DOCUMENT RESUME

ED 107 410 RC 008 538

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TITLE Profile of a Rural Area Work Force: The Wyoming Uranium Industry.
INSTITUTION Wyoming Univ., Laramie. Agricultural Experiment Station.
SPONS AGENCY Department of Agriculture, Washington, D.C.
REPORT NO RJ-79
PUB DATE Jan 74
NOTE 35p.
JOURNAL CIT People, Crops, Soils, Livestock Research Journal; n79 January 1974

EDRS PRICE MF-$0.76 HC-$1.95 PLUS POSTAGE
DESCRIPTORS Age; Education; Employment Opportunities; Ethnic Distribution; *Industrial Personnel; Information Needs; Job Tenure; Job Training; Males; *Manpower Needs; Occupational Information; *Policy Formation; *Profile Evaluation; *Rural Development; Salaries; Tables (Data); Vocational Retraining
IDENTIFIERS Uranium Industry; *Wyoming

ABSTRACT

Designed to provide insights into policies relative to human resource investments and employment information channels, the study's objectives were to: (1) relate types of employment in Wyoming's uranium mines and mills to work force participants; (2) determine employee earnings and relate those earnings to employment categories and characteristics; (3) examine employee tenure and turnover patterns; and (4) describe employment channels of information. Between December 1971 and June 1972, data were collected on 1,059 males via questionnaires administered to either the manager or personnel manager of each of 6 Wyoming uranium operations and via questionnaires taken to county Employment Security Commission offices in the study areas. Utilizing tabular techniques of analysis, the following variables were analyzed: type of job held, earnings, tenure, formal education, vocational-technical training, age, racial-ethnic classification, industrial and occupational category of last job, and previous place of residence. Findings indicated that the Wyoming uranium industry had: a high employee turnover, favorable median employee earnings, little need for formal education, and inadequate long term information relative to the projected decline in uranium industry. Broader training of young men and retraining of middle-aged men were recommended, therefore. (JC)

Preface

This report results from research carried out under Wyoming Agricultural Experiment Station Project Wyo. 63-71 and Western Regional Research Project W-113, entitled "Improvement of Employment Opportunities and Earnings for Disadvantaged People in Non-Metropolitan Areas."

A previous paper, entitled "Location Aspects of a Rural Work Force: the Wyoming Uranium Industry," covered location aspects of the uranium industry work force. Those aspects of the study are, therefore, not treated in this report. The previous paper was presented at the AAEA/CAES/WAEA Joint Annual Meetings in Edmonton, Canada in August 1973. Copies may be obtained from the Division of Agricultural Economics, University of Wyoming.

A number of reviewers in the Division of Agricultural Economics and the College of Agriculture provided constructive criticisms of earlier drafts of this report. Dan Miller and Forrest Root of the Geological Survey of Wyoming also generously contributed their time in reviewing manuscripts based upon this study. The assistance of Jay Whitney and Ben Avery in sorting data and making computations is gratefully acknowledged.

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PROFILE OF A RURAL AREA WORK FORCE:

THE WYOMING URANIUM INDUSTRY

by

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Introduction

Wyoming's mineral industries have recently become a central concern of state and national policy makers as a result of the present "energy crisis." The state's uranium and coal industries, relying primarily upon "surface" or "strip" mining methods, may play a major role in serving national energy demands over the remainder of this century. However, potential developments raise a number of complex policy questions in the areas of environmental quality and rural development. This report addresses some of the human resource dimensions in rural development and focuses on the Wyoming uranium industry.

Mineral industries in the context of rural development

"Rural," "community," and "human resource" development are all terms presently being associated with **people-oriented** research and planning. We will henceforth use the term rural development in an attempt to be consistent. In essence, rural development implies a general concern for the improved well-being of persons presently residing in rural areas.

One means which has been and will no doubt continue to be important in improving the well-being of rural people is education and training to facilitate the mobility of persons **out of** economically depressed or stagnant regions. Improved well-being while remaining within the region of origin may be achieved, or at least attempted, by various means. Provisions of improved health services in rural areas is but one example. Rural development may also focus directly on improvement of employment and earnings opportunities for individuals within the region. Human resources are thought of in this case as economic factors of production. Figure 1 depicts the relationship of human resources to employment opportunities. Human resources (A) relate to employment opportunities (C) via manpower markets (B). Human resources provide labor inputs to employers, for which wages are received in return.

The Western Regional Research Project, of which this study is a part, has examined various facets of three potential avenues to the improvement of employment and earnings in rural areas.[1] One potential avenue is expansion of demand for the services of human resources. This is shown as an expansion of employment opportunities (Box C) in Figure 1. Efforts to attract industries to rural areas are representative of this approach. A second set of possibilities considered focuses on making human resources more employable and more productive. Investments in human capital (under A in Figure 1), such as vocational-technical training, constitute the general mechanism for improving employability and productivity. The third area examined in the Regional Research Project concerns manpower markets, i.e., the linkages between human resources and employment opportunities (B in Figure 1). A major concern in this third area is the type and effectiveness of employment information available in rural areas.

*Assistant Professor and former Graduate Research Assistant, respectively.

[1] Analytical Framework for Western Regional Research Project W-113, November 1971.

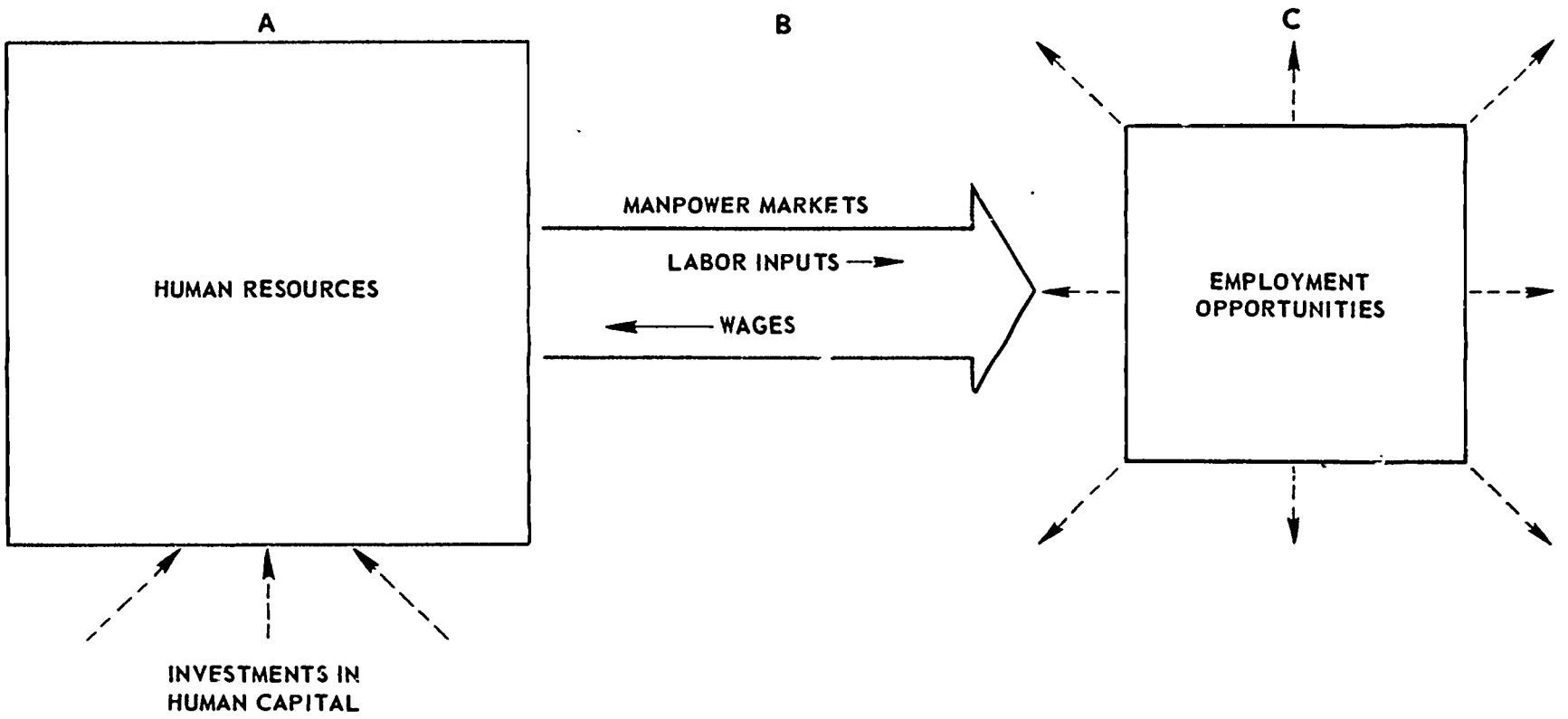

Figure 1. Conceptualization of methods by which which employment and earnings opportunities may be improved.

Demands for energy resources such as uranium are largely determined by forces external to Wyoming. Although state policies and laws may prevent expansion of the mineral industries, there is little that can be done at the state level to stimulate expansion of these industries. Since employment opportunities in the mineral industries are dependent upon exports of mineral products from the state, it is apparent that the power to expand mineral industry employment opportunities does not rest in the hands of state or local policy makers. Certain actions can be taken at a state level, however, to enhance the employability of local people in the mineral industries, and to strengthen the linkages between human resources (labor) and mineral sector employment opportunities. Thus, even though rural development policies at a state level would be largely ineffectual in promoting mineral sector growth and consequent employment, policies can be geared toward human resources and their relationship to externally induced growth.

Purpose of the study

This study was designed to provide a profile of the existing Wyoming uranium industry work force. Although manpower studies of some of Wyoming's natural resource industries have been carried out [18, 19, 20], we know of no such study of the state's uranium industry.[2] Knowledge of existing labor force participation patterns in each of the state's natural resource industries is an essential ingredients in manpower planning for future developments. This study of the uranium industry was therefore undertaken with the following specific objectives in mind:

1. To relate types of employment in Wyoming's uranium mines and mills to work force participants.

2. To determine employee earnings, and to relate those earnings to employment categories and employee characteristics.

3. To examine employee tenure and turnover patterns.

4. To describe employment information channels being utilized in the industry.

Descriptive data generated and analysis carried out in pursuit of the above objectives are expected to provide insights into policies relating to investments in human resources and to employment information channels. Location aspects of the uranium industry work force were also examined in the study, but were discussed in a previous paper (see the Preface).

Study procedures

Much of the work in manpower economics has focused on labor force participation. Regression analysis is typically utilized in an attempt to explain labor force participation rates. Cross sectional or time series data are used. Data are generally taken from such sources as the decennial census, the One-in-a-Thousand Sample, and the Current Population Survey. The major recent representation of research in this area is the work of Bowen and Finegan [1]. Also representative is the work by Gallaway [7] and by Cohen, et al. [5].

The study reported herein, in contrast to the above, focuses on the work force of a single industry within a regional economy. In addition, data utilized were collected specifically for the study. This study of uranium workers embodies primarily tabular techniques of analysis, in contrast to the regression techniques generally used in the more aggregate "participation" studies. Several of the variables considered in our study, however, are commonly used in manpower economics analysis.

Variables included in the study are listed in Table 1. "Participation" variables represent three dimensions of worker participation in the uranium industry.[3] These variables are both interdependent and dependent upon the "externally determined" variables. If our analysis rested upon a formal system of equations, we would refer to the first set as "endogenous" variables. Variables in the second column would in that case be referred to as "exogenous" variables; they are determined outside the system, but help shape an individual's employment status. Variables 1 and 2 in the second column vary with investments in human capital, mentioned earlier with reference to Figure 1.

[2] A sociological study of uranium workers in one area of Wyoming has recently been carried out [6].

[3] A fourth dimension—covering residence and commuting status—was discussed in a previous paper.

Table 1. Variables included in the analysis.

Participation variables [1]	Externally determined variables
1. Type of job held	1. Formal education
	2. Vocational-technical training
2. Earnings	3. Age
	4. Racial-ethnic classification
3. Tenure (time with firm)	5. Industrial and occupational category of last job
	6. Previous place of residence[2]

[1] Commuting status could be listed here, but is not covered in this report.

[2] Receives only brief consideration in this report.

Data pertaining to variables in Table 1 were drawn primarily from the personnel files of six of the eight firms with uranium mining and/or milling operations in Wyoming.[4] These data were collected between December 1971 and June 1972. Questionnaires administered to either the manager or the personnel manager of each firm provided additional information. A questionnaire taken to county Employment Security Commission offices in the study areas, together with the uranium firm questionnaire, provided insights into employment information channels. Data on individual employees were coded and compiled for sorting and retrieval with the XDS Sigma MANAGE computer program.

[4] Two of the eight are under the same parent company, but were treated as separate firms for purposes of this study.

Wyoming Uranium Industry Production and Employment

Production

Uranium production has been an important segment of the Wyoming economy since the early 1950's. Production began in the Gas Hills area at that time. Table 2 shows production in both physical and dollars terms since the mid-1950's. Physical output has trended upward, except for declines in 1962 and 1964-65. The state's production of U_3O_8 was nearly 28% of total United States output in 1971; Wyoming's production was second only to New Mexico's in 1971 and 1972 [12, p. 19; 17].

Uranium is presently mined in four areas of the state (Figure 2). Gas Hills, the first area to come into production in Wyoming, is located in the eastern portion of Fremont County and the very western edge of Natrona County. Three firms had mining and milling operations in this area in 1972, two of which cooperated in providing data for this study.

Mining began in Wyoming's second uranium area—the Crooks Gap-Green Mountain area—in the mid-1950's. This area (hereafter simply referred to as the Crooks Gap area) is in the southeastern corner of Fremont County, in the vicinity of Jeffrey City. Two uranium firms had mining operations there until 1972, when one was absorbed by the other. There is one uranium mill there. The remaining Crooks Gap uranium firm cooperated in this study.

Uranium operations began in Shirley Basin in the late 1950's and underwent marked expansion in the 1960's. Three uranium firms mined ore there in 1972. The ore went through mills of two of the firms. All three of these firms provided employee data.

The newest uranium mining area in Wyoming is located northwest of Douglas in Converse County. Both mining and milling operations are underway there on the part of one firm. Production operations were just getting underway in 1972, and we were unable to obtain data on the firm's employees.

Mining operations are largely underground in the Crooks Gap area, and "surface" or "strip" in the other three areas. Some tunneling-in from pit walls does take place in the strip mining areas.

Projections indicate there will be marked expansion in Wyoming uranium production until the year 2000, after which the uranium industry will decline (Figure 3). Production is expected to peak at around 25 million tons of ore (or 25 thousand tons of U_3O_8) [2, p. 24]. Projected declines are based upon the expectation that economically feasible breeder reactors will be in operation at least by the year 2000. This development is anticipated to eliminate most of the market for newly-mined uranium [3, pp. 435-39].

Table 2. Quantity and value of uranium production in Wyoming, 1950 through 1971.

Year	Production	
	Quantity	Value
	(Ore—Short tons)*	(1000 dollars)
1950	NA†	NA†
1951	NA	NA
1952	NA	NA
1953	NA	NA
1954	NA	NA
1955	NA	NA
1956	156,509	2,765
1957	274,669	4,669
1958	651,790	13,286
1959	864,582	17,610
1960	1,357,225	27,387
1961	1,521,064	28,218
1962	1,301,784	25,716
1963	1,475,070	27,243
1964	1,183,745	23,321
1965	1,048,176	17,758
	U_3O_8—1000 lb.)*	(1000 dollars)
1966	4,593	36,741
1967	4,655	37,243
1968	5,928	44,343
1969	6,716	40,318
1970	6,346	38,768
1971	6,986	43,311

* Method of reporting weights changed in 1966.

† NA=Not Available; figures withheld for these years.

Sources: [14 and 15]

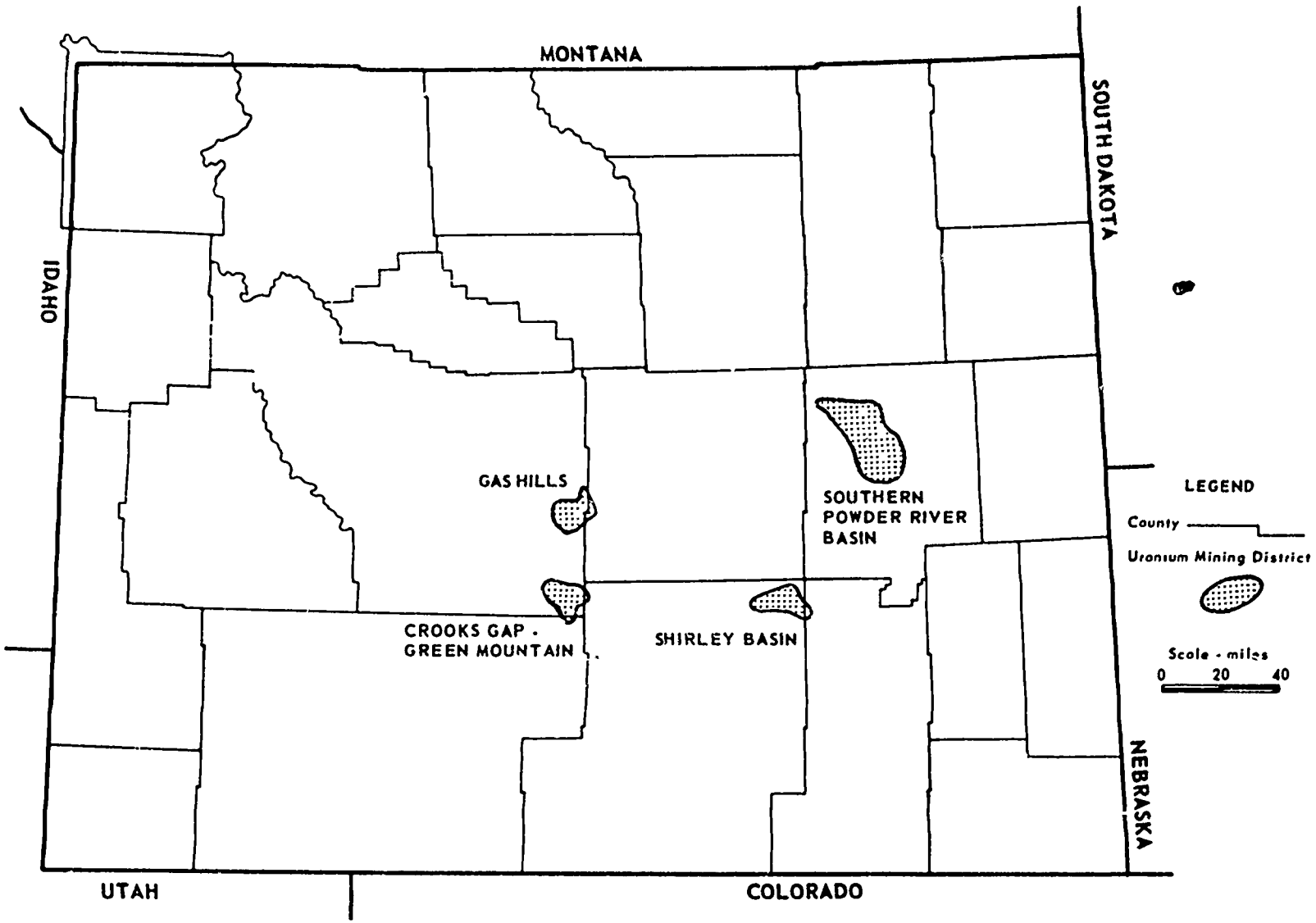

Figure 2. Wyoming uranium mining and milling locations in 1972.

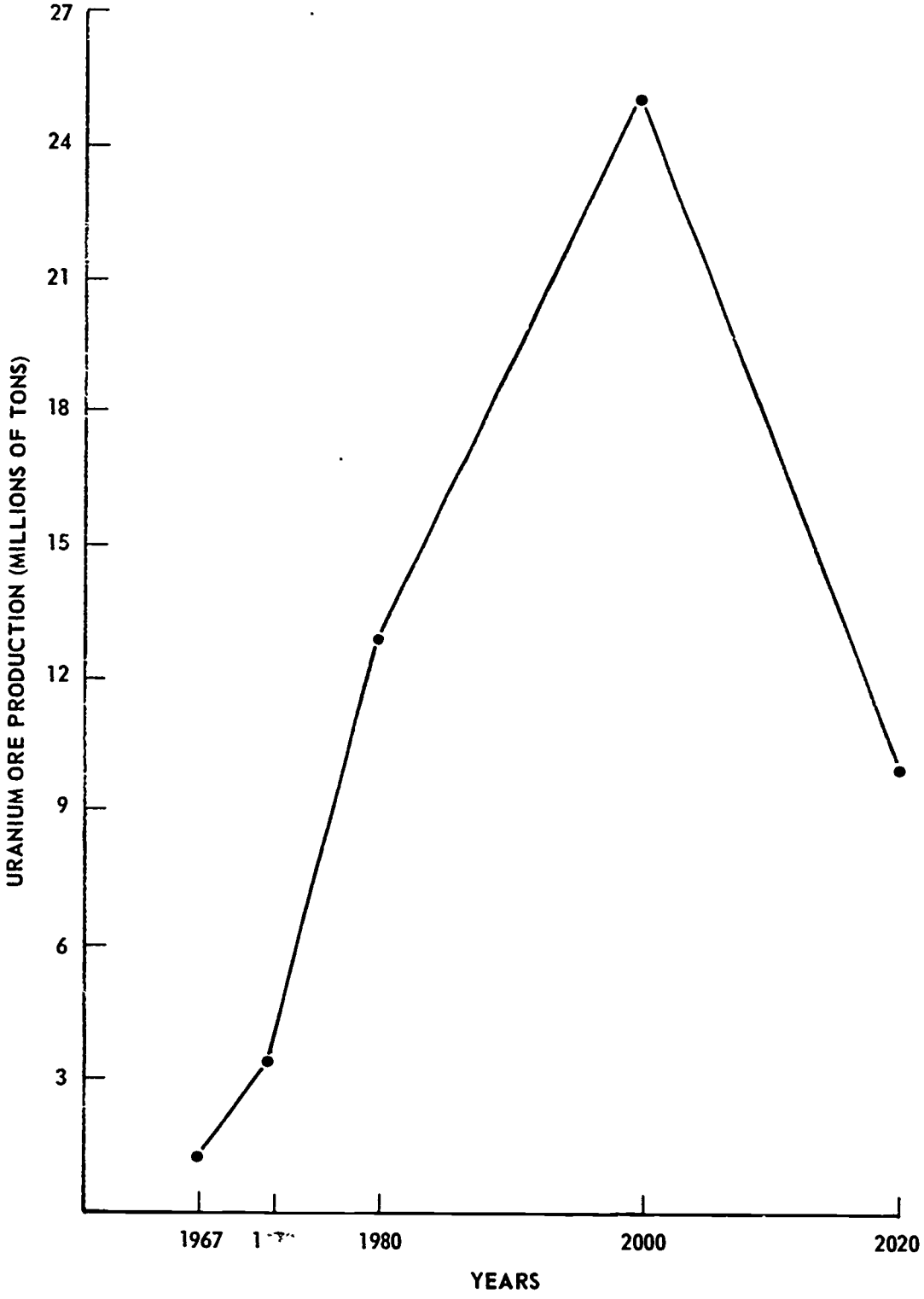

Figure 3. Projected tonnage of uranium ore production in Wyoming.
Source: [2, p. 24].

Employment

Wyoming's mining industries provide 9% of the state's employment, ranking second to the agriculture, forestry, and fisheries group (which provides 10%) [10]. The uranium industry provides 12-15% of the mining employment, or slightly more than 1% of total state employment. Employee numbers for the industry are shown in Table 3. The steady growth in employment (except for the 1963-66 period) corresponds to the production growth shown earlier in Table 2.

Data collected for this study covered 1,059 male, wage employees in the uranium industry. As indicated earlier, two firms were not represented in the study. Since those two firms combined had approximately 160 male, wage employees, our data covered approximately 87% of the 1972 uranium industry's work force, exclusive of salaried employees, clerical help, and employees of contractors for uranium companies. Thus, a large proportion of the employees directly involved in Wyoming's uranium mining and milling operations in 1972 were covered in this study.

Employment projections to the year 2020 are shown in Figure 4. The projections indicate that uranium employment in the state may go from less than 2,000 in the 1960's to 9,000 at the turn of the century. Uranium industry employment has been projected to constitute 31% of total state employment in the mineral industries in the years 1980 and 2000 [2]. Employment in the industry is expected to occur in 15 of the state's 23 counties at some time between the projection base year (1967) and the year 2020. Even though a great deal of confidence in the precise levels of these projections is probably not warranted, it is clear that the uranium industry will be an important source of employment in Wyoming over the next 25 years.

Table 3. Number of employees in uranium industry in Wyoming, 1950 through 1971.

	Mining companies		Contractors for mining companies	
Year	Average number of employees, excluding office help	Average number of employees, including office help	Average number of employees, excluding office help	Average number of employees, including office help
1950	NA*	NA*, †	NA*	NA*, †
1951	NA	NA	NA	NA
1952	NA	NA	NA	NA
1953	NA	NA	NA	NA
1954	NA	NA	NA	NA
1955	NA	NA	NA	NA
1956	NA	NA	NA	NA
1957	451	NA	NA	NA
1958	463	NA	5	NA
1959	791	NA	0	NA
1960	1,019	NA	35	NA
1961	1,020	NA	99	NA
1962	1,044	1,161	NR§	NR§
1963	952	979	NL‡	NL‡
1964	869	961	NL	NL
1965	677	782	NL	NL
1966	704	780	65	65
1967	823	917	56	57
1968	1,004	1,045	79	81
1969	1,110	1,243	267	286
1970	1,222	1,365	277	286
1971	1,285	1,476	292	314
1972	1,440	1,625	154	166

* NA=Not Available; figures withheld for these years.
† Data including office help was apparently not tabulated until 1962.
§ NR=Not Reported.
‡ NL=None Listed.
Source: [11]

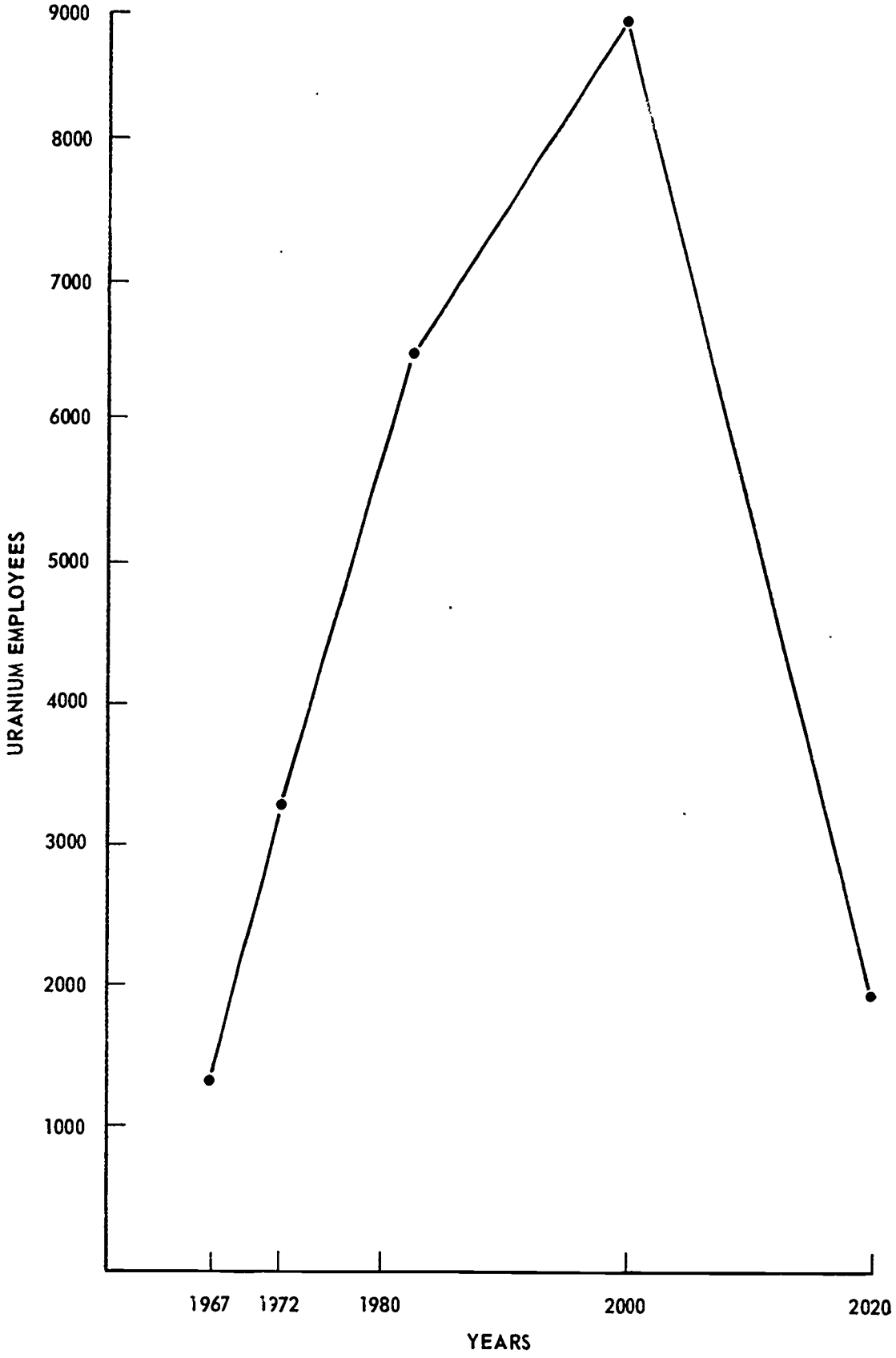

Figure 4. Projected employment in the Wyoming uranium industry.
Source: [2, pp. 26-30]

Nature of Employment and Participation

The nature of uranium industry wage employment and participation in this employment are described in this section. Current and anticipated manpower "needs" are also discussed.

Job descriptions

Mine and mill hourly wage employment in the Wyoming uranium industry was broken into 13 categories in this study. Job categories varied slightly from firm to firm; by aggregating categories somewhat, however, we were able to fit the employees of all firms into the 13 categories listed herein. The categories are defined as follows:[5]

1. **Electric shovel operator**—One who operates an electric shovel in the removal of overburden or ore in strip mining. Operation of the electric shovel requires greater skill and responsibility than does operation of other heavy equipment used in uranium mining.
2. **Heavy equipment operator**—One who operates power equipment used in moving overburden and earth in mine pits and pit areas. Examples of this equipment are scrapers, dozers, backhoes, and front-end loaders. The operator usually has an apprentice period in which he is trained in the operation and safe use of heavy equipment.
3. **Truck driver**—One who drives a truck used in moving overburden, ore, or other material. Included in this category are drivers in training on up to operators of large, electric powered trucks.
4. **Heavy equipment operator or truck driver**—One who performs duties described in either category No. 2 or No. 3 above. In the case of some firms, it was not possible to tell from an individual's job classification whether he was a heavy equipment operator or a truck driver. Such employees were placed in this category for purposes of analysis.
5. **Mine maintenance man**—One who is responsible for the repair, upkeep, overhaul, and adjustment of equipment used in the mining operation. Maintenance covers heavy equipment, trucks, and other machinery or equipment used in strip or underground mining. Maintenance may take place both in the mine areas and in maintenance shops.
6. **Instrument man**—One who is skilled in repair and replacement of the various instruments in the uranium mill.
7. **Mill operator**—One who operates equipment in the uranium mill during the process of sifting, crushing, mixing, or transporting uranium ore in the milling process.
8. **Mill maintenance man**—One responsible for the repair, overhaul, and adjustment of rollers, crushers, blenders, and other equipment found in a uranium mill.
9. **Warehouseman**—One who carries out tasks related to receiving, shipping, storing, or distributing materials, equipment, or parts needed for operation of a mine or mill.
10. **Laboratory technician**—One who performs laboratory tests in a uranium mill to determine the composition and characteristics of materials and ore. Tests may be for quality control or conformance to production standards.
11. **Ore control man**—One who uses a device such as a geiger counter at a mine to designate areas of mineable ore, or one who tests ore that is ready to deliver to a uranium mill. The latter test information is necessary in the uranium mill for a consistent quality and type of ore flow to be maintained in the milling process.
12. **Underground miner**—One who works underground in shafts and tunnels performing various tasks in connection with removal of earth and ore from a mine.
13. **Laborer**—One who works at a mine or mill performing any combination of tasks, including (among others) cleaning work areas, digging and maintaining ditches, painting, and so forth.

[5] Information obtained from uranium industry personnel, the Dictionary of Occupational Titles [16], and personal judgment were used in developing these categories.

The number of employees in each job category, by uranium area, is shown in Table 4. Employees included in the study totaled 1,059, of which the largest number (498) were in the Shirley Basin area. The largest single job category was the mine maintenance category (21% of the total). A large number of employees were found in the first four categories (31% of the total), which pertain to operation of shovels, trucks, and other heavy equipment.

Only the Crooks Gap area has extensive underground mining. Underground miners constituted 48% of its work force in 1972. The few underground miners in the Gas Hills area merely work shafts dug in from the sides of pit walls.

Employee characteristics

Age—Average ages of workers and percentages appearing in the various age categories are shown in Table 5. The "average" uranium industry worker in the state was 34.6 years old at the time of this study. Mill maintenance men were the oldest on the average (42.8 years). Average ages for electric shovel operator, heavy equipment operator or truck driver, mine maintenance man, instrument man, mill operator, and underground miner categories were all above the average for the industry as a whole. Ore control men and laborers were the youngest, averaging under 30 years of age in each case.

One can garner some knowledge of experience associated with various job categories by examining age distributions. At one extreme was the electric shovel operator category, with no workers in the youngest (18-25) age category. The laboratory technician, laborer, and ore control man categories were at the other extreme, with from 50 to 70% of workers falling in the 18-25 age group.

Interestingly, the percentage of electric shovel operators in older age categories did not increase progressively. Over 60% of electric shovel operators fell in the 26-35 age category. In fact, large percentages (over 39% in each case) of workers in each of the first four job categories were in the 26-35 group; while a certain amount of experience is valuable in these jobs, health and endurance are also important.

Somewhat more even age distributions were noted in maintenance, mill operator, warehouseman, and underground miner categories. Given equal experience and training, older workers can probably perform maintenance, mill operation, and warehouse duties about on a par with younger workers. There appears to be an aging process taking place in the underground miner work force, where the largest percentage was in the 36-50 age group. Apparently, few young persons entering the work force today find underground mining appealing as an occupation.[6]

Race.—An attempt was made to determine the racial-ethnic makeup of the work force. However, we were only able to obtain racial-ethnic information on 423 of the 1,059 employees covered in the study. Of the 423, 95% were White, 2.6% had Spanish surnames, 1.9% were Indian, and 0.5% were Negro.

Both the Crooks Gap area and much of the Gas Hills area are within Fremont County, the population of which is 13.4% Indian [10, Table 3]. Participation by Indians in the uranium industry work force was therefore of specific interest. Unfortunately, only two of the three firms in the Gas Hills area cooperated in this study, and racial-ethnic information on employees was available for only one of the two cooperating firms. We were able to determine that two Indians were employed at one firm in the Gas Hills area and five were employed in the Crooks Gap area.

Based upon this incomplete empirical information and upon interviews with firm managers and personnel managers, Indian participation in the uranium industry work force can be considered "low" in relation to the population makeup of two of the three uranium areas studied. Commuting distances from the Indian reservation are sizeable, however. From Ft. Washakie (on the reservation), it is 74 miles to the center of the Crooks Gap area and 71 miles to the center of the Gas Hills area. Other complex factors—beyond the scope of this study—no doubt also have a bearing on the apparently low Indian participation rate.

Education and training.—Formal education and vocational training of uranium industry workers are shown in Tables 6 and 7, respectively. The average formal education for the industry work force was 11.5 years in 1972. Average education was fairly uniform among job categories, with most categories having between 11 and 12 years. Laboratory technicians, ore control men, and warehousemen had the most education—between 12 and 15 years on the average. Approximately 50% of the warehousemen and laboratory technicians had from 13 to 15 years of formal educa-

[6] A portion of the Wyoming uranium work force is unionized. The possible union role in assigning jobs, and the consequences for age-job distribution patterns, have not been examined in this study.

Table 4. Number of hourly wage workers in each job category, by uranium area, in Wyoming.

Job category	Uranium area						Total	
	Shirley Basin		Crooks Gap		Gas Hills			
	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)
Electric shovel operator	11	2.2	0	0	7	2.0	18	1.7
Heavy equipment operator	108	21.7	1	.5	108	30.4	217	20.5
Truck driver	57	11.5	0	0	11	3.1	68	6.4
Heavy equipment operator or truck driver	28	5.6	0	0	0	0	28	2.6
Mine maintenance man	147	29.5	1	.5	74	20.8	222	20.9
Instrument man	3	.6	0	0	4	1.1	7	0.7
Mill operator	42	8.4	21	10.2	31	8.7	94	8.9
Mill maintenance man	20	4.0	44	21.4	41	11.6	105	9.9
Warehouseman	17	3.4	0	0	8	2.2	25	2.4
Laboratory technician	0	0	0	0	6	1.7	6	0.6
Ore control man	20	4.0	0	0	23	6.5	43	4.1
Underground miner	0	0	99	48.1	4	1.1	103	9.7
Laborer	45	9.0	40	19.4	38	10.7	123	11.6
Total	498	100% *	206	100% *	355	100% *	1,059	100% *

* Percentages do not actually total 100.0 in some cases due to rounding.

Table 5. Ages of hourly wage workers in the Wyoming uranium industry.

Job category	Age group (years) 18-25	26-35	36-50	Over 50	Age unknown	Total	Average age
	(%)	(%)	(%)	(%)	(%)	(%)*	
Electric shovel operator	0	61.1	27.8	11.1	0	100	37.3
Heavy equipment operator	23.5	41.5	23.5	6.9	4.6	100	33.4
Truck driver	32.4	39.7	20.6	7.4	0	100	32.8
Heavy equipment operator or truck driver	25.0	39.3	21.4	14.3	0	100	35.3
Mine maintenance man	19.4	39.6	27.9	12.2	0.9	100	35.3
Instrument man	14.3	42.9	14.3	14.3	14.3	100	35.7
Mill operator	17.0	35.1	30.9	12.8	4.3	100	36.3
Mill maintenance man	8.6	24.8	31.4	32.4	2.9	100	42.8
Warehouseman	32.0	32.0	24.0	12.0	0	100	33.5
Laboratory technician	50.0	33.3	0	16.7	0	100	30.2
Ore control man	69.8	16.3	11.6	2.3	0	100	26.7
Underground miner	22.3	25.2	35.0	15.5	1.9	100	36.6
Laborer	54.5	19.5	12.2	10.6	3.2	100	29.7
All categories	26.4	33.6	24.8	12.6	2.6	100	34.6

* Some totals may not add to 100.0, due to rounding.

Table 6. Formal education of hourly wage workers in the Wyoming uranium industry.

Job category	Formal education (years)						Total		Average education
	8 or less	9-11	12	13-15	16 or more	Unknown			
	(%)	(%)	(%)	(%)	(%)	(%)	(No.)	(%)*	(Years)
Electric shovel operator	22.2	0	55.6	11.1	0	11.1	18	100	11.1
Heavy equipment operator	8.3	20.3	50.7	11.5	1.4	7.8	217	100	11.5
Truck driver	11.8	25.0	44.1	17.6	0	1.5	68	100	11.3
Heavy equipment operator or truck driver	17.9	14.3	50.0	17.9	0	0	28	100	11.1
Mine maintenance man	6.8	21.6	47.8	18.9	0.4	4.5	222	100	11.5
Instrument man	14.3	14.3	42.9	14.3	0	14.3	7	100	11.3
Mill operator	8.5	16.0	60.6	9.6	0	5.3	94	100	11.5
Mill maintenance man	20.0	19.1	37.1	17.1	1.9	4.8	105	100	11.1
Warehouseman	4.0	0	40.0	48.0	4.0	4.0	25	100	12.7
Laboratory technician	0	0	16.7	50.0	33.3	0	6	100	14.4
Ore control man	2.3	4.6	41.9	37.2	14.0	0	43	100	13.0
Underground miner	13.6	29.1	40.8	8.7	0	7.8	103	100	10.9
Laborer	8.1	16.2	51.2	17.1	3.3	4.1	123	100	11.8
All categories	10.0	19.0	47.5	16.5	1.8	5.2	1,059	100	11.5

* Some totals may not add to 100.0, due to rounding.

Table 7. Vocational training of hourly wage workers in the Wyoming uranium industry.

Job category	Vocational training (months)								
	6 or less	7-12	13-18	19-24	25 or more	Time unknown*	Information unavailable	None	Total
	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)	(No.)
Electric shovel operator	0	1	0	0	0	0	3	14	18
Heavy equipment operator	7	8	0	1	0	0	8	193	217
Truck driver	3	0	0	0	0	1	0	64	68
Heavy equipment operator or truck driver	0	0	0	0	0	0	0	28	28
Mine maintenance man	6	13	1	4	0	3	10	185	222
Instrument man	0	1	0	0	0	0	0	6	7
Mill operator	1	1	0	0	1	1	1	89	94
Mill maintenance man	5	4	0	3	1	0	2	90	105
Warehouseman	0	1	0	0	0	0	0	24	25
Laboratory technician	0	1	0	0	0	0	0	5	6
Ore control man	1	0	0	0	0	2	0	40	43
Underground miner	4	3	0	0	0	0	7	89	103
Laborer	4	6	0	0	0	1	2	110	123
Total	31	39	1	8	2	8	33	937	1,059
	(2.9%)	(3.7%)	(0.1%)	(0.8%)	(0.2%)	(0.8%)	(3.1%)	(88.4%)	(100.0%)

* In certain instances it was known that a person had some vocational training, yet not known how much.

tion. The largest proportions of workers in the other job categories had 12 years of education. As expected, very few (less than 2%) of hourly wage workers in the industry had 16 or more years of formal education.

The education level of uranium industry workers is generally similar to that of Wyoming adults as a whole. Approximately 66% of workers in the uranium industry had 12 or more years of education in 1972. This compares to 60% for all Wyoming males 25 years old and over in 1970 [10, Table 4].

Information on vocational training of workers was difficult to obtain. As nearly as could be determined, almost 9 out of 10 (88%) of the industry's workers had received no vocational training other than on-the-job training. Of those who had received vocational training somewhere along the line, most had received 12 months or less (Table 7). The most frequently recorded types of vocational training were in the areas of diesel or heavy duty mechanics and auto mechanics (Table 8). Several individuals had received training in electrical work, welding, and heavy equipment operation.

Previous employment.—Employment backgrounds of employees were examined to gain understanding of industrial and occupational shifts that may take place as mineral industries expand. Table 9 indicates that substantial numbers of uranium industry workers moved to their present employment from other mining (28%) or from construction (18%) employment. As mining activities decline in one area, workers no doubt migrate to similar employment in other areas.[7] There is most likely movement of workers in both directions between mining and construction, as equipment operation skill requirements are often similar. While road construction, for example, sometimes pays better on an hourly basis than does the uranium industry, the uranium industry provides year-round employment which road construction in Wyoming generally does not.

The third largest industrial category of previous employment was agriculture, forestry, and fisheries, from which 8% of workers came. The manufacturing and motor vehicle retailing and service stations categories were each the source of 6% of the uranium industry's workers.

A second approach to viewing employment backgrounds is by examining occupational categories of previous employment (Table 10). More than half of the employees in the uranium industry joined their present firms after having been employed in one of three occupational categories —(1) laborers, except farm (30%), (2) craftsmen, foremen, and kindred workers (20%), and (3) operatives, except transport (15%). A total of slightly more than 5% came from the two "farm" categories listed in Table 10.

The general picture emerging from data in Tables 9 and 10 is one in which uranium industry employees have accepted their present employment after having been employed elsewhere in the uranium or other mining industries, in the same occupations in other industries, or in industries and occupations with similar skill requirements. At the same time, a wide range of former industries and occupations were represented, indicating the possibility of receiving some types of uranium industry employment without a great deal of experience directly related to the industry. While former farmers and farm laborers were

Table 8. Types of vocational training received by Wyoming uranium industry workers.

Type of vocational training	Number	%
Diesel or heavy duty mechanics	16	1.5
Electrical work	12	1.2
Welding	9	0.8
Auto mechanics	14	1.3
Television repair work	1	0.1
Heavy equipment operation	8	0.8
Drafting	3	0.3
Mining	1	0.1
Computer work	1	0.1
Truck driving	1	0.1
Type unknown*	23	2.2
Information unavailable	33	3.1
None	937	88.4
Total	1,059	100.0

* In certain instances it was known that a person had received vocational training, yet not known what type.

[7] Especially where unions exist in an industry, one might expect employees in a "phase-down" area to be shifted to jobs in an expanding area.

not represented in large numbers in the uranium industry, persons with agricultural backgrounds —who are accustomed to working out of doors and with machinery—would seem fairly well equipped to move into various facets of the industry should they desire to.

Manpower needs

In strict economic terms, a shortage of a product or factor of production exists if the quantity demanded exceeds the quantity supplied at a particular price. Higher prices for the product or factor can—given time for adjustments to take place—equate supply and demand. The term "manpower needs" in this section is used in a slightly less rigorous economic sense. "Needs" here connote difficulties on the part of employers in finding or retaining qualified workers in particular job categories.

The need most frequently expressed by employers was for heavy duty equipment operators. Management at several uranium firms in the state

Table 9. Industrial categories of previous employment, Wyoming uranium industry workers.

Industrial category of previous job	Number	%
Agriculture, forestry, and fisheries	85	8.0
Mining	302	28.5
Construction	191	18.0
Manufacturing	63	6.0
Railroads and railway express service	5	0.5
Trucking service and warehousing	53	5.0
Other transportation	5	0.5
Communications	0	0
Utilities and sanitary services	17	1.6
Wholesale trade	4	0.4
Food, bakery, and dairy stores	21	2.0
Eating and drinking places	16	1.5
General merchandise retailing	11	1.0
Motor vehicle retailing and service stations	65	6.1
Other retail trade	33	3.1
Banking and credit agencies	1	0.1
Insurance, real estate, and other finance	6	0.6
Business services	6	0.6
Repair services	9	0.8
Private households	0	0
Other personal services	1	0.1
Entertainment and recreation services	3	0.3
Hospitals	1	0.1
Health services except hospitals	1	0.1
Elementary and secondary schools and colleges (gov't., private)	9	0.8
Other education and kindred services	0	0
Welfare, religious, and nonprofit membership organizations	2	0.2
Legal, engineering, and miscellaneous services	2	0.2
Public administration	41	3.9
First job	6	0.6
Information unavailable	100	9.4
Total	1,059	100.0

indicated there is a continual need for additional experienced operators of such heavy duty equipment as scrapers, backhoes, and bulldozers. Although training in some type of heavy equipment operator school might serve as a partial substitute for experience, employers seem to place a premium on experience in operation of this large, expensive equipment.

Maintenance personnel—both for mine and mill equipment—constituted the second major manpower need identified by managers. A number of managers indicated it is difficult to find sufficient numbers of men with either vocational training or experience in maintenance of heavy equipment, which is practically all diesel or diesel-electric powered. Needs expressed related not only to heavy equipment mechanics, however, but to qualified maintenance men in general; this covers welders, pipefitters, electricians, and so forth, as well as mechanics. An impression gained in this study was that vocational training has greater potential for equipping men for these maintenance positions than for the heavy equipment operator positions discussed above.

Manpower procedures being followed by the uranium firm which began operations in the southern Powder River Basin in 1972 are of interest. The initial mine and mill workers hired in 1972 (54 individuals) were called "operation technicians." Each individual was to be trained in at least 5 of the 13 mine and mill positions defined by the firm.[8] Every manual labor employee would therefore eventually be familiar with most facets of the mine and mill operation. A number of these employees would probably develop the capability to serve in training or foreman positions at possible future uranium mining sites of the parent company. It would be interesting to observe the results over time of this rather innovative procedure.

Table 10. Occupational categories of previous employment, Wyoming uranium industry workers.

Occupational category of previous job	Number	%
Professional, technical, and kindred workers	20	1.9
Managers and administrators, except farm	25	2.4
Sales workers	30	2.8
Clerical and kindred workers	4	0.4
Craftsmen, foremen, and kindred workers	212	20.0
Operatives, except transport	160	15.1
Transport equipment operatives	102	9.6
Laborers, except farm	323	30.5
Farmers and farm managers	11	1.0
Farm laborers and farm foremen	48	4.5
Service workers	19	1.8
Private household workers	0	0
First job	6	0.6
Information unavailable	99	9.3
Total	1,059	100.0*

* Due to rounding, total does not add to 100.0.

[8] That firm's 13 positions do not necessarily correspond to the 13 defined earlier in this study.

Employee Earnings

Variables potentially either affecting or interacting with earnings were examined, including (1) type of job held in the uranium industry, (2) age, and (3) education and training. Previous place of residence was also examined in relation to earnings, but was discussed in the paper cited in the preface to this report.

Earnings by type of job

Hourly, "regular time" wages averaged $3.73 in the Wyoming uranium industry in 1971. Mean and median yearly earnings—including both "regular" and "overtime" work—were $9,959 and $10,200 respectively. Individual earnings ranged from $6,400 to $15,100. The 1971 median industry earnings ($10,200) were 14% higher than the 1969 median income of all Wyoming families ($8,943), and 39% higher than the 1969 median income of all Wyoming males 16 years old and over with income ($7,335) [13, pp. 52-81 and 52-100]. Even after allowing for differences in wage levels between 1969 and 1971, uranium industry wage earnings appear favorable, relative to earnings in general in the state.

Earnings by type of job within the uranium industry appear in Table 11. Laborers, underground miners, and laboratory technicians were at the bottom of the annual mean and median earnings scales. Although hourly wages of underground miners were higher than the industry average, underground miners in the Crooks Gap area were receiving no overtime work at the time our survey was conducted.

Electric shovel and heavy equipment operators, truck drivers, maintenance men, and instrument men received the highest wages and earnings in the industry (Table 11). Electric shovel operators constituting a rather small group, stood at the top in terms of hourly wages ($4.53). Instrument men, of whom there were only seven in the survey, followed at $4.04 per hour.

In general, what might be considered competitive yearly earnings were observed in those job categories in which either open pit mine equipment operation or mine equipment maintenance is involved. Hourly wages were similar in mill maintenance and underground miner categories, but less overtime pay was received, keeping yearly earnings somewhat lower. While weekly overtime in several job categories ranged from 5 to 10 hours, up to 25 hours were put in by some individuals in heavy equipment operator and truck driver categories.

Table 11. Gross yearly earnings by job category in the Wyoming uranium industry (1971).

Job category	Gross yearly earnings		Mean hourly wages
	Mean	Median	
	(dollars)	(dollars)	(dollars)
Electric shovel operator	12,300	11,900	4.53
Heavy equipment operator	10,800	10,600	3.88
Truck driver	10,600	10,600	3.84
Heavy equipment operator or truck driver	12,600	12,600	3.73
Mine maintenance man	11,200	11,400	3.83
Instrument man	11,400	11,800	4.04
Mill operator	9,000	8,900	3.63
Mill maintenance man	9,200	9,200	3.82
Warehouseman	9,700	10,000	3.53
Laboratory technician	8,300	8,300	3.25
Ore control man	9,100	9,100	3.40
Underground miner	8,000	7,800	3.82
Laborer	8,000	8,300	3.20
All categories	9,959	10,200	3.73

Earnings by age

Highest gross yearly earnings were observed in the 26-35-year age category (Table 12). The 36-50-year category followed closely in yearly earnings, while the 18-25 and over 50 categories exhibited earnings slightly below the industry average. Age is often associated with experience and tenure, and hence with higher earnings. However, the higher paying uranium industry jobs—heavy equipment operation, for example—place a premium on men in their physical prime and with a few years of experience. A man in his late 20's or early 30's often fits this description.

Also important to an understanding of the age-earning relationship is the fact that the bulk of the industry's workers were under 50 years of age. (Refer back to Table 5.) Thus, while age and time on the job were positively correlated,[9] the effect of age and associated experience on earnings may have been somewhat "lost" in the aggregate age categories utilized.

Earnings by education and training

Education and vocational-technical training are two additional variables that might be hypothesized to affect earnings within the uranium industry. Tables 13 and 14 present evidence regarding these relationships.

Formal education appears to have had little or no influence on earnings in the hourly-wage portion of the uranium industry work force (Table 13). Earnings were similar among all education groups, except for those having 16 or more years of education. Little meaning can be attached to the latter case, however, as less than 2% of the work force had that much formal education. This lack of a relationship between education and earnings should not be surprising, given the nature of jobs in the uranium industry. Those skills that are required are normally not emphasized in the formal education process.

Personnel managers indicated that they do attach some importance to a high school degree, but care little about formal education beyond that level in potential employees. A high school degree is apparently regarded as one possible indication of the native ability to perform whatever "administrative" tasks might be called for. The fact that earnings of those employees with less than 12 years of education are quite similar to earnings of those with 12 or more may imply that experience is a fairly good substitute for formal education in this industry.

Limited evidence on the relationship between vocational training and earnings is presented in Table 14. This table should be interpreted with extreme caution, however, as only 89 of 1,059 industry employees were known to have had any vocational training (Table 7). Bearing this in mind, one can note that those with from 1 to 6 and 7 to 12 months of vocational training had slightly higher earnings than those with no vocational training. Of the 89 employees known to have had vocational training, 70 were either in the 1 to 6 or 7 to 12-month categories.

Although these data are certainly inconclusive, it was indicated previously in the section on "manpower needs" that vocational training may be advantageous in particular job categories. Vocational training in the maintenance area was noted in this regard.

Table 12. Gross yearly earnings by age group in the Wyoming uranium industry.

Age group	Mean gross yearly earnings
(years)	(dollars)
18-25	9,392
26-35	10,270
36-50	10,032
Over 50	9,869
Age unknown	10,165
All age groups	9,959

Table 13. Gross yearly earnings by formal education in the Wyoming uranium industry.

Formal education	Mean gross yearly earnings
(years)	(dollars)
0- 8	9,828
9-11	9,995
12	9,911
13-15	9,999
16 or more	8,942
Education unknown	10,085
All categories	9,959

[9] Tenure and turnover are treated later in this report.

Job Tenure

Firm personnel managers indicated employee turnover was fairly high—ranging from around 4 to 10% per month on a total employee basis. Variables potentially associated with job tenure, or length of time on the job, are, therefore, examined in this section. The focus is on tenure by (1) type of job, (2) age, (3) education, (4) previous place of residence, and (5) race.

Data presented in Table 15 indicate that most (63%) uranium industry employees had been with their present employers for 24 months or less at the time the survey was conducted. The Shirley Basin area had the largest percentage of employees with tenure of 24 months or less—72%. Approximately 55% of the Crooks Gap and Gas Hills employees had been employed for 24 months or less. Since firms in the Shirley Basin area have been in operation for a shorter period of time than firms in the Crooks Gap and Gas Hills areas, shorter employee job tenure might be expected there. As firms become more established, both jobs and employees probably become somewhat more "permanent."

Table 14. Gross yearly earnings by vocational training in the Wyoming uranium industry.

Vocational training	Mean gross yearly earnings
(months)	(dollars)
None	9,918
1- 6	10,532
7-12	10,366
13 or more	9,818
Vocational training unknown	10,129
All categories	9,959

Table 15. Job tenure of hourly wage workers in the Wyoming uranium industry, by uranium area.

Time with present firm	Uranium area			All areas
	Shirley Basin	Crooks Gap	Gas Hills	
(months)	(%)	(%)	(%)	(%)
0- 6	29.9	33.0	22.8	28.0
7-12	24.3	9.5	14.4	18.3
13-24	17.9	11.7	18.3	17.0
25-60	24.7	30.7	24.8	25.8
61-120	2.2	9.5	11.3	6.6
More than 120	1.0	5.6	8.4	4.3
Total	100.0%	100.0%	100.0%	100.0%

Tenure by type of job

Average job times by type of uranium job are given in Table 16. Those categories for which job tenure exceeded the industry average (28 months) were the electric shovel operator, instrument man, mill operator, mill maintenance man, and underground miner categories. The mill operation and maintenance jobs, in particular, appear to have provided "relatively" long term employment to quite a number of individuals.

Employees in four job categories had job times substantially below the industry average: warehouseman, laboratory technician, ore control man, and laborer categories. Job tenure averaged less than 1½ years in each of these categories. These jobs tend to be filled by younger workers (Table 5) and may, to some extent, be considered "temporary" jobs for many individuals. Men employed in the laborer category, for instance, can sometimes move up to higher paying positions within the industry; many probably intend their employment to be only on a short term basis, perhaps while they are between school terms or searching for better employment.

Table 16. Job tenure of hourly wage workers in the Wyoming uranium industry, by job category.

Job category	Employees*	Mean time with present firm
	(No.)	(months)
Electric shovel operator	18	35
Heavy equipment operator	216	25
Truck driver	68	26
Heavy equipment operator or truck driver	28	24
Mine maintenance man	222	25
Instrument man	7	77
Mill operator	94	47
Mill maintenance man	104	47
Warehouseman	25	14
Laboratory technician	6	15
Ore control man	43	9
Underground miner	78	31
Laborer	123	10
Total	1,032*	
All categories		28

* Information on job tenure was unknown for an additional 27 employees, most of whom were in the underground miner category.

Tenure by age

Age-tenure relationships followed the pattern one would generally expect (Table 17). Younger employees, on the average, had been with their present uranium firms shorter periods of time than had older employees. More than 70% of those in the youngest age group (18-25) had less than 1 year with their present firm, as compared to approximately 20% of those in the oldest age group (over 50). While less than 10% of the 18-25 year olds had more than 2 years of job tenure, 50% of the 36-50 year olds and 68% of those over 50 had more than 2 years on the job.

Table 17. Job tenure of hourly wage workers in the Wyoming uranium industry, by age.

Time with present firm	Age group (years)			
	18-25	26-35	36-50	Over 50
(months)				
0-12	72.6%	44.7%	33.3%	20.6%
13-24	17.7	18.3	17.1	11.1
25-60	9.4	32.0	31.7	33.3
More than 60	0.4	5.1	17.9	34.9
Total*	100.0%	100.0%	100.0%	100.0%

* Some totals do not add to 100.0, due to rounding.

Tenure by education

The inverse relationship between formal education and job tenure in the uranium industry is highlighted in Table 18.[10] The higher the education, the higher the percentage of workers with job tenure of 24 months or less. Education and age were most likely interrelated; older workers, who also probably had less education than younger workers, had longer job tenure.

We have observed thus far that formal education had little or no relationship to earnings and was inversely related to job tenure. This seems to imply that capable employees with limited formal education can fare reasonably well—relative to employees with slightly more education—in the uranium industry in terms of both earnings and job security.

Table 18. Job tenure of hourly wage workers in the Wyoming uranium industry, by education.

Time with present firm	Formal education (years)			
	8 or less	9-11	12	Over 12
(months)				
0-24	36.9%	56.0%	67.7%	77.1%
More than 24	63.1	44.0	32.3	22.9
Total	100.0%	100.0%	100.0%	100.0%

[10] Chi-square tests indicated this inverse relationship was significant at the 5% level.

Tenure by previous place of residence

Job tenure-previous place of residence relationships are tabulated in Table 19. Employees originating "within local labor markets" are those whose place of residence prior to joining their present firm was within a 60-mile radius of the pertinent mining-milling site.

No clear patterns emerge from the data in Table 19. Slightly higher percentages of out-of-state employees than in-state employees had been on the job 1 year or less. However, throughout the table, percentages neither increase nor decrease continuously from "local" labor markets to labor markets farthest away (other states). Overall, differences in job tenure by previous place of residence were not found to be statistically significant.[11]

Tenure by race

As noted earlier in this report, only limited racial data on employees was available. However, it is interesting to note that of the eight Indian employees identified, six had been employed more than 2 years. This compares very favorably with employees as a whole (Table 15). In contrast, personnel managers reported little success in hiring and retaining Indians. Although Indians were reported to be capable employees, personnel managers indicated that most had not chosen to remain very long.

Table 19. Job tenure of hourly wage workers in the Wyoming uranium industry, by previous place of residence.

	Previous area of residence			
	Wyoming		Out-of-state	
Time with present firm	Within local labor markets*	Elsewhere in state	Bordering states	Other states
(months)				
0-12	46.8%	40.0%	53.9%	50.9%
13-24	17.1	17.0	16.3	15.5
25-60	25.5	32.2	18.4	25.0
More than 60	10.6	10.8	11.4	8.6
Total	100.0%	100.0%	100.0%	100.0%

* This category includes each employee whose place of residence prior to joining his present firm was within a 60-mile radius of the pertinent uranium mining-milling site.

[11] A chi-square test failed to indicate statistical significance at the 5% level.

Employment Information

Employment information channels were given some attention in this study because of their importance in linking human resources to employment opportunities. (Refer back to Figure 1.) Questions regarding sources of employment information were asked on both the uranium firm questionnaire and the questionnaire administered to personnel at local Employment Security Commission (ESC) offices.

ESC offices in Casper, Riverton, and Lander reported they had been active through the years in referring potential employees to uranium firms in the Shirley Basin, Gas Hills, and Crooks Gap areas.[12] However, it is not clear just how successful ESC referrals have been in obtaining employment with uranium firms. Firm personnel managers generally indicated that only a small percentage of their "hires" resulted from ESC referrals. Estimates by personnel managers ranged from 0 to 15-20%.

Most uranium industry employment information has apparently come through company recruiting, such as newspaper advertising, and through informal channels, such as "word of mouth." There has been some firm recruiting at vocational-technical schools. At least one firm has sent job listings to minority group representatives, including officials on the Wind River Indian Reservation.

The firm which recently began its uranium operations in Converse County held a series of town meetings in the local area before it began hiring. New job opportunities with the firm were explained at these meetings. As a result of these town meetings, listings with ESC offices, and informal information channels, the firm reportedly received far more job aplications than it had openings.

Since uranium operations have been ongoing in three of the four Wyoming areas for some time now, it is unlikely that there is any serious lack of uranium "job information" on the part of local people. Procedures similar to those used by the new firm in Converse County might well be seriously considered in other cases of new development or major expansion, however. In this way, local people—particularly the underemployed or unemployed—might have every opportunity to apply and compete for new positions.

[12] Since 1972, all firms holding federal contracts have been required by a federal Executive Order to list job openings with ESC offices [8]. Included are any uranium firms holding federal contracts.

Summary and Implications

Uranium industry employment in Wyoming has been projected to expand from less than 2,000 workers in the 1960's to around 9,000 by the year 2000. The industry is expected to be a major employer within the state's minerals sector at that time. This projected employment has important ramifications for manpower and rural development policies in Wyoming. An understanding of labor force participation patterns in the industry is a necessary prerequisite to intelligent formation of such policies.

The objectives of this study were as follows:

(1) to relate types of employment in Wyoming's uranium mines and mills to work force participants;

(2) to determine employee earnings, and to relate those earnings to employment categories and employee characteristics;

(3) to examine employee tenure and turnover patterns; and

(4) to describe employment information channels being utilized in the industry.

Data were collected on 1,059 male uranium industry employees, constituting a large proportion of the industry's hourly-wage work force in Wyoming. Employee data covered six of the eight firms with uranium mining or milling operations in the state in 1972.

Uranium industry workers averaged 34.6 years in age, with one-third appearing in the 26-35 age category. Although American Indians constitute a sizeable minority group near two of the study areas, relatively few have apparently participated in uranium industry employment. The formal education level of the industry's workers—11.5 years—compared favorably with that of adult males in the state as a whole. Most workers had apparently received no vocational-technical training other than that received on-the-job.

A fairly wide range of industries and occupations were represented in "immediately prior employment" of workers. A large proportion came to their present employment from other mining or construction jobs, however. The agriculture, forestry, and fisheries industrial category was the source of immediately prior employment for 8% of the industry's workers. Slightly more than 5% were previously in "farm" occupational categories.

Most frequently expressed "manpower needs" were in the areas of heavy equipment operation and mine and mill maintenance. Management apparently places a premium on experience in heavy equipment operation, though vocational training may be of some use. Vocational training appears to have greater potential in preparing workers for various types of maintenance positions in the industry.

Median employee earnings of $10,200 in 1971 appear favorable in comparison to state-wide median individual and family incomes in Wyoming. Long hours of hard, physical work were often involved, however. Overtime earnings counted substantially in the total yearly earnings of many employees. Downturns in the industry could cut seriously into those overtime earnings. Furthermore, employee transportation costs have not been accounted for in this analysis. Although subsidized company transportation or transportation compensation is provided in some cases in the industry, many employees do incur significant monetary and non-monetary (leisure time foregone) commuting costs.

The highest industry earnings were received by electric shovel and heavy equipment operators, truck drivers, maintenance men, and instrument men. By age, those in the 26-35-year category received the highest annual earnings. Formal education appeared to bear little or no relation to earnings of workers within the industry.

Employee turnover in the uranium industry has been fairly high. More than 60% of the industry's workers had been employed with their present firms for 2 years or less at the time data were collected. Men employed in the uranium mills as operators and maintenance men averaged 47 months on the job, considerably longer than the industry average of 28 months. Although age and time on the job tended to increase together, formal education was inversely related to time on the job.

Uranium industry employment information in local labor markets did not appear inadequate. Although Employment Security Commission offices have played a role in providing uranium employment information, company recruiting and informal information channels have perhaps been more important. Town meetings—used by the newest Wyoming uranium firm to advertise job

openings—may merit serious consideration in other new developments or major expansions.

Figure 1 was utilized in the introduction of this study to conceptualize ways by which employment and earnings opportunities of rural people might be improved. Given the nature of uranium industry employment, it would appear that future growth in the industry has potential for positively affecting the employment opportunities of local persons with limited formal education. Further, more detailed investigation of vocational-technical training in maintenance areas and in heavy equipment operation as an investment in human capital to help take advantage of these employment opportunities is warranted.

However, expected employment declines in the uranium industry by the end of this century must be given serious consideration in plans for manpower training. Training that is too narrow —that does not equip men to move into other industries if and when the uranium industry contracts—could later prove to be a disservice to the very persons it is intended to help. The time horizon for uranium employment in the state perhaps calls for training and retraining of middle-aged men for certain positions, rather than young men with their entire working lives ahead of them.

Regarding the functioning of manpower markets (Figure 1), a lack of information in local areas on current uranium industry employment opportunities was not apparent. However, as indicated immediately above, a longer time perspective is required. A program in which employment projections in Wyoming's uranium and other natural resource industries—by precise job category, by time period, and by county—are made available to high school youth and others should be given serious consideration. This would facilitate informed decision-making by individuals regarding location and training investments which may be under consideration.

A perspective broader than the uranium industry is also required. The projected decline in state uranium employment after the year 2000 highlights this necessity. What will happen to uranium industry employees as the state's minerals economy evolves? It is possible that individuals will be equipped and able to move into other areas or mineral industries then experiencing expansion. To make more than conjectural statements, however, projected state employment in the various natural resource (and other) industries and the nature of jobs in those industries must be examined conjunctively. Comprehensive manpower planning of that nature requires labor force participation studies such as that reported herein, as well as detailed projections of employment opportunities.

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