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LABOR MARKET TRENDS FOR NUCLEAR ENGINEERS THROUGH 2000

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ABSTRACT

Information is provided on the past, current, and expected future trends in the labor market for new graduates in nuclear engineering. Data are presented on trends in degrees and available supplies of new graduates in nuclear engineering, employment changes, job openings for new graduates, salaries for new nuclear engineering graduates in comparison to other fields, and placement activities for recent graduates.

For the time period 1983 through 1989, the available supply of new graduate nuclear engineers was somewhat less than the demand for new graduates. During 1990 through 1993, the supply and demand for new graduates was basically in balance as employment growth slowed and the decrease in the annual number of new graduates slowed and then increased in 1993.

Currently, the labor market appears to have fairly balanced supply and demand for new graduates. Information on the placement of new graduates indicates that most are still finding employment in their field, but there are fewer job opportunities and the job search is taking longer. Also, it appears that more graduates are entering graduate school.

Total employment of nuclear engineers is expected to decrease slightly over the next few years. Large numbers of job openings will still exist as the need to fill vacant positions resulting from workforce attrition will more than offset the small decrease in total employment. For 1994 through 1996, it is quite likely that the supply of new graduates will exceed the number of job openings available for new graduates. During the latter part of the decade, it appears that the supply of and demand for new graduate nuclear engineers will again be closer to being in balance.

INTRODUCTION

Throughout most of the 1980s, both private organizations and government agencies were concerned about the availability of an adequate supply of qualified nuclear engineers. This concern was primarily the result of a number of nuclear engineering academic programs being eliminated coupled with a continuous decline in graduate and undergraduate enrollments and degrees. By the early 1990s, the number of degrees and available supply had declined to new lows, but cutbacks in funding for the nuclear weapons program and nuclear energy R&D, and in hiring by the electric utility industry, offset in large measure the declining supply. Recently, concerns about environment and waste management and about nuclear safety have again generated questions about the adequacy of supply of qualified personnel for nuclear energy activities.

This report briefly examines the nuclear engineering labor market. Trends in employment, new graduates, job openings, and salaries are reviewed as a basis for understanding the current labor market. This review is then used as a basis for assessing future employment needs and new graduate supply to provide an outlook for future labor market conditions through 2000.

EDUCATION AND EMPLOYMENT TRENDS, 1983-1993

Total Number of Degrees and Total Employment

Between 1983 and 1993, employment of nuclear engineers in civilian positions increased by 18 percent to a level of 11,100.[1] (See Figure 1.) There was a very slight decline in employment between 1991 and 1993. During the same 10-year period, the total number of new graduates (bachelor's plus master's plus doctorates) declined continuously through 1992 and then increased somewhat between 1992 and 1993. Figure 2 compares trends in total number of nuclear engineering degrees with the trends in the estimated available supply of new graduates (defined as those new graduates available for U.S. civilian employment).[2]

For the period 1983 through 1989, an average of 946 degrees were awarded annually; however, for the 4-year period from 1990 to 1993, the annual average dropped to 766 degrees, a decline of almost 20 percent.[3] The number of new graduates available for civilian employment declined by a larger amount—from an annual average of 578 for 1983-1989 to an annual average of 432 for the 1990-1993 period, a decline of 25 percent.

Job Openings and New Graduate Supply

Job openings for new graduates result from growth in employment and from replacement needs for nuclear engineers who retire, die, leave the labor force, or switch occupations (e.g., moving into business management, university administration, or sales work). Although some job openings for nuclear engineers are filled by workers moving in from other engineering or science occupations or by persons returning to the nuclear engineer occupation, the greatest number by far are filled by new graduates. Actual labor force movements are complex and

Figure 1. Nuclear Engineers in Civilian Employment, 1983-1993

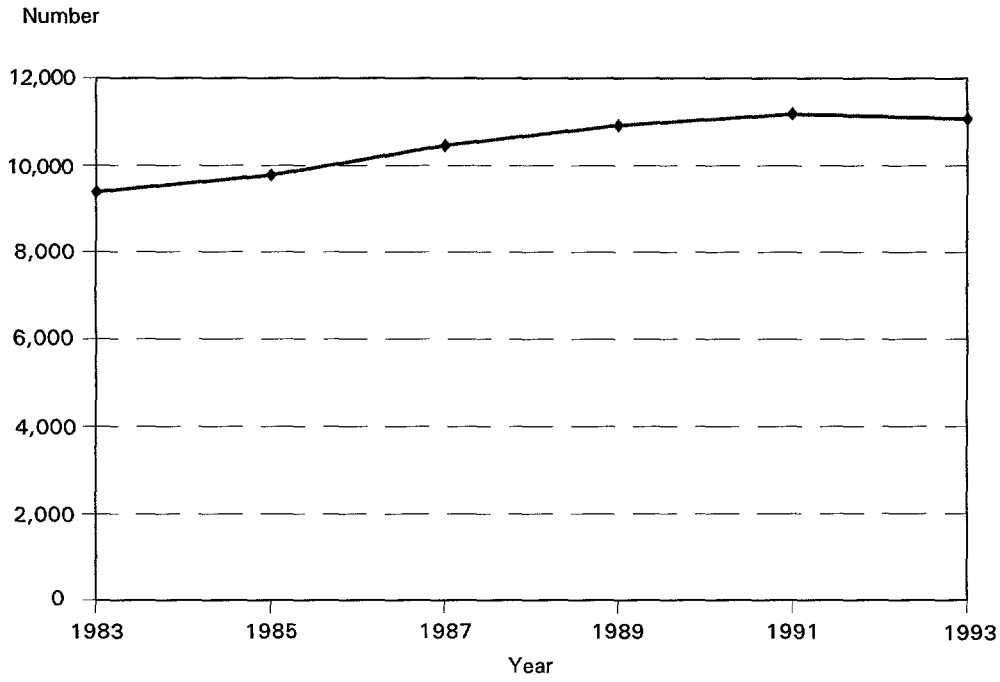
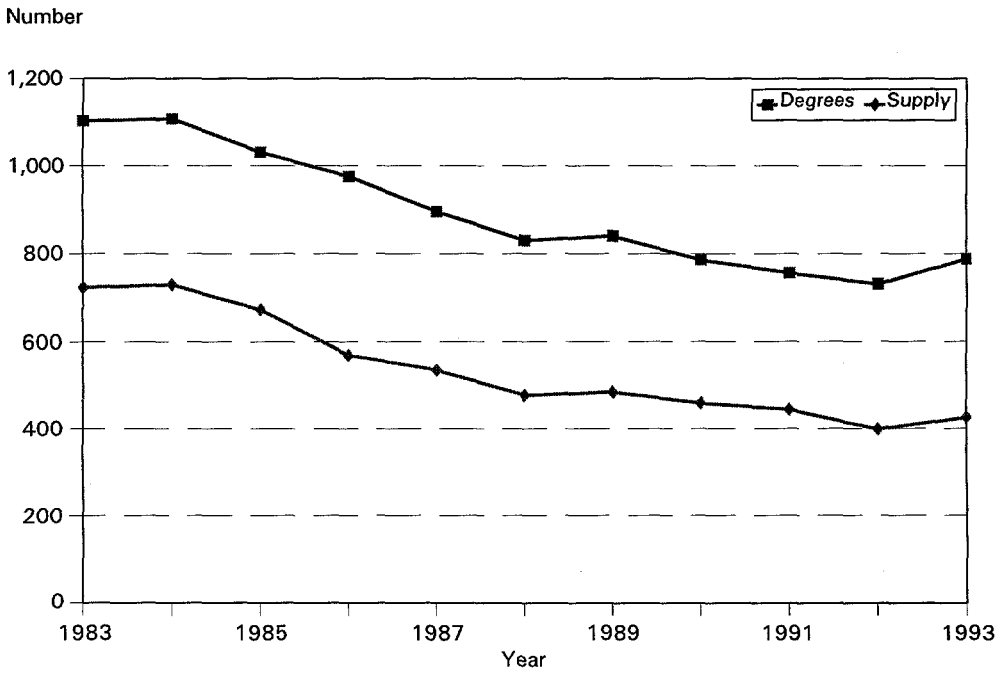


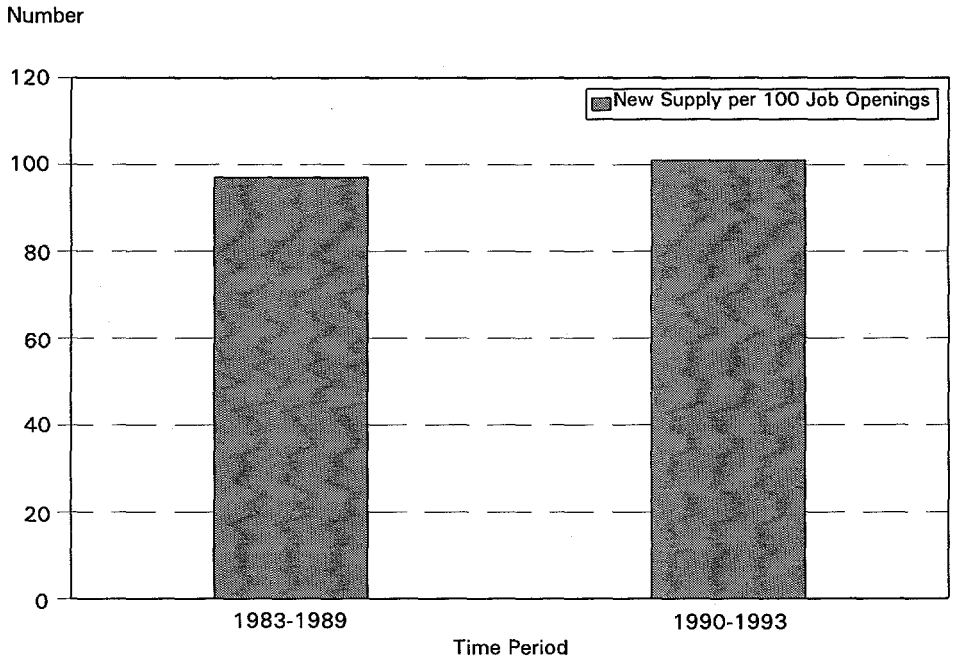
Figure 2. Total Nuclear Engineering Degrees and Supply of Graduates Available for Employment, 1983-1993



detailed data on occupational mobility and job openings do not exist. However, net replacement needs (the number to be filled by new graduates) can be estimated using methods developed by the Bureau of Labor Statistics as adjusted by the Oak Ridge Institute for Science and Education.[4]

For the period 1983-1993, estimated job openings (for growth and replacement) for new graduates averaged about 540 positions annually, while the annual number of graduates available for civilian employment averaged 520. On average, there were approximately 97 graduates available for each 100 job openings during this decade. For 1983-1989, the average was 95 graduates per 100 job openings but increased to an average of 101 for 1990-1993. (See Figure 3.) Thus, the data indicate a modest shortage in the supply of new graduates entering the labor market throughout the 1980s. This modest supply shortage was eliminated in the early 1990s with a balance between job openings and the available supply of new graduates.

Figure 3. Estimated Annual Available Supply of New Graduate Nuclear Engineers per 100 Job Openings for Selected Time Periods

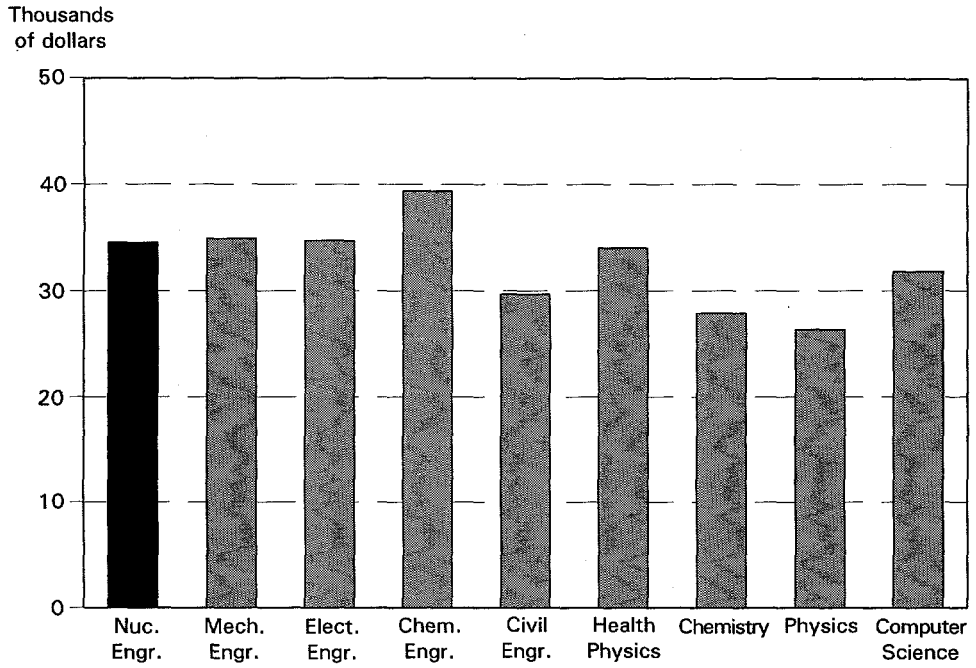


CURRENT LABOR MARKET SITUATION

Nuclear Engineering Salary Offers

One indicator of labor market conditions is salary trends. Surveys of starting salaries revealed that in 1994 the average starting salary for new bachelor's degree nuclear engineers was $34,500. This was fairly comparable with large engineering fields such as mechanical and electrical/electronic engineering, but was higher than civil engineering and lower than chemical engineering. (See Figure 4.) The average bachelor's level starting salary for nuclear engineers was slightly higher than that for bachelor's level health physicists (a nuclear-related technical

Figure 4. Average Annual Starting Salaries for B.S. Level Nuclear Engineers and Other Scientists and Engineers, 1994



specialty), but was considerably higher than for most other science fields.[5] Starting salaries for new nuclear engineering graduates increased throughout the 1980s and early 1990s although the rate of increase slowed considerably over the past two years.

In 1994, at the master's degree level, average starting salaries for new nuclear engineering graduates was just over $38,000, an increase over the past few years, but lower than for all large engineering fields except civil engineering. As was true at the bachelor's level, starting salaries for nuclear engineers at the master's level, were slightly higher than for health physicists.[6]

Placement of New Graduates

Contacts with 22 university and college nuclear engineering programs during the late summer and early fall of 1994 revealed a mixed situation for 1994 graduates seeking employment, especially for bachelor's degree graduates. Although reports of cutbacks in funding for nuclear-related activities had been very prevalent over the past year, there were no reports of widespread unemployment or nonprofessional employment for new graduates. However, a large number of schools mentioned that there appeared to be far fewer job opportunities and less recruiting than in recent years. Successful job searches were taking much longer than in the past, and there appeared to be an increased flow of bachelor's degree graduates going to graduate school. There were indications of relatively more job opportunities for master's degree graduates than at the bachelor's degree level, although several schools reported more difficulties in master's level job placement than existed a year ago.

American Nuclear Society Employment Exchange

Contact with staff of the American Nuclear Society (ANS) regarding employment placement activities at their national meetings reveals what appears to be a relative lessening of available job opportunities. For example, at the most recent meeting in November 1994, there were 11 companies recruiting and over 200 job resumes submitted. In comparison, at a meeting six months earlier, there were 16 companies recruiting and 116 job resumes filed. A year earlier, about 25 organizations had come to the national meeting seeking prospective employees. Further, there is some anecdotal information indicating that some of the employers at the recent ANS meetings were building inventories of qualified applicants for possible future hiring rather than actively recruiting for current employment.

Institute of Nuclear Power Operations Data

The Institute of Nuclear Power Operations (INPO) completed the biennial survey of nuclear-related employment in member utilities as of January 1, 1993.[7] Data obtained revealed that 3.9 percent of all nuclear and reactor engineering positions were vacant, a substantially lower percentage than existed two years earlier in 1991. The turnover rate in 1992 for nuclear and reactor engineers (for existing utilities—not intra- nor inter-industry movements) was 2.1 percent, by far the lowest rate that had occurred at any time during the past 10 years.

Office of Personnel Management, U.S. Government

In February 1993, the Office of Personnel Management reauthorized nuclear engineers as eligible for "special salary rates." This allowed federal government agencies to pay higher than the general scheduled salaries to assist in recruitment and retention of nuclear engineers.[8]

Summary: Current Labor Market Balance Between Supply and Demand

Currently, the labor market for nuclear engineers has relatively fewer job opportunities for new graduates than in the past, and graduates are having to search longer before securing jobs. However, the labor market is probably still close to being in balance rather than having a large surplus of new graduates. This conclusion is supported by the data trends and information for nuclear engineers on starting salaries, job placement activities, vacancy and turnover rates in nuclear electric utilities, and the actions by the U.S. Office of Personnel Management.

FUTURE LABOR MARKET TRENDS

Future Employment Trends

As Table 1 shows, nuclear engineers are employed in a wide variety of nuclear-related activities. In 1993, employment was concentrated in three segments—reactor operations and maintenance; reactor and facility design and redesign/betterment/backfit (RBB); and government.[9]

Overall, nuclear engineering employment is expected to decline about 4 percent, from 11,100 to 10,600 between 1993 and 2000. It is anticipated that almost all of this employment decline will occur in DOE-funded

Table 1. Employment of Nuclear Engineers by Segment, 1993

Primary Segment	Number[1]	Percent
Weapons Development	370	3.4
Waste Management & Decommissioning	370	3.3
Reactor/Facility Design/RBB	2,070	18.6
Reactor Operations & Maintenance	2,610	23.5
Non-University Research & Development	780	7.0
Fuel Cycle	110	1.0
Government	3,660	33.0
University	500	4.5
All Other, Miscellaneous	630	5.7
TOTAL	11,100	100.0

[1] Numbers rounded to the nearest ten.

NOTE: These segments are by primary activity of the employing establishment.

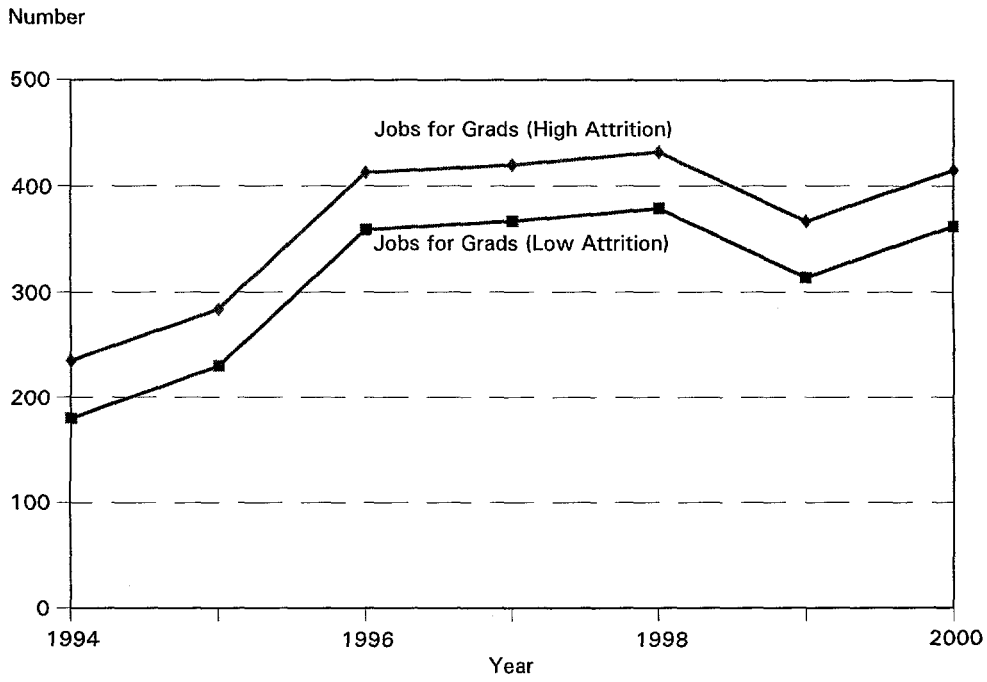
activities. Most of this decrease is expected in DOE-funded R&D. The decline in nuclear energy R&D plus some additional declines in weapons development employment will more than offset the slight growth expected in some other segments. Little employment change is anticipated in the civilian nuclear electric power industry although some modest increases may occur near the end of the decade. The National Research Council Committee on Nuclear Engineering Education issued a 1990 report in which the "best estimate" scenario indicated that nuclear electric power would compose 10 percent of all incremental capacity through the year 2005 and 20 percent through 2010.[10]

From 1994 through 2000, the anticipated decline in the number of nuclear engineering positions is expected to be more than offset by job openings created by attrition of nuclear engineers who retire, switch occupations, etc. The replacement needs due to attrition are expected to generate a net demand for new graduates averaging 310 to 370 annually over the period 1994-2000. (See Figure 5.) The lower number is based on a replacement rate of 3.5 percent that has been considered a normal attrition rate for nuclear engineers over the past decade. The higher number is based on a replacement rate of 4 percent, which would result in many more job openings and may occur because of an aging population within the nuclear engineer work force.

Future Education Trends

During 1983 to 1993, the total number of new nuclear engineering degrees dropped by almost 30 percent, and bachelor's level nuclear engineering degrees fell 37 percent. During the same period, it is estimated that all bachelor's degrees in science and engineering declined at only about half the rate for nuclear engineering degrees. Recent estimates of trends in all bachelor's degrees in science and engineering for the period 1994-2000 indicate a

Figure 5. Job Openings for New Nuclear Engineering Graduates, 1994-2000



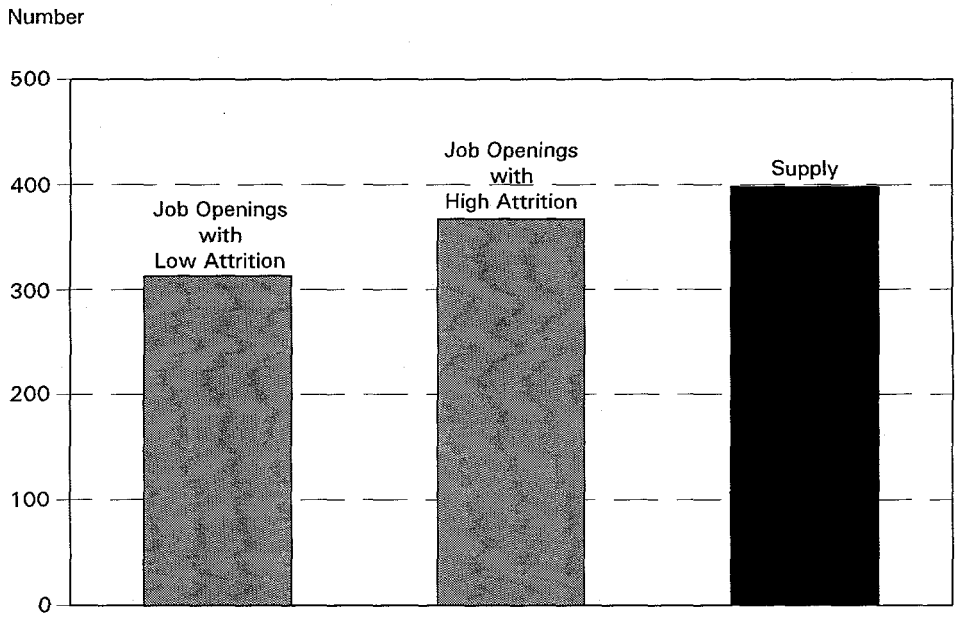
further decline is expected.[11] Assuming that total nuclear engineering degree awards will similarly decline, then the total will drop from 788 in 1993 to an annual average of approximately 710 in the 1994-2000 period. Using estimates for the most recent years of the available supply of new graduates for employment, it appears that the average annual number of graduates available for employment will decline from about 430 to approximately 400.

Future Job Openings and Supply of New Graduates

The projected modest employment decline for nuclear engineers from 1994 to 2000 means that virtually all job openings for new graduates during this period result from replacement needs. Figure 6 shows job openings for new graduates at two different attrition rates—a lower rate of 3.5 percent and a higher rate of 4 percent. (It should be noted that the attrition rate for nuclear engineers is somewhat higher than for all engineers because of indications that a higher average age exists among nuclear engineers.)

For the entire period 1994-2000, projected job openings compared with projected available supply of new graduates, based on both attrition levels, indicates some oversupply although much less so at the higher attrition rate. The potential oversupply is much more likely during 1994-1996. For 1997-2000, the labor market appears to be much more balanced, and there may even be a slight shortfall if the higher attrition rate occurs—more so if the supply declines more than currently estimated. Specifically, for 1997-2000, at the higher attrition rate, there is an estimated ratio of 98 new graduates available for employment per 100 job openings.

Figure 6. Average Annual Job Openings and Available Supply of Nuclear Engineers, 1994-2000



It should be kept in mind that the supply of new graduates includes a relatively sizeable number of foreign students, especially at the graduate degree level. While in the past foreign students remaining in the United States for employment comprised about 10 percent of new degree supply, it is likely that in the future fewer of these persons will be able to obtain permanent visas and jobs in this country. This would result in a lower supply in relation to projected job openings. Further, there may be some additional job opportunities arising for new nuclear engineering graduates in such areas as environmental engineering, waste management and radiation protection.

Current Support for Education

For more than a decade, a variety of programs have been undertaken to enhance the number and quality of students in nuclear engineering and science programs. In the private sector, the U.S. nuclear power industry, through the National Academy for Nuclear Training Assistance Program, has provided both undergraduate and graduate fellowships for students in nuclear engineering programs. Private companies and the Electric Power Research Institute (EPRI), which is funded by electric utilities, provide research funds for nuclear science and engineering at universities. In addition, several utilities have assisted universities in setting up laboratories and in providing equipment and curriculum for nuclear engineering programs. In the public sector, the Department of Energy continues to provide fellowships and scholarships in nuclear engineering, fusion and civilian waste management, as well as in health physics. There is also a Utility/DOE Matching Grant Program whereby major utilities provide funds to five large universities (with matching funds from DOE) for a variety of needs (student support, equipment needs, etc.) related to nuclear engineering. The U.S. Nuclear Regulatory Commission continues to support graduate education in nuclear science and engineering by encouraging new hires to enroll in graduate study.

CONCLUSIONS

Although employment opportunities for nuclear engineers in both the private and public sectors were fairly widespread during the 1980s, the demand for and the supply of new nuclear engineering graduates were basically in balance by the early 1990s. However, based on recent trends, even at the highest possible rate of attrition, the number of potential job openings will be somewhat less than the average available supply of new graduates during the remainder of the 1990s. If the supply of new degrees should decline more than currently estimated, there could be an insufficient number of new graduates available as the end of the decade approaches.

ENDNOTES

1. The employment data are from the biennial U.S. Department of Energy, "Survey of Occupational Employment in Nuclear-Related Activities," conducted by the Oak Ridge Institute for Science and Education (ORISE). These survey data are augmented by estimates of university faculty developed by ORISE and by data from the Institute of Nuclear Power Operations (INPO).

2. New graduates available for employment are estimated by subtracting from total new graduates those new graduates who join the military, undertake further study, or accept foreign employment.

3. The data are from the annual U.S. Department of Energy "Survey of Nuclear Engineering Enrollments and Degrees" conducted by the Oak Ridge Institute for Science and Education.

4. U.S. Department of Labor, BLS, Office of Employment Projections, "Total and Net Occupational Separations: A Report of Recent Research," (Washington, D.C., 1991); and Michael G. Finn and Joe G. Baker, Phase I: A Comment on Occupational Separation and Replacement Needs for Engineers (Oak Ridge, TN: ORISE, 1992).

5. Oak Ridge Institute for Science and Education, Salary Information for Nuclear Engineers and Health Physicists, October 1994 (Oak Ridge, TN, December 1994); and College Placement Council, Salary Survey, July 1994 (Bethlehem, PA: 1994).

6. Oak Ridge Institute for Science and Education, Salary Information for Nuclear Engineers and Health Physicists, October 1994; and College Placement Council, Salary Survey, July 1994.

7. Institute for Nuclear Power Operations, 1993 Survey of Nuclear-Related Employment in the United States Electric Utilities (Atlanta, GA: INPO, 1993).

8. Office of Personnel Management, "FPM Supplement," February 1993, Table 422.

9. See endnote (1).

10. National Research Council, Committee on Nuclear Engineering Education, U.S. Nuclear Engineering Education: Status and Prospects (Washington, D.C.: National Academy Press, 1990).

11. According to the Higher Education Research Institute, University of California at Los Angeles, the number of college freshmen interested in majoring in engineering in 1994 was the lowest reported in 19 years. Also, see Michael G. Finn and Joe G. Baker, Assessing the Adequacy of Future Science and Engineering Degree Awards (Oak Ridge, TN: ORISE, 1992).