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URANIUM EXPLORATION EXPENDITURES IN 1979 AND PLANS FOR 1980-1981

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MAY 1980

U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado

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URANIUM EXPLORATION EXPENDITURES IN 1979 AND PLANS FOR 1980-1981

INTRODUCTION AND SUMMARY

The Grand Junction Office has conducted annual surveys of actual and planned uranium exploration activities since 1971¹. This work is part of an overall program to evaluate future supplies of nuclear fuel.

The annual surveys have covered:

1. Land acquired for exploration and cost of acquisition (since 1966).
2. Surface drilling footage and cost (since 1966).
3. All other exploration expenditures (since 1966).
4. Estimates of exploration activities and costs for the next 2 years (since 1971). This year's survey covered estimates for 1980-81.
5. Exploration for non-sandstone deposits (since 1974).
6. Exploration for non-established areas (since 1974).
7. Foreign uranium exploration expenditures by U.S. companies (since 1966).
8. Foreign participation in exploration activities in the United States (since 1976).
9. Aerial radiometric exploration activities (since 1977²).
10. Solution mining production drilling (since 1976).

This report presents a compilation of data from the replies of 164 companies³. Table 1 summarizes the results of this year's survey as compared with data from the previous 13-year period. Total surface drilling, as reported on questionnaires, was 41.1 million feet in 1979. This footage is 15 percent lower than the previous record high of 48.1 million feet reported for 1978. Total exploration expenditures for 1979 were \$315.9 million, which included \$44.5 million for land acquisition, \$163.0 million for surface drilling, and \$108.4 million for other related exploration activities. The total expenditures for 1979 are slightly higher than the previous record of \$314.3 million reported for 1978. The industry's planned exploration expenditures are \$277 million in 1980 and \$271 million in 1981. These plans include 39.4 million feet of surface exploration and development drilling in 1980 and 35.5 million feet in 1981.

TABLE 1. *Summary of Domestic Exploration Activities*

	<u>Millions</u>	<u>Total for 1966-78</u>	<u>1979</u>	<u>Estimated for</u>	
				<u>1980</u>	<u>1981</u>
Land Acquired	Acres	47.96	4.21		
	Dollars	177.22	44.53		
Surface Drilling	Feet	308.17	41.08	39.4	35.5
	Dollars	717.12	162.98		
Other Exploration Expenditures	Dollars	384.13	108.40		
Total Expenditures	Dollars	1,278.47	315.91	276.8	271.1

¹The 1971 survey covered 1966-70.

²The 1977 survey covered 1972-76.

³See pages 11 and 12 for list of survey respondents.

LAND HOLDINGS

As of December 31, 1979, 149 companies reported holdings of 17.15 million acres for uranium exploration. This compares with 18.97 million acres held by 157 companies as of December 31, 1978.

LAND ACQUISITIONS

Acquisitions of 4.21 million acres in the United States were reported by 108 companies. The total cost was \$44.53 million.

Types of land holdings and acquisitions include fee land, mineral fee, leases, patented and unpatented claims, and options to purchase mineral fee. The costs of all such acquisitions were included. Land acquired or held for production of uranium from known commercial uranium deposits is not included. Table 2 summarizes land acquisitions from 1966 through 1979.

TABLE 2. *Land Acquired for Uranium Exploration*

		Millions of	
<u>Acquired During</u>		<u>Acres</u>	<u>Dollars</u>
	1966-70	17.84	52.95
	1971-74	8.89	34.73
	1975	3.48	16.70
	1976	4.75	13.89
	1977	6.00	28.22
	1978	6.39	30.73
	1979	4.21	44.53
			<u>221.75</u>
Additional lands acquired for which no costs were provided:	1966-70	0.32	
	1971-73	0.29	
	Total Acquisitions	<u>52.17</u>	

Land Acquisition Costs

Acquisition costs during 1979 ranged from less than \$0.50 per acre to more than \$500 per acre, with an average cost of \$10.58 per acre. Some of the land acquisitions reported for 1979 involved lands to which considerable value has been added by previous exploration drilling activities. A greater percentage of such lands were reported in 1979 than in past years. Figure 1 shows the cumulative percentage of acreage acquired in terms of cost per acre.

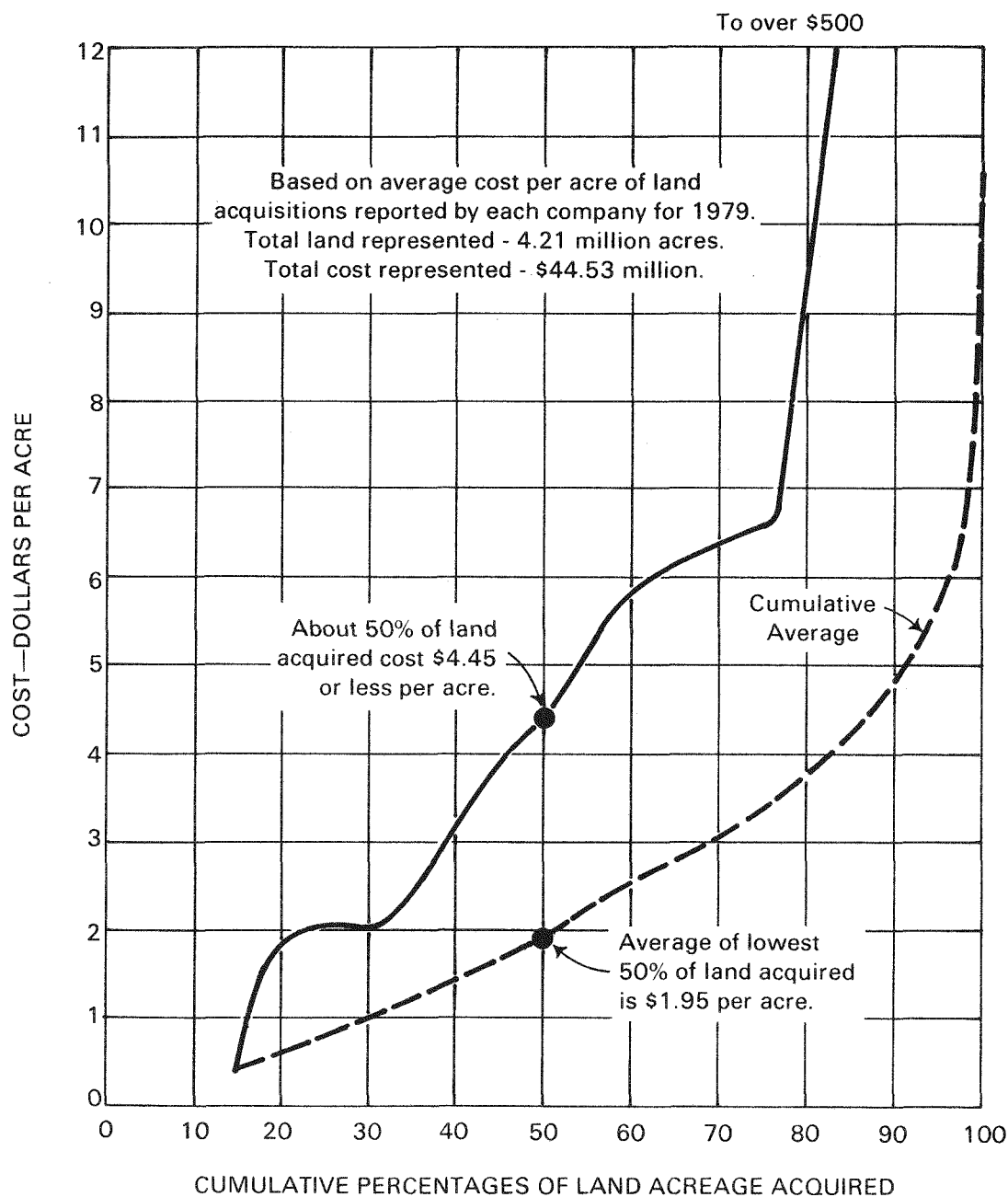


FIGURE 1. 1979 Land Acquisition Costs

SURFACE DRILLING

One hundred and fifty-four of the 164 companies responding to the survey reported 41.08 million feet of surface drilling at a cost of \$163.0 million. This represents a 15 percent decrease in footage from 1978 and a 4 percent decrease in expenditures. Surface drilling activities are summarized in Table 3.

TABLE 3. Summary of Surface Drilling

Category of Drilling	Millions of	
	Feet	Dollars
A. Exploration		
1966-74	106.58	159.4
1975	15.69	51.9
1976	20.36	70.7
1977	27.96	99.4
1978	28.95	113.3
1979	28.07	119.6
B. Development		
1966-74	35.12	36.5
1975	9.73	21.9
1976	14.44	38.3
1977	17.62	55.6
1978	19.15	56.4
1979	13.01	43.4
C. Exploration and development reported together, 1966-72	12.57*	13.7
Totals Reported, 1966-79	349.25	880.1

*Includes 2,074,000 feet of exploration drilling and 530,000 feet of development drilling for which no costs were reported (1966-71).

Exploration drilling includes (a) drilling in search of new ore deposits or extensions to known deposits, and (b) drilling at the location of a discovery up to the time the company decides sufficient ore reserves are present to justify commercial exploitation. *Development drilling* includes all drilling of an ore deposit to determine more precisely size, grade, and configuration subsequent to the time that commercial exploitation is deemed feasible.

Surface Drilling Costs

Surface drilling costs include drilling, drill roads, site preparation, geological and other technical support, sampling, and drill hole logging. These costs ranged from less than \$1.25 to more than \$30 per foot. The average cost was \$3.97 per foot. This represents a 12 percent increase over the 1978 average of \$3.53 per foot. Figure 2 shows the cumulative percentage of total surface drilling in terms of cost per foot of drilling.

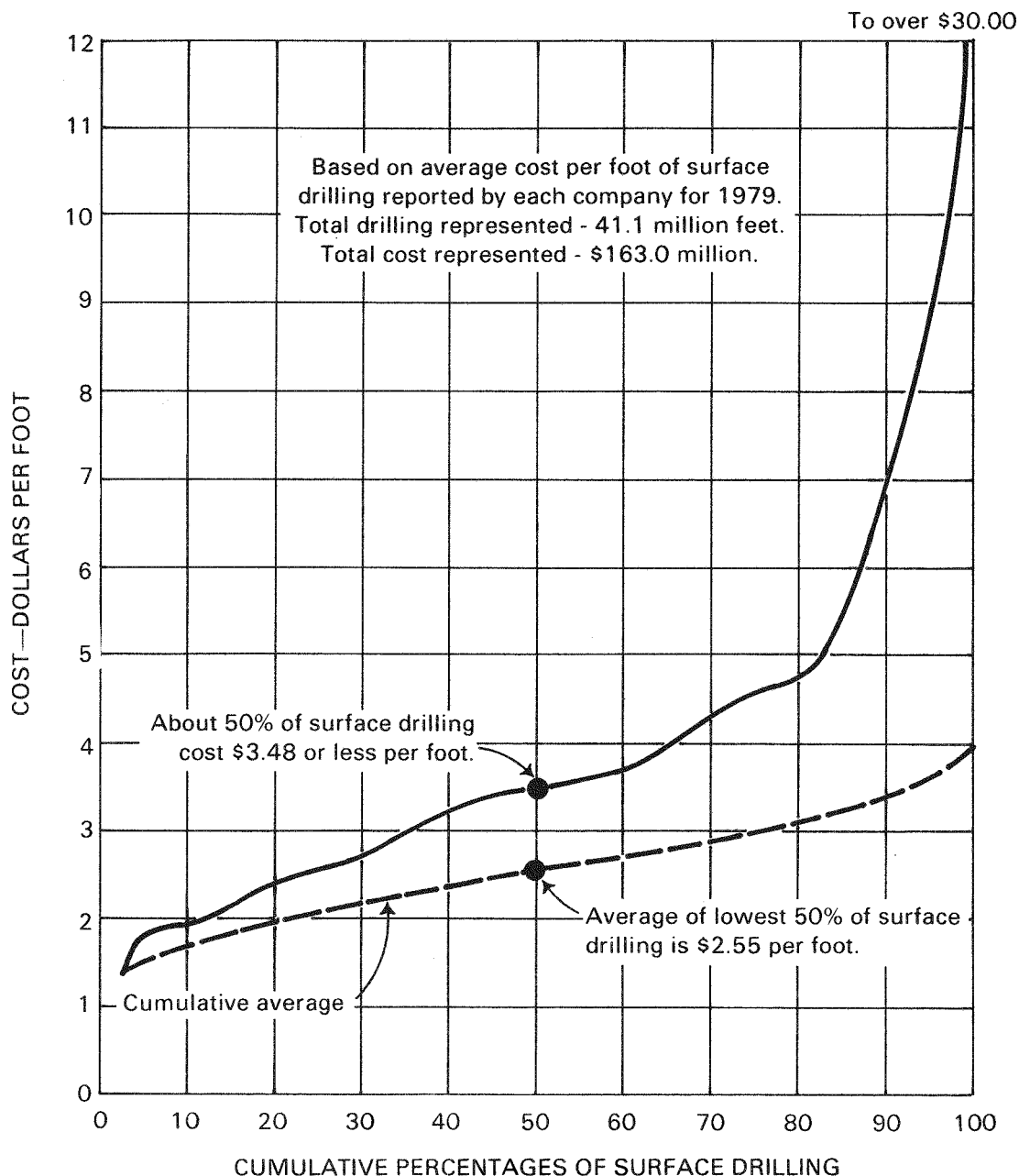


FIGURE 2. 1979 Surface Drilling Costs

OTHER DOMESTIC EXPLORATION EXPENDITURES

Table 4 includes all other costs directly associated with uranium exploration effort. Included are expenditures for geological and geophysical investigations and research, costs incurred by field personnel during exploration, and overhead and administrative charges specifically associated with supervising and supporting exploration activities. The overhead and administrative charges reported do not include internal corporate charges such as directors' salaries that are not directly associated with a company's exploration effort.

TABLE 4. *Other Exploration Expenditures*

<u>Period</u>	<u>Expenditures, Millions of Dollars</u>
1966-74	116.1*
1975	31.5
1976	47.8
1977	74.9
1978	113.9
1979	108.4
Total Reported, 1966-1979	492.6

*This total also includes some drilling costs which a few companies in the past listed under this category. Less than 2 percent of the total cost for the period is involved.

PLANNED 1980 AND 1981 U.S. EXPLORATION ACTIVITIES

One hundred and thirty-four of the 164 responding companies reported plans for 1980, and 98 of these companies reported plans for 1981. Plans for 1981 are less complete than those projected for 1980 because of the lower response. Table 5 lists total estimated drilling footage and exploration costs, and Figure 3 shows the record of past drilling activities and related plans for 1980 and 1981.

TABLE 5. *Planned Exploration*

<u>Calendar Year</u>	<u>Millions of Feet of Drilling</u>			<u>Millions of Dollars Total Explor. Costs</u>
	<u>Explor.</u>	<u>Develop.</u>	<u>Total</u>	
1980	27.9	11.5	39.4	277
1981	24.7	10.8	35.5	271

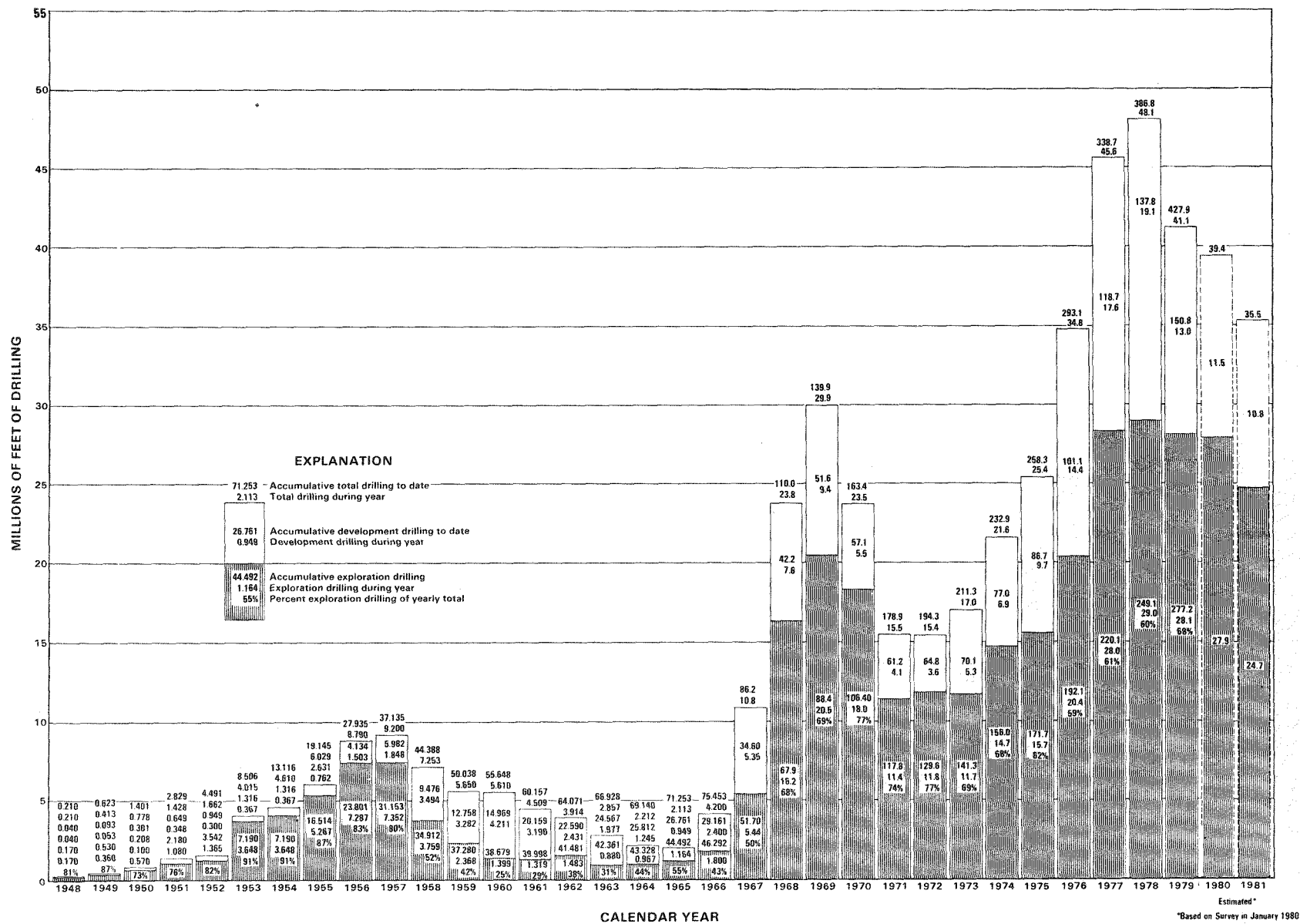


FIGURE 3. History and Forecast of U.S. Uranium Exploration

COMPARISON OF PLANNED VERSUS ACTUAL ACTIVITIES

Table 6 shows a comparison of actual uranium exploration activities with footages and costs based on surveys during the past 3 years.

TABLE 6. *Planned Versus Actual Activities*

	Planned for 1978 (1978 Survey)	Reported for 1978 (1979 Survey)	Planned for 1979 (1979 Survey)	Reported for 1979 (1980 Survey)
Drilling Footage, (Millions of Feet)	52.5	48.1	53.0	41.1
Total cost, (Millions of Dollars)	289	314.4	339	315.9

DOMESTIC EXPLORATION FOR NON-SANDSTONE DEPOSITS AND IN NON-ESTABLISHED AREAS

Table 7 is a summary of reported activities and plans for exploration efforts in non-sandstone geologic environments and/or in geographic areas outside the Colorado Plateau, Wyoming Basins, and Texas Gulf Coast Provinces.

TABLE 7. *Exploration Activities Related to Non-Sandstone Deposits and in Non-Established Areas*

	Non-Sandstone		Non-Established Areas	
	Percentage of Exploration Costs	No. of Companies	Percentage of Exploration Costs	No. of Companies
1974	16.3	39	19.1	45
1975	11.1	39	19.2	45
1976	16.7	51	23.2	53
1977	13.1	72	22.0	78
1978	19.7	90	27.5	93
1979	18.8	87	28.7	94
1980 (Planned)	19.1	79	28.7	80
1981 (Planned)	20.6	59	30.8	63

SOLUTION MINING PRODUCTION DRILLING

Although solution mining is not an exploration activity, and is not included in the data provided elsewhere in this report, it has been included in the survey for the past 4 years to obtain complete data on uranium surface drilling activities. Solution mining drilling is exclusively for solution mining production, and is subsequent to the initial development drilling which identified the size, grade, and configuration of a solution mining deposit. Pattern development and monitor wells are included.

TABLE 8. *Solution Mining Production Drilling*

<u>Year</u>	<u>No. of Companies</u>	<u>Drilling Footage (Millions of Feet)</u>	<u>Drilling Cost (\$ Millions)</u>	<u>Drilling Cost (\$ Per Foot)</u>
1976	10	0.35	1.83	5.20
1977	7	0.625	3.17	5.07
1978	14	2.035	11.36	5.58
1979	16	2.305	14.32	6.21

FOREIGN PARTICIPATION IN DOMESTIC EXPLORATION

Twenty-eight companies reported that foreign interests provided full or partial funding of their 1979 exploration activities. The total foreign participation amounted to \$34.1 million, or about 11 percent of the \$315.9 million total domestic exploration expenditures reported for 1979. Foreign participation in 1979, in terms of costs, was about 13 percent less than that reported for 1978.

FOREIGN URANIUM EXPLORATION BY U.S. COMPANIES

Twenty-four U.S. companies reported that they expended \$43.24 million in foreign countries in 1979. This is a 20 percent increase over the \$35.89 million reported for 1978. Total foreign expenditures of \$115.92 million were reported for 1966-78.

Table 9 is a summary of reported activities and plans for the uranium exploration expenditures of U.S. companies in foreign countries.

TABLE 9. *Foreign Uranium Exploration Expenditures*
(Expenditures in millions of dollars)

<u>Year</u>	<u>Africa</u>	<u>Canada</u>	<u>Australia</u>	<u>Others*</u>	<u>Total</u>
1975	2.66	1.00	1.34	0.10	5.10
1976	4.36	2.60	1.97	9.87	18.00
1977	7.50	3.60	4.70	15.36	31.16
1978	6.98	3.47	3.56	21.88	35.89
1979	7.05	8.75	6.22	21.22	43.24
1980 (Planned)	4.59	12.50	6.98	18.09	42.16
1981 (Planned)	3.42	15.47	8.99	18.53	46.41

*Includes expenditures for which countries were not specified in the survey responses.

AERIAL RADIOMETRIC EXPLORATION

In 1977 an item was added to the survey to obtain an estimate of the aerial radiometric effort of private companies for the 5-year period 1972-1976. This activity has been continued on an annual basis. In 1979, as in previous years, the western United States was the most heavily flown area, although some activity was reported for Alaska and the midwestern and eastern parts of the United States. Aerial radiometric exploration activities are summarized in Table 10.

TABLE 10. *Aerial Radiometric Exploration*

	Year			
	1972-76	1977	1978	1979
Number of companies reporting	30	29	44	25
Total line miles flown	910,000	435,000	570,000	130,000
Percentage gamma spectrometry	57	68	58	72
Percentage gross gamma ray	43	32	42	28
Flight-line spacing range (miles)	0.25-1.0	0.1-2.6	0.1-2.0	0.2-3.0
Weighted average of flight-line spacing (miles)	0.67	0.78	0.39	0.35

LIST OF COMPANIES FURNISHING DATA FOR SURVEY

DOE acknowledges the excellent support of individuals and companies of the uranium industry in submitting data in response to the questionnaires for this study.

Accent Energy Corp.	Exxon Minerals Co., USA
Adobe Oil & Gas Corp.	Federal Resources Corp.
Agip Mining Co., Inc.	Felmont Oil Corp.
Alliance Nuclear, Inc.	Ferret Exploration Co., Inc.
AMAX Petroleum Corp.	Ralph Foster and Sons
American Copper & Nickel Co., Inc.	Four Corners Exploration Co.
American Nuclear Corp.	Freeport Exploration Co.
Amoco Minerals	Fremont Energy Corp.
The Anaconda Copper Co.	French American Metals Corp.
Anschutz Mining Corp.	Frontier Resources, Inc.
Aquitaine Mining Corp.	Gates & Fox Co., Inc.
Arizona Public Service Co.	GCO Minerals Co.
Atlas Minerals	General Electric Uranium Management Corp.
Calvin Black Enterprises	Geoexplorers International, Inc.
Bobcat Properties	Geological Services Co.
Bokum Resources Corp.	GEOMET Exploration, Inc.
William A. Bowes, Inc.	Getty Oil Co.
Brooks Minerals, Inc.	Graham Mining Co.
BurWest Joint Venture	Gramlich Exploration Co.
Buttes Resources Co.	Graves & Associates, Ltd.
C & H Mining, Inc.	Gulf Mineral Resources Co.
Central and South West Fuels	Hills Gas, Inc.
Charco Uranium Co.	Homestake Mining Co.
Chevron Resources Co.	Houston Oil & Minerals Corp.
The Cleveland-Cliffs Iron Co.	Hunt Oil Co.
Coastal Uranium, Inc.	Idaho Mining Corp.
Cobb Nuclear Corp.	Intercontinental Energy Corp.
Cominco American Inc.	Locke Jacobs
Concord Oil Co.	Johns-Manville Sales Corp.
Conoco Inc.	Kennecott Exploration, Inc.
Continental Nuclear, Inc.	(Bear Creek Mining Co.)
Cordex Exploration Co.	Keradamex, Inc.
Cotter Corp.	Kerr-McGee Corp.
Cyprus Exploration Co.—Wyoming Mineral Corp.	James A. Knupke
(Joint Venture)	Koppen Mining Construction Corp.
Dawn Mining Co.	Lacana Mining Inc. Uranium Joint Venture (U.S.)
Dawson Mining Co.	Lomex Corp.
Denison Mines (U.S.) Inc.	Mapco, Inc.
DEPCO, Inc.	Martin-Trost Associates
Duval Corp.	Minatome Corp.
Ebasco Services, Inc.	Mineral Energy, Inc.
Frank Elmer	Minerals Recovery Corp.
Empire Explorations, Inc.	Mobil Oil Corp.
Energy Fuels Nuclear, Inc. & Energy Fuels	Mountain States Resources Corp.
Exploration Co.	Newmont Mining Corp.
Energy Reserves Group, Inc.	Newpark Resources, Inc.
Energy Uranium Co.	North American Mining and Minerals Co.
Ensearch Exploration Inc.	Nuclear Dynamics, Inc.
Everest Minerals Corp.	Nuclear Exploration & Development Co.

LIST OF COMPANIES FURNISHING DATA FOR SURVEY, *Continued*

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Pathfinder Mines, Inc.
David Martin Phillip
Phillips Uranium Corp.
Pioneer Nuclear, Inc.
Pioneer Uranium, Inc.
Placer Amex Inc.
Plateau Resources Ltd.
Portland General Electric Co.
Power Resources Corp.
Puget Sound Power & Light Co.
Rajah Ventures, Ltd.
Rampart Exploration Co.
Ranchers Exploration and Development Corp.
Reserve Oil and Minerals Corp.
Resource Associates of Alaska, Inc.
Resources International Corp.
Rio Algom Corp.
Rocky Mountain Energy Co.
Sabine Production Co.
St. Joe American Corp.
St. Jude Mining Co.
Santa Fe Mining Inc.
Ralph L. Schauss & Associates
Schumacher-Lloyd Ventures
R. H. Searphim Engineering Ltd.
Sierra del Rio Nuclear, Inc.
Sohio Western Mining Co.
Spearhead Energy, Inc.
Standard Metals Corp.
Strategic Minerals Exploration Co.
Sunoco Energy Development Co.
Systems Exploration, Inc.

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Tenneco Oil Co.
Tennessee Valley Authority
Texaco, Inc.
Texasgulf, Inc.
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Wyoming Fuel Co.
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