation and Depletion	3.75	3.55	3.55	3.65	3.75	3.85	3.90	4.00
Unit Operating Profit	$8.60	$0.20	$2.45	$4.55	$6.20	$7.90	$8.65	$9.25
Kuparuk Net Production (mb/d)	94.9	109.9	110.0	110.0	110.0	110.0	110.0	110.0
Kuparuk Operating Profit (Dollars in Millions)	$298	$8	$98	$183	$249	$317	$347	$371
Lisburne Formation								
Lisburne Formation Crude Price in U.S. Gulf[a,b]		$14.95	$16.65	$19.00	$20.90	$22.80	$23.75	$24.70
Transportation Deductions								
Valdez to U.S. Gulf Coast		$3.80	$3.85	$4.10	$4.25	$4.40	$4.50	$4.60
TransAlaska Pipeline Charge		4.75	3.90	3.50	3.25	3.00	3.00	3.00
Equals: Lisburne Wellhead Price		6.40	8.90	11.40	13.40	15.40	16.25	17.10
Production Expenses								
Severance Tax		$0.64	$0.90	$1.15	$1.35	$1.55	$1.65	$1.70
Field Operating Expenses		2.70	2.75	2.75	2.85	2.90	3.00	3.10
Depreciation and Depletion		6.00	6.00	6.00	6.00	6.00	6.00	6.00
Unit Operating Profit		$(2.94)	$(0.75)	$1.50	$3.20	$4.95	$5.60	$6.30
Lisburne Net Production (mb/d)		4.1	15.0	20.0	30.0	35.0	40.0	40.0
Lisburne Operating Profit (Dollars in Millions)		$(4)	$(4)	$11	$35	$63	$82	$92
Total Alaskan Operating Profits Before Exploration Expenses (Dollars in Millions)	$1,666	$301	$660	$1,028	$1,306	$1,496	$1,541	$1,544
MEMO: Net Alaskan Crude Oil Production (mb/d)	403.4	421.3	432.0	438.0	448.0	430.0	416.0	395.0

[a] Wellhead prices at Prudhoe Bay, Kuparuk River and Lisburne were [illegible] related to the forecast prices of West Texas intermediate crude oil, based on the historical relationships of these crude prices to the WTI crude prices.
[b] Lisburne production began in the fourth quarter of 1986.
Mb/d Thousands barrels per day. E Estimate.

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Appendix D

Alaska Oil Industry Development Time Line

1954 - BLM issues 272 oil and gas leases.

1957 - Swanson River oil discovered.

1962 - Cook Inlet oil discovered (Middle Ground Shoals)

1965 - Three additional Cook Inlet oil fields discovered (Granite Point, McArthur River, Trading Bay)

1967 - Prudhoe Bay oil is discovered. With over 10 billion barrels of reserves, it is a "super-giant" and the largest oil field in North America.

- Middle Ground Shoals, Granite Point and Trading Bay begin production.

1969 - Prudhoe Bay lease sale.

- Kuparuk River oil discovered. With a billion barrels of reserves it is a "giant" and is second only to Prudhoe Bay as the most productive field in the United States and Canada.

1977 - Prudhoe Bay oil Begins flowing to Valdez through Trans-Alaska Pipeline System (TAPS).

1978 - Endicott oil discovered.

1985 - Milne Point begins production.

1986 - Lisburne begins production.

- Kuparuk production peaks at 300,000 barrels per day.

1987 - Endicott begins production.

- Milne Point shuts down.

Appendix E

Total ANS Production and TAPS Profits
1977 through 1987
(millions of dollars)

1982 - 1987

	1987	*1986*	*1985*	*1984*	*1983*	*1982*
Revenue	10393	8051	14707	14790	14685	15758
Expenses:						
Depreciation	1636	1674	1386	1258	1219	1131
Operating Expenses	1169	967	907	1065	954	1080
Overhead	129	124	164	100	104	84
Interest	328	611	585	709	719	807
Royalty	900	587	1316	1291	1283	1413
Severance Taxes	872	623	1403	1395	1388	1536
Property Taxes	341	353	353	339	329	329
State Income Taxes	150	94	257	253	248	239
Windfall Profit Taxes			39	211	426	1375
Federal Income Taxes	1653	0	3443	2170	2532	3031
Profits	**3215**	**3018**	**4854**	**5999**	**5483**	**4733**
Profit ($ per barrel)	**5.45**	**5.23**	**8.54**	**11.27**	**10.43**	**9.14**

1977 - 1981

	1981	*1980*	*1979*	*1978*	*1977*
Revenue	16935	13095	8855	4243	717
Expenses:					
Depreciation	941	979	741	609	38
Operating Expenses	1020	617	514	538	46
Overhead	51	15	2	0	2
Interest	698	730	927	1049	117
Royalty	1596	1143	706	221	86
Severance Taxes	1291	924	622	195	76
Property Taxes	317	314	297	278	30
State Income Taxes	872	712	486	127	30
Windfall Profit Taxes	3089	797			
Federal Income Taxes	2570	2703	512	17	32
Profits	**4490**	**4161**	**4048**	**1209**	**260**
Profit ($ per barrel)	**9.24**	**8.56**	**9.88**	**3.47**	**2.58**

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