Federal Scientists and Engineers: 1989-93

Special Report

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FOREWORD

This report has two main objectives: (1) it draws together general and statistical information that shed light on the character and status of Federal scientists and engineers by presenting a new body of statistical data, and (2) it examines the data to determine the character of Federal scientific and engineering employment over the 1989-93 period.

The report is divided into eight sections and provides a descriptive analysis of various characteristics of Federal scientists and engineers, including the agency of employment, primary work activity, educational attainment, age, salary, and geographic patterns of the Federal science and engineering (S&E) workforce.

Finally, the report presents data on Federal scientists and engineers based on a new occupational classification system developed within the National Science Foundation's Division of Science Resources Studies on the U.S. science and engineering workforce. The new system allows our readers to compare data on the occupations of Federal scientists and engineers with occupational data collected from other NSF surveys of the U.S. science and engineering workforce.

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EXECUTIVE SUMMARY

Employment of Federal scientists and engineers rose from 185,623 in 1989 to 196,908 in 1993, 6.1 percent growth. U.S. scientists and engineers employed in science and engineering (S&E) jobs increased an estimated 10.6 percent. Overall U.S. civilian employment during 1989-93 increased by 1.7 percent. In 1989, the Federal S&E workforce consisted of 89,530 scientists and 96,093 engineers. By 1993, scientists (101,348) surpassed engineers (95,560).

During 1989-93, among Federal scientists, social scientists had the largest increase (17.8 percent), followed by life scientists (16.6 percent), computer and mathematical scientists (15.4 percent), and physical scientists (3.9 percent). Overall employment of engineers decreased by 0.6 percent during this period. Among the major engineering occupational groups, the employment change ranged from a decrease of
21.3 percent for industrial engineers to an increase of 4.0 percent for electrical, electronics, and computer engineers.

Over the 1989-93 period, the change in Federal S&E employment varied by agency. The largest decrease during the period occurred within the Department of Defense (DOD), where S&E employment decreased by 2.2 percent. In 1993, 46.8 percent of all Federal scientists and engineers were employed by DOD, down from 50.7 percent in 1989. Declining defense spending during 1989-93 paralleled a decrease of S&E employment at DOD. The 4-year employment growth for all other agencies (excluding DOD) was 14.6 percent.

The distribution of work activities of Federal scientists and engineers changed during 1989-93. Scientists and engineers employed in primary work activities associated with defense functions decreased during the period. Scientists and engineers decreased their activities involving design; installation, operations, and maintenance; planning; production; construction; and standards and specifications. Primary work activities showing increasing importance in Federal scientific and engineering employment during 1989-93 included clinical practice, counseling, and ancillary medical practice; teaching and training; scientific and technical information; regulatory enforcement or licensing; natural resource operations; and technical assistance and consulting. Employment of scientists and engineers engaged in research and development showed slow growth throughout the period, but R&D continued to be the largest work activities for the Federal S&E workforce.

The average age of Federal scientists and engineers increased slightly during 1989-93. In 1989, 25.1 percent of the scientists employed by the Federal Government were under the age of 35 and 10.6 percent were 55 or older. By 1993, 22.6 percent of the scientists were under the age of 35 and 11.5 percent were 55 or older. Further, in 1989, 42.1 percent of the engineers were under the age of 35 and 11.5 percent were 55 or older. In 1993, however, only 38.3 percent of the engineers were under the age of 35 and 12.9 percent were 55 or older. Federal scientists and engineers employed in development or design work were likely to be younger than those employed in research.

The number of female scientists and engineers employed in the Federal Government increased by 27.3 percent between 1989 and 1993, from 29,328 to 37,341. By contrast, the number of male scientists and engineers grew by only 2 percent over the same period. Despite higher growth for women, in 1993 women accounted for only 27.3 percent of all scientists and 10.1 percent of all engineers (up from 23.6 percent and 8.6 percent in 1989, respectively).

The number of Federal scientists and engineers who are members of ethnic/racial minority groups rose 18.3 percent between 1989 and 1993, from 26,052 to 30,810. Most of this increase represents growth in the numbers of Asians, which rose from 9,866 to 11,930, or 20.9 percent, during the period. Black scientists and engineers increased by 15.1 percent and Native Americans grew 34.4 percent. Hispanics showed a 19.9-percent increase, rising from 5,331 in 1989 to 6,394 in 1993.

The median annual base salaries of Federal scientists and engineers increased 21.9 percent, from $41,100 to $50,100, during 1989-93. By contrast, the average annual weekly earnings in private nonagricultural establishments rose only 12 percent during the same period.[1] The median salaries for

[1] U.S. Bureau of the Census, *Statistical Abstract of the United States: 1994* (114th edition), Washington, DC, 1994, p. 420.

than those for scientists, and the rise in salaries for engineers (24.5%) outpaced that for scientists (19.1%).

The South Atlantic Region[2] led the country in the number of Federal scientists and engineers: 36 percent of the Nation's federally employed scientists and engineers worked in this region (mostly in Maryland and the District of Columbia, which accounted for 31.5 percent and 24.6 percent of the region's total, respectively). The Pacific Region was the second-largest region, with 16 percent of the total number of Federal scientists and engineers (almost 62.7 percent of the region's Federal scientists and engineers work in California). By contrast, New England was the smallest region, with 3.8 percent of the Federal S&E total. Massachusetts accounted for 44.2 percent of all Federal scientists and engineers in New England.

[2] See table 12 for listing of States within the regions identified in this section.

SECTION 1. EMPLOYMENT OF FEDERAL SCIENTISTS AND ENGINEERS

LEVELS AND TRENDS

Employment of Federal scientists and engineers increased from 185,623 in 1989 to 196,908 in 1993, or by 6.1 percent. Over the same period all U.S. scientists and engineers employed in S&E jobs increased an estimated 10.6 percent. Overall U.S. civilian employment during 1989-93 increased by 1.7 percent (table 1).

Employment trends of the various engineering occupational series were generally negative. Overall employment of engineers decreased by 0.6 percent during 1989-93. Only one major engineering occupational group enjoyed employment growth during the period of analysis—electrical, electronics, and computer engineers, which increased by 4 percent.

Table 1. Federal scientists and engineers by major occupational group: 1989-93

Occupation	1989	1990	1991	1992	1993
Total, All S&E occupations	185,623	189,049	194,726	198,853	196,908
All scientists	89,530	92,467	96,919	101,006	101,348
Computer & mathematical scientists	25,737	26,725	28,210	29,371	29,691
Life scientists	23,082	24,009	25,280	26,765	26,920
Physical scientists	23,204	23,725	24,140	24,427	24,118
Social scientists	17,507	18,008	19,289	20,443	20,619
All engineers	96,093	96,582	97,807	97,847	95,560
Aerospace engineers	8,433	8,624	8,777	8,584	8,330
Chemical engineers	1,503	1,413	1,344	1,311	1,245
Civil engineers	13,945	13,621	13,357	13,231	12,874
Electrical,electronics & computer engineers	31,121	31,899	32,753	32,955	32,374
Industrial engineers	3,463	3,419	3,173	3,016	2,725
Mechanical engineers	12,186	11,787	11,763	11,532	11,159
Other engineers	25,442	25,819	26,640	27,218	26,853

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

The relatively small increase in Federal science and engineering employment was part of the modest increase in overall Federal employment. Federal full-time civilian white collar employees, which include Federal scientists and engineers, increased by only 1.2 percent. In 1993 the number of scientists (101,348) surpassed the number of engineers (95,560). Scientists accounted for 48.2 percent of the Federal scientific and engineering workforce in 1989, gradually increasing to 51.5 percent in 1993. Among scientists, social scientists grew the most (17.8 percent). Growth in two other major scientific occupational series was also high—life scientists increased by 16.6 percent, and computer and mathematical scientists increased by 15.4 percent. Physical scientists showed the lowest growth, 3.9 percent.

All other major occupational groups in engineering decreased, with the largest decline being among industrial engineers (21.3 percent).

MOBILITY

Data on the mobility of scientists and engineers in the Federal Government are not available. However, if we examine the proportion of those employed in an occupational group who also held their highest degree in a field related to their occupational group, we can infer some conclusions concerning mobility.

If an occupational group has a large portion of employees holding their highest degree in a field

similar to the field of the occupational group, it may mean that entry into the group is rigid and dependent on the field of degree. Conversely, a lower proportion indicates that entry is flexible and that educational training in one of a variety of degree fields is acceptable for entry.

Across most scientific and engineering occupations in the Federal Government, a large portion of those employed in a particular field also hold their degree in that field. In 1993, 72 percent of scientists employed in the Federal Government had their highest degree in a scientific discipline, whereas 86.3 percent of the engineers had their highest degree in engineering (table 2). In two occupational categories, fewer than 61 percent of Federal scientists and engineers had their highest degree in a field corresponding to their occupational field. The occupations include computer and mathematical scientists (41.2 percent) and social scientists (60.3 percent). In 1993 a significant proportion of computer and mathematical scientists (11 percent) had their highest degree in one of the social sciences and a large proportion had degrees in non-S&E fields (35.7 percent). A large proportion of those working as social scientists had their highest degree in non-S&E fields (34.8 percent).

Table 2. Proportion of Federal scientists and engineers whose occupational group is the same as their field of degree: 1993

Occupation	Percent	
	1989	1993
All S&E occupations	85.2	84.1
All scientists	73.0	72.0
Computer & mathematical scientists	40.3	41.2
Life scientists	75.3	72.2
Physical scientists	69.8	69.2
Social scientists	59.9	60.3
All engineers	86.2	86.3
Aerospace engineers	86.2	87.4
Chemical engineers	88.3	87.2
Civil engineers	93.5	92.7
Electrical, electronics & computer engineers	84.5	84.6
Industrial engineers	75.7	83.0
Mechanical engineers	92.3	91.8
Other engineers	82.7	83.0

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

Comparisons With Other Sectors

The proportion of all U.S. scientists and engineers employed by the Federal Government is small and declining. In 1989 7.3 percent of all scientists and engineers were employed by the Federal Government, with the proportion decreasing to 7.0 percent in 1993 (table 3). However, the growth in the number of Federal scientists and engineers (6.1 percent) is higher than that for all Federal civilian white collar employees (1.2 percent). The growth in employment of R&D scientists and engineers (2.3 percent) did not keep pace with the growth for all Federal scientists and engineers (6.1 percent).

In 1989 research or development was the primary work activity of 27 percent of all Federal scientists and engineers. By 1993 this percentage had decreased slightly, to 26 percent. Federal support for research and development is one of the most important factors affecting Federal Government employment of scientists and engineers. During the period covered in this report there was a significant increase reported in the Federal R&D intramural budget—the actual intramural performance of R&D supported by Federal agencies. But although the Federal intramural R&D budget grew by 10 percent, the growth amounted to a very small increase when adjusted for inflation.

Table 3. Comparison of Federal scientific and engineering employment with other demographic and economic variables: 1989-93

Year	Federal scientists and engineers	Federal R&D scientists and engineers	U.S. scientists and engineers (thousands)[1]	Federal civilian white-collar employment [2, 3]	U.S. civilian employment (thousands)[4]	U.S. labor force (thousands)[4]	Noninstitutional population (thousands)[4]	Federal R&D obligations (millions of dollars)	Federal "R&D intramural obligations (millions of dollars)
1989	185,623	50,033	2,534	1,775,658	117,342	125,557	188,081	61,407	15,121
1990	189,049	50,571	2,652	1,791,875	117,914	126,424	189,686	63,688	16,003
1991	194,726	49,270	2,679	1,832,403	116,877	126,867	191,329	61,295	15,238
1992	198,853	52,545	2,706	1,831,286	117,598	128,548	193,142	70,368	16,635
1993	196,908	51,199	2,802	1,797,289	119,306	129,525	195,034	71,445	16,643

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files, except as noted

[1] Compiled from data provided by the Bureau of Labor Statistics from The Occupatuional Employment Matrix. Data were not available for off numbered years and have been interpolated from even numbered years. The Occupational Employment Matrix data mearsure the number of jobs in the economy, not the number of people holding those jobs. Postsecondary teachers of science and engineering are not included in the data.

[2] The data include all civilian full-time, white-collar employees working for the Federal Government.

[3] Excludes the U.S. Postal Service

[4] Data obtained from The Statistical Abstract of the United States: 1994, page 395.

SECTION 2. CHARACTER OF FEDERAL SCIENCE AND ENGINEERING EMPLOYMENT

In this section we examine the number of employed Federal scientists and engineers by agency and work activity, with emphasis on the agencies with the largest number of Federal scientists and engineers. Research, development, and design, together with data collection, processing and analysis, and natural resource operations are the major work activities of Federal scientists and engineers. In 1993, the Department of Defense (DOD), the U.S. Department of Agriculture, the Department of the Interior, and the National Aeronautics and Space Administration employed almost three-quarters of all Federal scientists and engineers. Work activity and agency of employment are indicators of the character of the Federal science and technology establishment. Whereas the overall number of Federal scientists and engineers increased, their numbers declined in the defense agencies and increased in most nondefense agencies. This shift resulted in a decrease in the number of scientists and engineers engaged in defense R&D.

EMPLOYMENT GROWTH

During 1989-93, employment of scientists and engineers in DOD decreased by 2.2 percent. All other agencies increased by 14.1 percent. Within DOD the number of Federal scientists and engineers employed in the Department of Army decreased by 4.7 percent, followed by the Navy (-3.6 percent), and the Air Force (-1.3 percent). Other Defense agencies, which account for a smaller portion of DOD's share of Federal scientists and engineers, increased significantly (34.8 percent) (table 4).

The large DOD decrease reflected weakened demand within DOD for engineers and scientists to work on various defense-related activities (e.g. research; design; production; and installation, operations, and maintenance). Despite the decrease in the number of scientists and engineers at DOD during 1989-93, DOD continued to maintain the largest share of Federal S&E human resources.

Most nondefense agencies, such as the Departments of Commerce, Energy, Health and Human Services, Housing and Urban Development, Interior, Justice, Labor, State, Treasury, Transportation, Veterans Affairs, the Environmental Protection Agency, and the Nuclear Regulatory Commission, showed higher than average growth during 1989-93.

Table 4. Employment change and five year growth rate of Federal scientists and engineers, by selected agency: 1993

Agency	5-Year growth rate	Employment change
TOTAL	6.1 %	11,285
Department of Agriculture	5.3 %	889
Department of Commerce	12.8 %	998
Department of Defense	- 2.2 %	- 2,031
Department of the Army	- 4.7 %	- 1,657
Department of the Navy	- 3.6 %	- 1,426
Department of the Air Force	- 1.3 %	- 221
Other Defense Agencies	34.8 %	1,273
Department of Energy	33.7 %	1,294
Department of HHS	18.4 %	1,493
Department of HUD	12.8 %	50
Department of the Interior	13.5 %	1,604
Department of Justice	63.6 %	1,004
Department of Labor	13.2 %	250
Department of State	18.2 %	524
Department of Transportation	19.3 %	882
Department of the Treasury	37.6 %	945
Department of Veterans Affairs	21.7 %	954
Environmental Protection Agency	24.0 %	1,558
General Services Administration	32.0 %	237
NASA	4.2 %	504
National Science Foundation	- 13.0 %	- 49
Nuclear Regulatory Commission	9.3 %	136
US Intl Development Coop Agency	- 19.7 %	- 115
All other agencies	5.0 %	158

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

The relative importance of each agency in providing employment opportunities for scientists and engineers varied significantly. In 1993, the Department of Defense employed 66.9 percent of all Federal engineers but only 27.9 percent of all Federal scientists. The U.S. Department of Agriculture, the second-largest employer of Federal scientists and engineers, employed 15.3 percent of all Federal scientists and 2.3 percent of all Federal engineers. The agencies with the largest populations of Federal scientists and engineers are discussed in the agency sections that follow.

Work Activities

Scientists and engineers employed in primary work activities associated with defense programs decreased more rapidly than those employed in nondefense work activities during 1989-93. The proportion of Federal scientists and engineers engaged in development decreased slightly, from 15.5 percent in 1989 to 15.0 percent in 1993. The proportion employed in design activities decreased from 8.2 percent in 1989 to 7.2 percent in 1993, whereas those engaged in installation, operations, and maintenance decreased from 6.2 percent in 1989 to 5.8 percent in 1993. Test and evaluation; technical assistance and consulting; regulatory enforcement or licensing; clinical practice, counseling, and ancillary medical service; and scientific and technical information all increased in relative importance during 1989-93. Nevertheless, research (11 percent) and development (15 percent) activities continued to be the major work activities of Federal scientists and engineers in 1993 (appendix table B-2).

Work Activities by Major Agencies

Changes in primary work activities reflect shifts in employment and work activity patterns within individual agencies. To better understand activities within the Federal sector, we examine the agencies with the largest number of scientists and engineers.

Department of Defense

The number of scientists and engineers employed at DOD decreased during 1989-93. This drop was accompanied by significant decreases in certain occupational groups and certain primary work activities.

Over the 4-year period, employment of engineers at DOD decreased while that for scientists increased. The occupations with the highest growth included life scientists (30.9 percent), social scientists (11.2 percent), and computer and mathematical scientists (4.8 percent). All engineering occupations showed decreases except for electrical, electronics, and computer engineers, which showed a small increase during the period.

There was a slight shift in the primary work activities of DOD scientists and engineers over the period 1989-93. In general, those employed in 1993 were less likely to be employed in activities such as research, design, management, planning, data collection processing and analysis, standards and specifications, production, and construction, and more likely to be employed in activities such as development; test and evaluation; regulatory enforcement and licensing; clinical practice, counseling, and ancillary medical services; and scientific and technical information.

Department of Agriculture

Employment of Federal scientists and engineers at USDA reached 17,764 in 1993, or 9 percent of all Federal scientists and engineers. This number was up from 16,875 and represents an increase of 5.3 percent. The growth was accompanied by some shifts in both occupational groups and work activities. For instance, as a proportion of total science and engineering employment at USDA, the number of scientists increased from 86.4 percent in 1989 to 87.5 percent in 1993.

The occupational distribution of scientists and engineers at the U.S. Department of Agriculture (USDA) changed over the 4-year period covered in this report. The growth of USDA scientists was 6.6 percent, whereas engineers decreased by 3.0 percent. Among the individual occupational series, computer and mathematical scientists showed the most rapid growth (23.8 percent), followed by electrical, electronics, and computer engineers (23.7 percent), and social scientists (8.7 percent). Notably slower growth was recorded by life scientists (5.9 percent) and chemical engineers (5.3 percent). Decreases in employment were recorded for civil engineers (5.9 percent), physical scientists (4.0 percent), and mechanical engineers (2.6 percent).

Work activities of scientists and engineers employed at USDA shifted during 1989-93. Scientists and engineers employed at USDA were less likely to be employed in research, design, planning, technical assistance and consulting, and construction and more likely to be employed in development; test and evaluation; management; installation, operations and maintenance; and natural resource operations. Natural resource operations was the largest primary work activity (51.8 percent of all USDA scientists and engineers in 1993). During 1989-93 the number of scientists and engineers at USDA engaged in this work activity increased by 10.2 percent.

Department of the Interior

The number of scientists and engineers employed at the Department of the Interior increased by 13.5 percent during 1989-93, from 11,846 in 1989 to 13,450 in 1993. There were also some shifts in the occupational mix and the work activities of those employed. The scientists and engineers at Interior made up approximately 6.8 percent of all Federal scientists and engineers in 1993, up from 6.4 percent in 1989.

Excluding chemical engineers, all major occupational series increased in number at the U.S. Department of the Interior over the 4-year period covered in this report. Scientists increased by 16.7 percent, whereas engineers increased by a lower amount, 2.8 percent. Among individual occupational series, life scientists showed the most rapid growth (31.8 percent), followed by computer and mathematical scientists (29.8 percent), social scientists (19.9 percent), industrial engineers (13.3 percent), and mechanical engineers (12.9 percent). Notably slower growth was recorded by physical scientists (2.0 percent), civil engineers (3.6 percent), and electrical, electronics, and computer engineers (7.5 percent). Negative growth was recorded for chemical engineers (8.2 percent).

There was a shift in the primary work activities of scientists and engineers employed at Interior during 1989-93. Those employed in 1993 were more likely to be engaged in activities such as natural resource operations, technical assistance and consulting, development, management, planning, scientific and technical information, research, construction, and test and evaluation.

The largest number of scientists and engineers at Interior were engaged in natural resource operations, and they increased by 33.5 percent during 1989-93. In 1993, 18.3 percent of Interior's scientific and engineering workforce was conducting research, down from 19.2 percent in 1989. This portion of Interior's workforce experienced moderate growth between 1989 and 1993 (7.8 percent). The next largest group was employed in data collection, processing, and analysis. In 1993 there were 2,200 scientists and engineers at Interior in this category, up from 2,029 in 1989, representing an increase of 8.4 percent. Scientists and engineers in planning accounted for only 6.2 percent of Interior's S&E workforce and decreased by 5.6 percent during 1989-93.

National Aeronautics and Space Administration

The number of scientists and engineers employed at the National Aeronautics and Space Administration (NASA) increased slightly during 1989-93. Despite low employment growth, there were some shifts in the occupational mix and the work activities of those employed. The number of scientists and engineers employed at NASA grew by 504 employees, from 11,920 in 1989 to 12,424 in 1993. The scientists and engineers at NASA made up approximately 6.3 percent of all Federal scientists and engineers in 1993, down from 6.4 percent in 1989. During 1989-93 the number of scientists decreased by 1.2 percent and that of engineers increased by 5 percent. Among the individual occupational series, industrial engineers showed the most rapid growth (30.8 percent), followed by life scientists (24.5 percent) and electrical, electronics, and computer engineers (7.6 percent). Notably slower growth was recorded for physical scientists (4.1 percent), aerospace engineers (2.1 percent), and mechanical engineers (1.5 percent). Negative growth was recorded for civil engineers (37.5 percent), computer and mathematical scientists (14.3 percent), and chemical engineers (3.8 percent).

There was a shift in the primary work activities of scientists and engineers employed at NASA during 1989-93. Those in 1993 were more likely to be employed in management, design, research, and development work, and less likely to be employed in most other activities.

The largest number of scientists and engineers at NASA were engaged in development; they increased their numbers by 4.8 percent. The next largest group (2,324) was employed in research, up very slightly from the number in 1989 (2,306). In 1993, 10.8 percent of NASA's scientific and engineering workforce was classified in management. This portion of NASA's workforce grew rapidly; the increase from 1989 to 1993 was 12.9 percent. Employment growth in all other activities (planning; standards and specifications; scientific and technical information; installation, operations, and maintenance; data collection, processing, and analysis; and technical assistance and consulting) declined during 1989-93.

SECTION 3. EDUCATIONAL ATTAINMENT OF FEDERAL SCIENTISTS AND ENGINEERS

FIELD OF HIGHEST DEGREE

The most common highest-degree field among all Federal scientists and engineers was engineering. In 1993 approximately 44 percent of all Federal scientists and engineers had obtained a highest degree in engineering (table 5). Life sciences was the second most common highest degree field among Federal scientists and engineers (12.5 percent) followed by physical science (11.1 percent), social science (8.8 percent), and computer and mathematical sciences (7.9 percent). Among Federal scientists, the most common highest-degree field in 1993 was life sciences (23.9 percent), followed by physical sciences (18.3 percent) and computer and mathematical sciences (12.9 percent). The most prevalent highest degree among Federal engineers was the engineering degree (86.3 percent), followed by the physical sciences degree (3.5 percent).

HIGHEST DEGREE LEVEL

In 1993, 10.6 percent of all Federal scientists and engineers had acquired a Ph.D. degree as their highest degree, 25.1 percent a master's degree, and 63.4 percent a bachelor's degree (table 6). These ratios remained fairly steady and were approximately the same ratios evident in all years of the 1989-93 period covered in this report. In 1993 the most Ph.D.-intensive occupational group among Federal S&Es was physical scientists, 27.8 percent of whom had a Ph.D. as their highest degree. Other Federal S&E occupational groups with high levels of Ph.D.s included life scientists (21.2 percent) and social scientists (19.7 percent).

Table 5. Federal scientists and engineers, by highest degree field: 1989-1993

Highest degree field	1989	1990	1991	1992	1993
Total	185,623	189,049	194,726	198,853	196,908
Physical sciences	21,501	21,867	22,053	22,263	21,914
Computer & mathematical sciences	13,505	14,218	14,931	15,474	15,591
Life sciences	22,108	22,850	23,711	24,738	24,541
Social sciences	14,773	15,333	16,403	17,294	17,315
Engineering	86,270	87,288	88,325	88,378	86,177
Non-science/non-engineering	25,668	27,042	28,713	30,161	30,662
No report	1,798	451	590	545	708

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data

Table 6. Federal scientists and engineers, by highest degree level: 1989-93

Highest degree level	1989	1990	1991	1992	1993
Total, All S&E occupations	185,623	189,049	194,726	198,853	196,908
Ph.D	19,273	19,758	20,461	21,100	20,888
MS/MA	43,208	44,509	46,620	48,453	49,495
BS/BA	121,628	123,194	125,976	127,594	124,862
Professional	1,514	1,588	1,669	1,706	1,663

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

SECTION 4. AGE PROFILES

The average age of the Federal science and engineering (S&E) workforce increased over the 1989-93 period. In 1989, 25.1 percent of the scientists employed by the Federal Government were under the age of 35 and 10.6 percent were 55 years of age or older (table 7). By 1993, 22.6 percent of the scientists were under the age of 35 and 11.4 percent were 55 years of age or older. In 1989, 42.1 percent of the engineers were under the age of 35 and 11.9 percent were 55 years of age or older. In 1993, however, 38.3 percent of engineers were under the age of 35 and 12.9 percent were 55 years of age or older.

Table 7. Federal scientists and engineers, by age and occupational group: 1993

Age	1989		1993	
	Scientists	Engineers	Scientists	Engineers
TOTAL	89,530	96,093	101,348	95,560
Under 35 years	22,440	40,421	22,868	36,606
35-39 years	16,886	11,104	17,034	13,406
40-49 years	31,002	22,866	36,772	22,925
50-54 years	9,702	10,233	13,067	10,334
55-56 years	2,664	3,066	3,409	3,341
57-59 years	3,187	3,665	3,678	3,689
60-61 years	1,395	1,655	1,655	1,879
62 years & over	2,252	3,083	2,862	3,378
No report	2	-	3	2

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data

An analysis of age profiles by selected work activity reveals that Federal scientists and engineers employed in development; design; installation, operations, and maintenance; test and evaluation; and production are more likely to be younger than those employed in research. This trend intensified during the period covered in this report. Of the Federal S&E workforce under the age of 35 in 1989, 24.5 percent were engaged in research work; 42.6 percent in development work; and 41.4 percent in design work (table 8). In 1993, these same proportions were 21.4 percent, 40.2 percent, and 35.3 percent, respectively. As expected, the proportion of Federal S&Es working in management under the age of 35 was small (12.8 percent in 1989 and 13.1 percent in 1993). The share of Federal S&Es 55 years of age or older in management increased from 18.7 percent in 1989 to 20.8 percent in 1993.

Table 8. Federal scientists and engineers, by age and selected work activity: 1993

Age	1989				1993			
	Research	Development	Design	Management	Research	Development	Design	Management
Total	21,242	28,791	15,171	8,407	21,670	29,529	14,209	8,488
Under 35 years	5,211	12,257	6,277	1,076	4,637	11,859	5,016	1,113
35-39 years	3,398	3,154	2,045	906	3,551	4,021	2,162	976
40-49 years	6,620	6,925	3,685	3,172	6,753	6,506	3,809	2,998
50-54 years	2,771	3,177	1,531	1,681	3,043	3,402	1,461	1,634
55-56 years	807	922	434	475	971	1,056	460	536
57-59 years	1,067	1,095	509	525	1,103	1,143	583	574
60-61 years	471	464	232	216	528	580	249	267
62 years and over	897	795	458	356	1,084	962	469	390
No report	-	2	-	-	-	-	-	-

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files.

SECTION 5. SALARIES

The median annual base salaries of Federal scientists and engineers increased 21.9 percent during 1989-93, from $41,100 to $50,100. By contrast, the average annual weekly earnings in private nonagricultural industries rose only 12 percent during the same period (table 9).

Median annual base salaries for Federal scientists and engineers vary by occupation, work activity, and years of service. In 1993, median annual salaries for scientists ($48,100) were below those for engineers ($52,300), with the highest salaries reported for aerospace and civil engineers and the lowest salaries reported for life scientists. Among scientists, the highest median annual base salaries were paid to physical scientists, followed by computer and mathematical scientists, social scientists, and life scientists. The highest S&E salaries for engineers after aerospace engineers were reported for electrical, electronics, and computer engineers; chemical engineers; and civil engineers.

Table 9. Median average annual base salaries of Federal scientists and engineers, by major occupation group: 1989 and 1993

Major occupational group	In dollars		Percent change
	1989	1993	
Total	$41,100	$50,100	22
All scientists	40,400	48,100	19
Computer & mathematical scientists	42,100	49,900	19
Life scientists	35,300	42,600	21
Physical scientists	43,800	52,300	19
Social scientists	41,000	48,000	17
All engineers	42,000	52,300	25
Aerospace engineers	45,200	54,400	20
Chemical engineers	39,800	51,000	28
Civil engineers	41,100	49,900	21
Electrical, electronics & computer engineers	41,100	52,200	27
Industrial engineers	38,800	48,300	24
Mechanical engineers	38,800	49,200	27
Other engineers	45,100	54,300	20

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

The median annual base salaries for engineers increased more rapidly (25.3 percent) than did the salaries of scientists (19.1 percent). In general, all engineering occupations (except for civil engineers) received higher than average annual base salary increases, and all scientific occupations received lower than average increases. The fastest growing median salaries were for chemical engineers (28.1 percent), and the slowest growing salaries were for social scientists (17.1 percent).

Federal scientists and engineers with a Ph.D. degree reported a median annual salary of $60,400 in 1993, 20.6 percent higher than the average for all degree levels. Employees with a master's degree reported a median annual base salary of $52,500—4.8 percent higher than the average—and those with a bachelor's degree reported a median annual salary of $48,300—3.7 percent less than the average for all Federal scientists and engineers.

SECTION 6. WOMEN AND MINORITIES

WOMEN

Levels and Trends

The number of women scientists and engineers in the Federal Government increased by 27.6 percent between 1989 and 1993, from 29,328 to 37,431 (table 10). By contrast, the number of men scientists and engineers in the Federal Government grew by 2.0 percent over the same period. The growth of women was 18.6 percent during 1989-91 and 7.6 percent during 1991-93. The growth trend for men scientists remained at a low 2.3 percent in 1989-91. A slight decrease occurred during 1991-93.

Table 10. Federal scientists and engineers, by sex: 1989-93

Gender	1989	1990	1991	1992	1993
Total	185,623	189,049	194,726	198,853	196,908
Women	29,328	31,733	34,787	36,854	37,431
Men	156,294	157,316	159,939	161,997	159,474
No report	1	-	-	2	3

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

Employment growth for women outpaced that for men across all major occupational groups between 1989 and 1993. The highest employment growth for women in the sciences was posted for the life sciences (42 percent); the lowest level was among physical scientists (19 percent). Corresponding growth levels for men ranged from 9.6 percent for life sciences to 0.7 percent for physical scientists. Employment growth increases for women were highest in the engineering occupations, at 17.6 percent. The highest growth was posted for electrical, electronics, and computer engineers (23.5 percent), and the lowest growth was for industrial engineers (-18.7 percent). Corresponding levels for men ranged from 2.4 percent to -21.7 percent, respectively.

Despite experiencing more rapid employment growth than men, women in 1993 accounted for only 27.4 percent of all Federal scientists and 10.1 percent of all Federal engineers. These ratios were higher than the 1989 ratios (23.6 percent for scientists and 8.6 percent for engineers).

Primary Work Activity

Men and women scientists and engineers vary in their pattern of primary work activities. The largest proportion of women are employed in research, whereas the largest proportion of men are engaged in development work. Other primary work activities for women in order of importance include development; data collection, processing, and analysis; natural resource operations; clinical practice, counseling, and ancillary medical services; test and evaluation; and design. Other primary work activities for men in order of importance include research; design; data collection, processing, and analysis; natural resource operations; installation, operations, and maintenance; and test and evaluation.

Between 1989 and 1993 the fastest growing work activities for women included management; natural resource operations; and clinical practice, counseling, and ancillary medical services. The fastest growing work activities for men included teaching and training; clinical practice, counseling, and ancillary medical services; and regulatory enforcement or licensing.

MINORITIES

Level and Trends

The number of Federal scientists and engineers who are members of ethnic/racial minority groups rose 18.3 percent between 1989 and 1993, from 26,052 to 30,810 (table 11). In 1993, members of minority/ethnic groups represented 15.6 percent of the Federal S&E labor force, up from 14 percent in 1989. Most of this increase is attributable to the increased number of

Table 11. Federal scientists and engineers, by racial/ethnic status: 1989-93

Racial/ethnic status	1989	1990	1991	1992	1993
Total	185,623	189,049	194,726	198,853	196,908
White	159,401	161,431	165,564	168,316	166,084
Black	8,409	8,712	9,216	9,579	9,682
Asian	9,866	10,565	11,192	11,764	11,930
Hispanic	5,331	5,687	6,071	6,354	6,394
Native American	929	1,002	1,106	1,198	1,249
All other	1,517	1,576	1,523	1,516	1,555
No report	170	76	54	126	14

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

Asian scientists and engineers, from 9,866 to 11,930. Black scientists and engineers in the Federal Government increased by 15.1 percent over the same period. Hispanic scientists and engineers grew 19.9 percent during 1989-93, and Native Americans increased by 34.4 percent.

In 1993, 15 percent of all Federal scientists and engineers were a member of an ethnic or racial minority group. Asians were the largest minority group representing 6 percent of Federal scientists and engineers, followed by Black Americans with 5 percent of the total. Hispanics and Native Americans were the smallest minority groups representing 3 percent and 1 percent of the total number of Federal scientists and engineers, respectively.

Employment growth for all minority groups (19.2 percent) outpaced the growth of white Federal scientists and engineers between 1989 and 1993 (4.2 percent). The growth of Asians and Native Americans outpaced that of other minorities, with increases of 21 percent and 34 percent, respectively. Hispanics in the Federal science and engineering workforce during the same period grew by 20 percent and Blacks rose by 15 percent.

Specific occupational areas of growth among selected minority groups included

- an 82-percent increase in aerospace engineering jobs for Native Americans,
- a 53-percent increase in computer and mathematical science jobs for Asians,
- a 35-percent rise in social science jobs for Hispanics, and
- a 29-percent growth in social science jobs for Blacks.

Primary Work Activity

Minorities employed as Federal scientists and engineers have varied primary work activities. The largest proportion of Asians are employed in work activities such as development, research, and design, whereas the largest proportion of blacks are engaged in development; data collection, processing, and analysis; and research. Hispanics are primarily engaged in development, test and evaluation, and design. Almost one-quarter of the Native Americans employed as scientists and engineers in the Federal Government are engaged in natural resource operations work.

SECTION 7. GEOGRAPHIC PATTERNS IN THE EMPLOYMENT OF FEDERAL SCIENTISTS AND ENGINEERS

In 1993 almost 1.8 million civilian white collar employees worked for the Federal Government. Fewer than one-fifth of the white collar employees worked in the Washington DC metropolitan statistical area; the remaining four-fifths held U.S. duty stations in the other 50 States or were employed in U.S. territories and foreign countries. The decision to open and close Federal facilities has a large impact on the economic growth and development of States and localities. This is especially true for Federal laboratories that employ large numbers of scientists and engineers. This section analyzes the geographic distribution of Federal scientists and engineers, examining the regional patterns that have emerged during the eighties and nineties and the concentration of Federal scientists and engineers in States.

The South Atlantic Region led the country in the number of Federal scientists and engineers; 36 percent of the Nation's federally employed scientists and engineers work in this region (mostly in Maryland and the District of Columbia, which accounted for 31.5 percent and 24.6 percent of the region's total, respectively) (table 12). The Pacific region was the second-largest region, with 16 percent of the total number of Federal scientists and engineers (almost 62.7 percent of the region's Federal scientists and engineers work in California). By contrast, New England was the smallest region, with 3.8 percent of the Federal S&E total. Massachusetts accounted for 44.2 percent of all Federal scientists and engineers employed in New England.

- Among the six remaining regions the number of Federal scientists and engineer's is concentrated in a few States; for example:

- Pennsylvania and New Jersey accounted for 77.6 percent of Federal scientists and engineers in the Middle Atlantic Region.[3]

- Ohio accounted for more than 42.9 percent of the Federal scientists and engineers in the East North Central Region.

- Missouri accounted for 37.6 percent of the Federal scientists and engineers in the West North Central Region.

- Alabama accounted for 56.4 percent of Federal scientists and engineers in the East South Central Region.

- Texas accounted for 62.3 percent of the Federal scientists and engineers in the West South Central Region.

- Colorado and New Mexico accounted for 51.2 percent of the Federal scientists and engineers in the Mountain region

Employment growth varied by region during the late 1980s and early 1990s, ranging from a high of 12.8 percent for the Mountain region to a low of 1 percent for the Middle Atlantic region. Idaho and Colorado contributed heavily to the increasing employment growth in the Mountain States with growth levels of 29.8 and 17.7 percent, respectively. The substantial growth level of the South Atlantic States (8.4 percent) was fueled by significant growth in Federal S&E employment for West Virginia (19.4 percent), North Carolina (16.2 percent), and Maryland (8.7 percent). All other regions showed employment growth levels at or less than 7.5 percent. Despite the varying levels of regional employment growth, the regional rankings had minor changes during 1989-93. The Mountain States showed the most strength, surpassing the Middle Atlantic States and the East North Central States and becoming the third most populous Federal S&E region after the South Atlantic region and the Pacific region.

[3] See table 12 for a listing of States within the regions indentified in this section.

Table 12. Federal scientists and engineers (S&Es): distribution by region and ranking by State: 1993

Region/State	Federal S&Es	Percent of U.S. total	Region/State	Federal S&Es	Percent of U.S. total
New England	7,491	3.8	East South Central	11,206	5.7
Middle Atlantic	16,018	8.1	West South Central	13,375	6.8
East North Central	16,552	8.4	Mountain	17,067	8.7
West North Central	8,072	4.1	Pacific	31,420	16.0
South Atlantic	70,947	36.0	State unknown	4,760	2.4

Region/State	U.S. ranking	Region/State	U.S. ranking
New England:		East South Central:	
Connecticut	32	West Virginia	41
Maine	42	Alabama	8
Massachusetts	16	Kentucky	39
New Hampshire	49	Mississippi	22
Rhode Island	30	Tennessee	33
Vermont	50		
		West South Central:	
Middle Atlantic:		Arkansas	44
New Jersey	7	Louisiana	29
New York	15	Oklahoma	20
Pennsylvania	10	Texas	5
East North Central:		Mountain:	
Illinois	14	Arizona	27
Indiana	21	Colorado	11
Michigan	24	Idaho	34
Ohio	6	Montana	38
Wisconsin	43	Nevada	40
West North Central:		New Mexico	18
Iowa	46	Utah	25
Kansas	37	Wyoming	45
Minnesota	36		
Missouri	17	Pacific:	
Nebraska	35	Alaska	31
		California	2
North Dakota	47	Hawaii	26
South Dakota	48	Oregon	19
		Washington	12
South Atlantic:			
Delaware	51		
District of Columbia	3		
Florida	9		
Georgia	13		
Maryland	1		
North Carolina	23		
South Carolina	28		
Virginia	4		

SOURCE: National Science Foundation tabulations from Office of Personnel Management's Central Personnel Data Files

SECTION 8. FEDERAL CIVILIAN EMPLOYEES EDUCATED AS SCIENTISTS AND ENGINEERS EMPLOYED IN NON-S&E OCCUPATIONS

To accurately measure the supply of scientific and engineering skills in the Federal Government, a more complete examination would be required of Federal employees who are trained as scientists and engineers but work in non-S&E occupations. In 1993, 73 percent of all Federal white collar employees with a bachelor's degree or higher were employed in a non-S&E occupation. These levels remain consistent throughout the 4-year period covered in this report. Federal employees trained as social scientists and life scientsts are more likely to be employed in non S&E jobs than other scientists and engineers.

There is also a group of Federal employees with degrees in nonscientific or nonengineering fields who are increasingly employed in S&E occupations. They may have acquired skills during the attainment of that degree that are easily transferable to other S&E occupations. This group grew from 6.9 percent of white collar employees in 1989 to 7.6 percent in 1993. Federal employees with their highest degree in a non-S&E field and employed as life scientists have grown more rapidly than any other group (29.8 percent). Other rapidly growing S&E occupations that include a larger proportion of graduates with non-S&E degrees include computer and mathematical scientists (19.1 percent), social scientists (18.4 percent), and physical scientists (17.4 percent).

Appendixes

Appendix A. Technical Notes

Scope

The preceding report presents data on the demographic and employment characteristics of Federal scientists and engineers. This population consists of individuals in selected white collar civilian occupational groups who hold at least a university or college bachelor's degree. One table also provides information on Federal civilian white collar personnel educated in S&E fields but employed in non-S&E occupations. This report differs from previous reports on Federal scientists and engineers in that it presents for the first time a historical 5-year time-series on Federal scientists and engineers. The statistical tables were prepared by selecting various crosscuts of the following data elements on Federal scientists and engineers:

1. Agency of employment
2. Primary work activity (functional classification)
3. Sex
4. Occupational group and series
5. Highest degree field
6. Race/ethnicity
7. Geographic division and State of official duty station
8. Age
9. Highest degree level

Data Sources

The data presented in this report were collected by the Office of Personnel Management (OPM) and provided to the National Science Foundation on magnetic tape. OPM extracted the data from its Central Personnel Data File (CPDF). The CPDF, which was established in 1972 and is maintained by OPM, is an automated system of individual records for almost all Federal civilian employees. Agencies collect these data on their employees from requests and notifications of individual personnel actions. The CPDF is maintained by monthly agency input of employment status files. All input files are edited for validity. The CPDF contains over 2 million records on full-time nonpostal Federal civilian employment.

Data Reference Period

The information provided by OPM for the years 1989-93 is from the Central Personnel Data Files (CPDF). The effective date of data provided for 1989-93 is as of September 30 of each year.

Agency Coverage

The CPDF does not contain information for (and as a result the report excludes data for) Members and employees of Congress, Architect of the Capitol, Botanic Gardens, Library of Congress, Congressional Budget Office, Copyright Royalty Tribunal, Office of Technology Assessment, Judicial Branch (except the Administrative Office of the U.S. Courts), White House Office, Office of the Vice President, Board of Governors of the Federal Reserve System, Defense Intelligence Agency, Central Intelligence Agency, National Security Agency, U.S. Postal Service, Postal Rate Commission, foreign nationals employed overseas, or the Public Health Commissioned Corps. The General Accounting Office was included in all years except 1993. The Tennessee Valley Authority (TVA) does not report to the CPDF, but the magnetic tape provided to the National Science Foundation by OPM was supplemented to include TVA data for 1993 only. TVA data were not included in the years 1989-92.

The acronyms and abbreviated references of the Federal agencies for which tabular data are provided in this report are as follows:

Air Force	- Department of the Air Force
Army	- Department of the Army
Commerce	- Department of Commerce
DOE	- Department of Energy
DOT	- Department of Transportation
Defense	- Department of Defense
EPA	- Environmental Protection Agency
HHS	- Department of Health and Human Services
Interior	- Department of the Interior
NASA	- National Aeronautics and Space Administration
Navy	- Department of the Navy
TVA	- Tennessee Valley Authority
USDA	- Department of Agriculture
VA	- Veterans Administration

Other abbreviations used are as follows:

R&D	- research and development
S&E	- science and engineering

Occupational Coverage

The data reported in this report should be used with caution when examining data reported on Federal scientists and engineers in previous years. Some reports published prior to this report contain data about all scientists and engineers, regardless of their highest degree level. This report covers only Federal scientists and engineers with at least a bachelor's degree.

The Federal scientists and engineers included in this report were compiled from a group consisting of all Federal white collar employees as presented and reported by the Office of Personnel Management. The list on the following pages indicates the occupational group and series, by code number, of all scientific and engineering personnel in the Federal Government. The list of occupations that were selected is presented together with the occupational codes established for NSF's SESTAT (Scientists and Engineers Data System). SESTAT is an occupational classification system that NSF has established for all its S&E personnel surveys. The table lists the occupations selected as S&E occupations from the CPDF and the corresponding SESTAT major and minor occupational groups.

Definitions of Work-Activity Classification Categories[4]

Research. Systematic, critical, intensive investigation directed toward the development of new or fuller scientific knowledge of the subject studied. It may be with or without reference to a specific application. The work involves theoretical, taxonomic, and experimental investigations or simulation of experiments and conditions for several purposes. The following list identifies these activities:

(1) Determining the nature, magnitude, and interrelationships of natural and social phenomena and processes.

(2) Creating and developing theoretical or experimental means of investigating such phenomena or processes.

(3) Developing the principles, criteria, methods, and a body of data of general applicability for use by others.

Excluded from this research category is work concerned primarily with the administration and monitoring of research contracts and research grants.

Development. Systematic application of scientific knowledge directed toward the creation of new or substantially improved equipment, materials, instrumentation, devices, systems, mathematical models, processes, techniques, and procedures that will perform a useful function or be suitable for a particular duty.

The work involves the following activities:

(1) Establishing requirements for technical objectives and characteristics.

(2) Devising and evaluating concepts for design approaches, criteria, parameters, characteristics, and interrelationships.

(3) Experimenting, investigating, and testing to produce new data, mathematical models, methods of testing concepts; formulating design criteria; and measuring and predicting natural and social phenomena and performance.

(4) Designing and developing prototypes, bread boards, and engineering models including the direction of their fabrication as required.

(5) Developing standards and test plans to assure reliability.

(6) Managing specific developments being executed in-house or under contract.

As does research, development advances the state of the art, but it is further characterized by the creation of specific end-items in the form of equipment or equipment systems (hardware development) and/or methodologies, mathematical models, procedures, and techniques (software development).

[4] These definitions are used by the Office of Personnel Management to gather information on work activities of Federal scientists and engineers

Crosswalk of NSF's SESTAT Major and Minor Occcupational Groups and OPM Occupations

SESTAT Major and Minor Groups	OPM Occupation Codes Detail Level
1.0 Computer and Mathematical Scientists	
1.1 Computer and information scientists	1550 Computer scientists (those individuals = or > GS-15 or equivalent) 1550 Computer scientists (those individuals < GS-15 or equivalent) 334 Computer specialists (those individuals = or > GS-12 or equivalent) 1670 Equipment specialists 330 Digital equipment specialist, administration
1.2 Mathematical scientists	1520 Mathematicians 1515 Operations research analysts 1529 Mathematical statisticians 1530 Statisticians 1540 Cryptographers 1541 Cryptography analysts
1.8 Postsecondary teachers- Computer & mathematical s	
2.0 Life and Related Scientists	
	Agricultural, forestry, and conservation scientists
2.1 Agricultural and food scientists	28 Environmental protection specialists 406 Agricultural extension specialists 437 Horticulturalists 454 Range conservationists 457 Soil conservationists 470 Soil scientists 471 Agronomers 487 Animal scientists
	Biological scientists, including biochemists and biophysicists
2.2 Biological scientists	403 Microbiologists 408 Ecologists 410 Zoologists 413 Physiologists 414 Entomologists 415 Toxicologists 430 Botanists 434 Plant pathologists 435 Plant physiologists 440 Geneticists 482 Fishery biologists 486 Wildlife biologists
	405 Pharmacologists
	401 Biological scientists, general
2.3 Environmental life scientists, including forestry scient	Included above under agricultural, forestry, and conservation scient
2.8 Postsecondary teachers- Life & related Sciences	

3.0 Physical and Related Scientists	
3.1 Chemists, except biochemistry	1320 Chemists
3.2 Earth scientists, geologists & oceanographers	1330 Astronomers and space scientists
	1340 Meteorologists
	1313 Geophysicists
	1315 Hydrologists
	1350 Geologists
	1372 Geodesists
	1360 Oceonographers
	1310 Physicists
3.4 Other physical scientists	1306 Health physicists
	1301 Physical scientists, general
3.8 Postsecondary teachers- Physical & related sciences	
4.0 Social and Related Scientists	
4.1 Economists	110 Economists
	135 Foreign agricultural affairs
	1140 Trade specialist
	1146 Agricultural market specialists
	1147 Agricultural market reporting
	2110 Transportation industry analysis
4.2 Political scientists and related scientists	130 Foreign affairs analysts
	131 International relations specialists
4.3 Psychologists	180 Psychologists
4.4 Sociologists and anthropologists	190 General anthropologists
	184 Sociologists
4.5 Other social scientists	106 Unemployment insurance specialist
	132 Intelligence specialist
	136 International cooperation specialist
	150 Geographers
	160 Civil rights analysts
	193 Archeologists
	140 Manpower research analysts
	1730 Education research analysts
	238x Social scientists, general
4.8 Postsecondary teachers- social & related sciences	
5.0 Engineering	
5.1 Aerospace and related engineers	861 Aerospace enineers
5.2 Chemical engineers	893 Chemical engineers
5.3 Civil and architectural engineers	810 Civil engineers
5.4 Electrical, electronic, computer, & communications er	854 Computer engineers
	850 Electrical engineers
	855 Electronics engineers
5.5 Industrial engineers	803 Safety engineers
	804 Fire prevention engineers
	896 Industrial engineers
5.6 Mechanical engineers	830 Mechanical engineers

5.7 Other engineers	890 Agricultural engineers
	858 Biomedical engineers
	819 Environmental engineers
	871 Naval architects
	806 Metallurgical engineers 892 Ceramic engineers 894 Welding engineers 1321 Metallurgists
	880 Mining engineers
	840 Nuclear engineers
	881 Petroleum engineers
5.8 Postecondary teachers- Engineering	801 Engineers, general

Design. The planning, synthesis, and portrayal for purposes of fabrication or construction of structures, equipment, materials, facilities, devices, and processes that will perform a useful function or be suitable for a certain duty.

The work involves the following activities:

(1) Investigating, analyzing, and determining needs and design considerations.

(2) Planning, synthesizing, and proportioning the structure of mechanisms so that the result is achieved with safety and economy.

(3) Preparing design criteria, detailed designs, specifications, cost estimates, and operating instructions.

(4) Reviewing and evaluating design proposals and designs prepared by others including the management of architectural and engineering contracts.

For present purposes, design in an R&D organization is the application of the known state-of-the-art in the form of standard guidelines and references to prepare the detailed working plans and data required for fabrication, assembly, and production.

Data collection, processing, and analysis. The collection, processing, and analysis of general-purpose scientific data describing natural and social phenomena. General-purpose scientific data include newly gathered statistics, observations, instrument readings, measurements, specimens, and other facts obtained from such activities as statistical and field surveys, exploration, laboratory analyses, photogrammetry, and compilations of operating records for use by others. The following activities are involved:

(1) Determining data needs and data processing requirements.

(2) Planning, directing, and evaluating collection activities performed in-house or under con tract.

(3) Designing overall processing plans and systems to handle, control, operate, manipulate, reduce, store, check, and retrieve data.

(4) Analyzing raw and processed data for validity and subject-matter interpretation.

(5) Providing analytic services such as chemical analyses.

(6) Forecasting and projecting data conditions.

(7) Summarizing and presenting data for general use.

Excluded from this category are collection and analysis of data only for R&D projects and internal operating or administrative purposes such as policy formulation or planning.

Natural resource operations. The development and utilization of federally owned lands and natural resources for the purposes of bringing current use into balance with natural processes of renewal to assure sustained yields to meet present and future public needs. Natural resources include land, air, and water, and their related products or uses, such as soil, minerals, timber, forage, wildlife, power, and recreation. The work involves implementing programs and projects to inventory, classify, utilize, improve, conserve, regulate, protect, sell, lease, exchange, or market natural resources. Resource operations as defined here are concerned with managing and conserving the land and resources in a specified geographic area.

Management. The direction and control of science and engineering (S&E) programs in any one or combination of functions in a line or staff capacity with responsibilities that have a direct and substantial effect on the organizations and programs managed. The work involves decisions, actions, and recommendations that establish the basic content and character of the programs directed in terms of program objectives and priorities, program initiation and content, funding, and allocation of organizational resources. This category is not intended to cover those primarily engaged in the supervision or monitoring of work carried out through contracts and grants, or in the contracts and grants administration. Such positions are to be coded to the appropriate function.

Installation, operations, and maintenance. The installing, assembling, integrating, and assuring of the proper technical operation and functioning of systems, facilities, machinery, and equipment. The work involves the following activities:

(1) Analyzing operating and environmental conditions in order to provide design inputs and feedbacks, and modifying designs as necessary to adapt them to actual environments.

(2) Developing and determining logistic require ments, documentation, technical plans, procedures, controls, and instructions.

(3) Equipping, supplying, and commissioning facilities.

(4) Analyzing performance and cost data and developing actual performance and cost-data requirements.

(5) Integrating equipment installation and operating schedules.

(6) Managing onsite an operating facility such as a power plant, test range, mission control center, irrigation station, data acquisition station, or flight control station.

(7) Managing installation, operations, or maintenance contracts.

Planning. The study and projection of present and future needs and the formulation of alternative policies and ways of meeting these needs for the utilization of land; natural, social, industrial, material, and manpower resources; physical facilities; and social and economic services and programs. The work involves the following activities:

(1) Gathering, compiling, analyzing, and evaluating data.

(2) Projecting needs and establishing goals.

(3) Developing single or alternative plans, policies, programs, and recommendations, and measures of their economic, social, and political costs, benefits, and feasibility.

(4) Reevaluating progress to assure that objectives are realized in putting the plans into effect.

This category includes physical, economic, and social planning for land population centers and mission, policy, and program planning.

Test and evaluation. The testing of equipment, materials, devices, components, systems, and methodologies under controlled conditions and the systematic evaluation of test data to determine the degree of compliance of the test item with predetermined criteria and requirements. This work is characterized by the development and application of test plans to be carried out in-house or under contract or grant utilizing one or more of the following kinds of tests: physical measurement techniques; controlled laboratory, shop, and field (demonstration) trials; and simulated environmental techniques.

Activities included in this category are as follows:

(1) Development testing to determine the suitability of the test item for use in its environment.

(2) Production and postproduction testing to determine operational readiness.

(3) Testing in regulatory programs to determine compliance with laws, regulations, and standards.

(4) Testing in the social sciences using demonstration or experimental and control groups to determine the effectiveness of new methodologies or practices.

Research contract and grants administration. The administration and monitoring of research contracts and research grants.

Construction. The original erection, repair, and improvement of structures that provide shelter for people and activities, support transportation systems, and control natural resources. The work involves surveillance and control of construction operations

carried out in-house or under Federal grants, contracts, or loans through the following activities:

(1) Conducting site surveys.

(2) Reviewing and interpreting project plans and specifications.

(3) Making cost analyses and estimates.

(4) Laying out and scheduling operations.

(5) Investigating materials, methods, and construction problems.

(6) Negotiating with utilities, contractors, and agencies involved.

(7) Inspecting work in progress and completed work and final acceptance of completed work.

Production. The fabrication and manufacture of structures, equipment, materials, machines, and devices. The work involves surveillance and control of production operations carried out in-house or under contract through the following activities:

(1) Planning, directing, controlling, inspecting, and evaluating production processes, equipment, and facilities.

(2) Refining designs to adapt them to production facilities and processes.

(3) Devising, applying, and monitoring procedures to measure and assure quality.

Scientific and technical information. The processing and dissemination of published and unpublished technical documents and information on work to facilitate their use. The work involves developing and implementing information systems through numerous activities:

(1) Providing for the selection, acquisition, compilation, exchange, and storage of scientific and technical information.

(2) Cataloging, abstracting, and indexing information for retrieval and dissemination.

(3) Providing reference, literature search, and bibliographic services for information users.

(4) Interpreting, evaluating, and briefing on the significance and relevance of information.

(5) Disseminating information through briefings, technical publications, and other communications media.

(6) Classifying and declassifying technical information where use must be controlled in the national interest.

Standards and specifications. The preparation and determination of mandatory and/or voluntary standards including rules, regulations, and codes. Some of the purposes for which these standards are developed include the following:

(1) Drafting Government codes and regulations.

(2) Assuring the acceptability, quality, and/or standardization of products, materials, and parts as required for design, production, purchasing, logistics, and documentation.

The work involves the development of performance criteria, test and inspection methods, and data for the application of the standards to technological products and services.

Regulatory enforcement and licensing. The application and enforcement of laws, rules, regulations, orders, and governmental agreements through inspection, investigation, surveillance, licensing, certification, and similar activities.

The work includes activities such as the following:

(1) Licensing power plants and radio stations.

(2) Enforcing plant or animal-disease eradication programs.

(3) Examining applications for patents.

(4) Inspecting operations for compliance with requirements.

(5) Approving utility rates and services.

(6) Investigating aircraft accidents.

(7) Allocating radio frequencies.

(8) Determining compliance with engineering aspects of Federal tax laws.

Teaching and training. The teaching of scientific and technical subjects; the education and training of scientific and technical personnel in-house and through programs consisting of fellowships, traineeships, and training grants; and the development of curriculums, training materials, and aids.

Technical assistance and consulting. The provision of scientific and technical expert assistance, consultation, and advice to other scientific personnel; foreign governments; government agencies at the Federal, State, or local level; private industry; organized groups; and individuals. The work involves advising and promoting application of the results of research and specialized program knowledge.

Other—not elsewhere classified. This category is to be used for the following positions:

(1) Those with highly specialized activities that are not covered in any of the other categories.

(2) Those of such generalized nature that a primary function cannot be identified.

(3) Trainee positions without functional assignments.

LIMITATIONS OF THE DATA

The criterion used in this report to classify a Federal white collar employee as a scientist and engineer is to select the occupational group or series that is considered to be an S&E series. Although some of the occupational series have been selected as S&E series, employees within these series or groups are not necessarily working as scientists and engineers or on S&E work. On the other hand, there are some occupations that have not been classified as S&E occupations because their occupational series are technical and not professional in nature. For example, patent examiners have not been included as as having S&E occupations, even though some of the employees within this occupation are trained as scientists and, particularly, engineers. (These employees were included in the statistical table on Federal personnel who held their highest degree in S&E but who were employed in non-S&E work.)

The information presented in this report is obtained from OPM's CPDF. The CPDF is updated on a quarterly basis by agency submissions. The agencies collect their data from individual notifications of (SF-50-B) and requests for (SF-52-B) personnel action. The forms are usually updated by personnel clerks and are subject to misclassification and miscoding. This is particularly true for three of the data elements: primary work activity (functional classification), highest degree field, and highest degree level. Primary work activity data are updated by personnel clerks, and unless the clerks refer to position descriptions or contact the employee (or the employee's manager) whose records are being updated, the coding is subject to misclassification. Education data (highest degree field and highest degree level) are collected only on permanent employees at the time of entry into the Federal Service and are not routinely updated by additional educational experience after the time of hiring.

For further information on data quality, survey methodology, and error analyses on the data provided to NSF, refer to the *Federal Civilian Workforce Statistics, Occupations of Federal White-Collar and Blue-Collar Workers*, issued biennially by OPM.