

Job Family Position Classification Standard for Professional Work in the Engineering and Architecture Group, 0800

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INTRODUCTION

This Job Family Standard (JFS) provides series definitions, titling instructions, and grading criteria for nonresearch and nonsupervisory professional positions in the Engineering and Architecture Group, 0800, for General Schedule (GS) and other “white collar” pay plans. In the General Schedule position classification system established under chapter 51 of title 5, United States Code, the positions addressed here would be two-grade interval positions.

This JFS is divided into three parts. Part I contains occupational information applicable to Federal work covered by this JFS without regard to pay plan or classification system. Part II provides the grading criteria for positions classified in accordance with GS grade definitions. Part III includes explanatory material about the development of this JFS.

The term “General Schedule” or “GS” traditionally denotes the major position classification system and pay structure for white collar work in the Federal Government. Agencies no longer subject to chapter 51 have replaced the GS pay plan indicator with agency-unique pay plan indicators. For this reason, reference to General Schedule or GS has been omitted from much of this JFS.

Coverage

This JFS covers the following occupational series:

Series	Series
General Engineering 0801	Computer Engineering 0854
Safety Engineering 0803	Electronics Engineering 0855
Fire Protection Engineering 0804	Bioengineering and Biomedical Engineering 0858
Materials Engineering 0806	Aerospace Engineering 0861
Landscape Architecture 0807	Naval Architecture 0871
Architecture 0808	Mining Engineering 0880
Civil Engineering 0810	Petroleum Engineering 0881
Environmental Engineering 0819	Agricultural Engineering 0890
Mechanical Engineering 0830	Chemical Engineering 0893
Nuclear Engineering 0840	Industrial Engineering 0896
Electrical Engineering 0850	

Modifications to and Cancellations of Occupational Series, Standards, and Guides

Issuance of this JFS modifies, renames, supersedes, or cancels occupational series, classification standards, and guides as described in the following table. The table also indicates how to classify work covered by previous classification standards.

Previous Series or Guidance	Action Taken / How to Classify Work Previously Covered
General Engineering 0801	<ul style="list-style-type: none"> • Modifies this series definition.
Safety Engineering 0803	<ul style="list-style-type: none"> • Supersedes this flysheet, last revised in August 1981.
Fire Protection Engineering 0804	<ul style="list-style-type: none"> • Modifies this series definition.
Materials Engineering 0806	<ul style="list-style-type: none"> • Supersedes this flysheet, last revised in October 1964. • Includes work previously covered in the Ceramic Engineering Series, 0892.
Landscape Architecture 0807	<ul style="list-style-type: none"> • Supersedes this standard, last revised in February 1963.
Architecture 0808	<ul style="list-style-type: none"> • Supersedes this standard, last revised in October 1986.
Civil Engineering 0810	<ul style="list-style-type: none"> • Supersedes this standard, last revised in June 1966.
Environmental Engineering 0819	<ul style="list-style-type: none"> • Supersedes this standard, last revised in May 1979.
Mechanical Engineering 0830	<ul style="list-style-type: none"> • Supersedes this standard, last revised in June 1977.
Nuclear Engineering 0840	<ul style="list-style-type: none"> • Supersedes this standard, last revised in February 1982.
Electrical Engineering 0850	<ul style="list-style-type: none"> • Supersedes this standard, last revised in February 1971.
Computer Engineering 0854	<ul style="list-style-type: none"> • Supersedes this flysheet, last revised in January 1988.
Electronics Engineering 0855	<ul style="list-style-type: none"> • Supersedes this standard, last revised in February 1971.
Biomedical Engineering 0858	<ul style="list-style-type: none"> • Renames this series, Bioengineering & Biomedical Engineering, 0858.
Aerospace Engineering 0861	<ul style="list-style-type: none"> • Supersedes this flysheet, last revised in May 1993.
Naval Architecture 0871	<ul style="list-style-type: none"> • Supersedes this standard, last revised in June 1961.
Mining Engineering 0880	<ul style="list-style-type: none"> • Supersedes this standard, last revised in February 1967.

(continued)

Previous Series or Guidance		Action Taken / How to Classify Work Previously Covered
Petroleum Engineering	0881	<ul style="list-style-type: none"> Supersedes this standard, last revised in June 1966.
Agricultural Engineering	0890	<ul style="list-style-type: none"> Supersedes this standard, last revised in June 1967.
Ceramic Engineering	0892	<ul style="list-style-type: none"> Cancels this series. Classify work previously covered by this series to the Materials Engineering Series, 0806.
Chemical Engineering	0893	<ul style="list-style-type: none"> Supersedes this standard, last revised in June 1972.
Welding Engineering	0894	<ul style="list-style-type: none"> Cancels this series. Classify work previously covered by this series to another engineering series if the work meets the intent of the series. If no other series is appropriate, classify the position to the General Engineering Series, 0801.
Industrial Engineering	0896	<ul style="list-style-type: none"> Supersedes this standard, last revised in January 1975.
Position Classification Standard for the Engineering Group	0800	<ul style="list-style-type: none"> Cancels this guide.
General Grade Evaluation Guide for Nonsupervisory Professional Engineering Positions	0800	<ul style="list-style-type: none"> Cancels this guide.
Valuation Engineering Grade Evaluation Guide	0800	<ul style="list-style-type: none"> Cancels this guide.
Grade Evaluation Guide for Engineer Positions Concerned With Production	0800	<ul style="list-style-type: none"> Cancels this guide.

PART I – OCCUPATIONAL INFORMATION

Part I is intended for use by all agencies in evaluating professional positions in the Engineering and Architecture Group, 0800. It provides series definitions, titling instructions, and detailed occupational information for this job family.

General Series Determination Guidelines

Selection of the correct series for a position is an essential part of the entire human resources management process for a variety of reasons. For example, qualification requirements used in recruiting are based on the series of the position; career ladders are influenced by the series; and organizational structure is often designed with consideration of the series of assigned positions.

Determining the correct series for a position is usually apparent by reviewing the assigned duties and responsibilities and comparing them to the series definitions and general occupational information the job family standard (JFS) provides. Generally, the series determination for a position is based on the primary work of the position, the highest level of work performed, and the paramount knowledge required to do the work of the position. Normally, it is fairly easy to make this decision. However, in some instances, determining the correct series may not be as obvious.

Use the following guidelines to determine the predominant series when the work of a position matches more than one job family or occupational group. Also, when the work of a position falls into more than one series within this job family, it may be difficult to determine which particular series predominates. In such situations, apply the guidelines below in the order listed to determine the correct series.

- **Paramount knowledge required.** Although there may be several different kinds of work in the position, most positions will have a paramount knowledge requirement. The paramount knowledge is the most important type of subject-matter knowledge or experience required to do the work.
- **Reason for the position's existence.** The primary purpose of the position or management's intent in establishing the position is a positive indicator for determining the appropriate series.
- **Organizational mission and/or function.** Positions generally align with the mission and function of the organization to which they are assigned. The organization's function is often mirrored in the organizational title and may influence the appropriate series.
- **Recruitment source.** Supervisors and managers can help by identifying the occupational series providing the best qualified applicants to do the work. This is closely related to the paramount knowledge required.

Although the work of some positions may require applying professional engineering and architecture sciences or related knowledge and skills, classification of professional positions to the Engineering and Architecture Group, 0800, may not be appropriate. The [Additional Occupational Considerations](#) section of this JFS provides examples where the work may involve applying related knowledge and skills, but not to the extent it warrants classification to this job family.

Additional information may be found in OPM's publication, [The Classifier's Handbook](#).

Classifying Professional Work

Professional work involves exercising discretion, analytical skill, judgment, personal accountability, and responsibility for creating, developing, integrating, applying, and sharing an organized body of knowledge:

- uniquely acquired through extensive education or training at an accredited college or university;
- equivalent to the curriculum requirements for a bachelor's or higher degree with major study in, or pertinent to, the specialized field; and
- continuously studied to explore, extend, and use additional discoveries, interpretations, and applications to improve data quality, materials, equipment, applications, and methods.

Interdisciplinary Professional Positions

An interdisciplinary position is a position involving duties and responsibilities closely related to more than one professional occupation. As a result, the position is classifiable to two or more professional occupational series. Due to the nature of the work, persons with education and experience in either of two or more professions may be considered equally well-qualified to do the work. The position description should clearly show the position is interdisciplinary and indicate the various series in which the position could be classified. The final classification of the position is determined by the qualifications of the person selected to fill it.

For further guidance on the use and classification of interdisciplinary positions, refer to [The Classifier's Handbook](#).

Distinguishing Between Professional and Technical Work

The developmental work of professional positions and the demanding work of high-level technical positions are sometimes similar. Typical distinctions between engineering and architecture professional and technical work follow.

Professional Work Involves:

- Creating, exploring, evaluating, designing, and sharing solutions and the validity of their predicted performance to resolve problems, conditions, and issues.
- Applying a range and depth of knowledge acquired specifically through an intensive learning regimen of the phenomena, theories, and concepts of a scientific body of engineering knowledge.
- Understanding theories, concepts, principles, and their relationships underlying the practices of engineering and/or professional architecture to improve the efficiency and quality of work performed or to protect the public's interests in the quality of life, health, infrastructures, and natural resources.
- Identifying, analyzing, advising, consulting, and reporting on scientific, theoretical, and factual data, conditions, and problems.
- Assessing, resolving, and predicting the relationships and interactions of data and findings under varying conditions.
- Reasoning from existing knowledge and assumptions in the engineering and/or architecture field to unexplored areas and phenomena.
- Staying abreast of and evaluating scientific subjects, analyses, and proposals in professional literature.

Technical Work Involves:

- Using and/or carrying out recurring methods, standardized procedures, and established processes for a specialized field in industry, technology, or science.
- Applying basic engineering knowledge acquired through practical experience and on-the-job activities of accepted processes, standards, methods, and their corresponding scientific principles and results.
- Understanding and skill in applying predetermined procedures, methods, and standardized practices in a narrow specialized field of industry, technology, or science, or in performing technical work requiring originality, initiative, and practical judgment in using and adapting standardized engineering techniques and methods.
- Carrying out tasks, methods, procedures, and computations based on oral instructions and/or precedents, guidelines, and standards.
- Collecting, observing, testing, and recording factual and scientific data within the oversight and management of professional employees.
- Foreseeing the effects of procedural changes or appraising the validity of results on the basis of experience and practical reasoning.
- Staying abreast of existing and new practical methods and applications through on-the-job and classroom training.

Official Titling Provisions

Title 5, United States Code, requires the U.S. Office of Personnel Management (OPM) to establish authorized official position titles to include a basic title (e.g., Mechanical Engineer) that may be appended with one or more prefixes and/or suffixes. Agencies must use the official position titles for human resources management, budget, and fiscal purposes. Instructions for assigning official position titles are provided for specific series in this section.

Supervisors and Leaders

Add the prefix “Supervisory” to the basic title when the agency classifies the position as supervisory. If the position is covered by the General Schedule, refer to the [General Schedule Supervisory Guide](#) for additional titling and grading information.

Add the prefix “Lead” to the basic title when the agency classifies the position as leader. If the position is covered by the General Schedule, refer to the [General Schedule Leader Grade Evaluation Guide](#) for additional titling and grading information.

Research Positions

Add the prefix “Research” to the basic title when the work satisfies the criteria for research as defined in the [Research Grade Evaluation Guide](#).

Organizational Titles

Organizational and functional titles do not replace but complement official position titles. Agencies may establish organizational and functional titles for internal administration, public convenience, program management, or similar purposes. Examples of organizational titles are Branch Chief and Division Chief. Examples of functional titles are Chief of Policy Development and Chief of Operations.

Parenthetical Titles

Some series in this JFS have prescribed parenthetical titles. For other series in this standard, agencies may supplement the titles authorized in this standard with agency-established parenthetical titles, if necessary, for recruitment or other human resources needs. Agencies may use a combination of two parenthetical specialty titles in official position titles where the two are of significant importance to the position. Use the basic title without a parenthetical specialty title for positions with no established specialty or for positions involving work in more than two of the established specialties.

Functional Classification Codes

Functional Classification Codes for Professional Scientific Work. The National Science Foundation (NSF) manages a system of functional classification codes to describe the work of scientists and engineers. NSF uses this data to conduct studies of the science and engineering workforce. OPM requires agencies to document and maintain functional classification codes for positions in science and engineering occupations to meet the needs of NSF. [The Guide to Personnel Data Standards](#) provides a list of the applicable occupations and definitions of the functional classification codes. Use established internal agency procedures to assign the appropriate code for positions covered by series in this JFS. A complete list of valid functional classification codes is given below.

Agencies must assign a functional classification code to each of the positions classified to the Engineering and Architecture Group, 0800.

Category	Code
Research	11
Research contract and grant administration	12
Development	13
Testing and evaluation	14
Design	21
Construction	22
Production	23
Installation, operations, and maintenance	24
Data collection, processing, and analysis	31
Scientific and technical information	32
Standards and specifications	41
Regulatory enforcement and licensing	42
Natural resource operations	51
Clinical practice, counseling, and ancillary medical services	81
Planning	91
Management	92
Teaching and training	93
Technical assistance and consulting	94
Other - not elsewhere classified	99

Occupational Information by Series

GENERAL ENGINEERING, 0801		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work. This series is applicable when the work of the position:</p> <ul style="list-style-type: none"> • requires knowledge and skills in two or more professional engineering series within the Engineering and Architecture Group, 0800, and no one discipline is paramount; or • is consistent with engineering work in this occupational group, but is not covered by an established series in this JFS. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>No basic titles or parenthetical specialty titles are specified for this series. Agencies may construct titles which appropriately describe the work. Do not use titles authorized for other occupations to construct titles for this series.</p>	
Occupational Information	<p>General Occupational Information</p> <p>There is no specific occupational information for this series due to its broad coverage. See other individual series in this JFS for occupational information.</p> <p><u>←BACK TO TABLE OF CONTENTS</u></p>	

SAFETY ENGINEERING, 0803		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving safety, health, and environmental issues anticipating, dealing with, eliminating, or controlling hazardous conditions, exposures, and practices. These hazards may result from human error, equipment, or machine operation and may lead to injuries or damage to property or the environment.</p> <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for this occupation is <i>Safety Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Safety engineering work involves the generation and/or application of theories, principles, practical concepts, systems, and processes related to:</p> <ul style="list-style-type: none"> • the science of safety engineering, engineering design, and the traditional engineering science disciplines (e.g., civil, mechanical, electrical, and chemical); • design standards and codes relevant to safety engineering practices and methods; • physical science disciplines, advanced mathematics, and economics; • critical inquiry, problem solving, and scientific methodology; • safety related elements of ergonomics, psychology, and physiology; and • safety principles, standards, practices, and analytical techniques. <p>Safety engineers identify, analyze, and control hazardous conditions, exposures, and practices. They apply their knowledge of psychological and physiological factors to design and/or evaluate safety features and controls compensating for the possibility of human errors in the operation of machinery and equipment. This work frequently includes analyzing materials, structures, safety codes, legal requirements, and operations; advising on safety requirements, including the economic impact of alternative solutions; and conducting accident investigations and inspections or reviews of facilities, plans, and equipment.</p> <p>Within the Federal Government, professional safety engineering work is performed in a wide variety of environments such as health research, energy generation, construction and facilities management, industrial and manufacturing operations, recreation, and transportation.</p> <p><u>←BACK TO TABLE OF CONTENTS</u></p>	

FIRE PROTECTION ENGINEERING, 0804		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work to protect life and property from destructive fire. This work includes:</p> <ul style="list-style-type: none"> • assessment and prediction of fire hazards or risks; • mitigation of fire damage by proper design, construction, and arrangement of facilities; • research, development, and testing of fire protection technologies (e.g., halon and water mist applicators); • design, construction, inspection, testing, and operation of fire detection and fire suppression apparatus, appliances, devices, and systems; and • assessment of fire protection requirements. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Fire Protection Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Fire protection engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and methods of fire prevention and fire phenomena related to:</p> <ul style="list-style-type: none"> • fire protection engineering science, engineering design, and the traditional engineering science disciplines (e.g., civil, mechanical, electrical, and chemical); • design or evaluation of the designs of integrated systems involving suppression, detection, and electrical and electronic alarm systems; • design standards and codes for fire protection engineering techniques and practices; • physical science disciplines, advanced mathematics, and/or economics; • critical inquiry, analytical reasoning, and scientific methodology; • performance-based modeling and calculations for fire growth and egress; • human responses to emergency situations; • fire tests and measurements; and • system concepts of fire safety and methods of analysis and evaluation. <p>Fire protection engineers prevent, identify, and mitigate fire hazards. They also detect, control, and suppress fire events. Fire protection engineers typically:</p> <ul style="list-style-type: none"> • consider the effects of fire on people, structures, commodities, and the continuity of operations; • identify fire hazards and their risks, the cost of protection, and fire safety design; • develop, interpret, and promote fire safety codes and standards; • use quantitative methods to assess aspects of fire and fire safety; and • determine and apply scientific principles and theories of fire phenomena. 	

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FIRE PROTECTION ENGINEERING, 0804 (continued)

Occupational Information (continued)

Fire protection engineers examine the nature and characteristics of fire phenomena and the associated products of combustion. They determine how fires originate, spread, and are detected, controlled, and/or extinguished. Their work includes the anticipation and prediction of fire behavior on materials, structures, machines, and apparatus to protect life and property.

Fire protection engineers integrate knowledge of various engineering and scientific disciplines to perform work such as:

- design overall fire protection systems;
- conduct investigations into post fire incidents; and
- provide specifications for building construction, exit and egress means, and mechanical systems.

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MATERIALS ENGINEERING, 0806		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work to:</p> <ul style="list-style-type: none"> • determine and advise on a material's essential composition, atomic and molecular configuration, and processing; • relate the material's essential composition to its properties, end use, and performance in engineering, architecture, and scientific applications and programs; • examine the interaction of materials in their processes and applications, taking into account the associated equipment, systems, components, and their fabrication, design, or use; • develop, maintain, and apply materials and material solutions to meet certain mechanical, electrical, environmental, and chemical requirements; and/or • test and evaluate substances for new applications. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Materials Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Ceramics – Work primarily involving nonmetallic, inorganic materials:</p> <ul style="list-style-type: none"> • generally requiring high temperatures for processing; and • including crystalline materials, cementitious materials, abrasives, refractories, porcelain enamels, structural clay products, white ware, and glass products. <p style="padding-left: 40px;">Coatings – Work primarily involving organic/inorganic coatings (typically solids) for control of radiant and electromagnetic energy, protection from environmental conditions, lubrication, corrosion protection, and minimization of wear.</p> <p style="padding-left: 40px;">Composites – Work primarily involving manufacturing materials fabricated by combining two or more distinct materials to create better materials, such as particulate or fiber-reinforced metal, polymer, and ceramic materials.</p> <p style="padding-left: 40px;">Electromagnetics – Work primarily encompassing:</p> <ul style="list-style-type: none"> • materials involved with the interaction of light and surfaces or volume of material in which the light is reflected or refracted due to electromagnetic field interaction; and • activities involving physical changes in a material caused by electromagnetic energy. 	

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MATERIALS ENGINEERING, 0806 (continued)	
Titling (continued)	<p>Environmental Effects – Work primarily involving the use of materials in special or corrosive environments (e.g., combustion, high-pressure oxygen, vacuum, atomic-oxygen, hydrogen, and ultra-violet light).</p> <p>Failure Analysis – Work primarily involving the investigation and evaluation of failed materials and surfaces to determine causes of failure.</p> <p>Fluids – Work primarily involving:</p> <ul style="list-style-type: none"> • liquids including materials for fuels, energetics, solvents, hydraulics, coolants, refrigeration, and fire-fighting and -suppression; and • liquid and gaseous lubricants and their properties and characteristics under various loads and environmental conditions. <p>Manufacturing – Work primarily involving improving or developing fabrication or processing techniques for manufacturing materials.</p> <p>Metals – Work primarily involving metals and alloys typically selected by testing and evaluating compatibility with end uses.</p> <p>Nondestructive Evaluation – Work primarily involving the development and application of methods for detecting flaws and discontinuities in materials.</p> <p>Polymers – Work primarily involving polymers with potential to improve products (e.g., plastics, adhesives, elastomers, coatings, and fibers).</p> <p>Structural Analysis – Work primarily involving the determination of mechanical properties under varying conditions of load (e.g., tension, stress rupture, and low and high cycle fatigue) and the development of methods and models to predict the life of materials under service conditions.</p> <p>Textiles – Work primarily involving natural or synthetic fibers, fibrous materials, and textiles.</p>
Occupational Information	<p>General Occupational Information</p> <p>Materials engineering work involves the generation and/or application of theories, principles, practical concepts, and processes related to:</p> <ul style="list-style-type: none"> • materials engineering science (including considerations of cost, availability, fabrication, performance, and use) and the traditional engineering science disciplines (e.g., civil, mechanical, electrical, and chemical); • material sciences (e.g., the interrelationships of composition, structure, and properties), including nondestructive evaluation and inspection;

(continued)

MATERIALS ENGINEERING, 0806 (continued)

Occupational Information (continued)

- critical inquiry, analysis, and scientific methodology;
- advanced mathematics and computer science;
- other engineering science disciplines (e.g., electronics, composites, chemical, and mechanical); and
- physical science disciplines (e.g., chemistry, physics of solids and liquids, physical and mechanical metallurgy, ceramics, crystallography, and polymer science) as they relate to the end use of the materials worked on.

Materials engineers may be responsible for one or more work functions or categories of materials. Their work usually includes:

- assuring availability of materials with required properties and characteristics to satisfy agency requirements;
- identifying new uses for materials;
- promoting conservation through recycling or using “green material,” ensuring environmental compatibility;
- advising on the best materials or combinations of materials for diverse and specific uses; or
- developing and applying the means of testing, evaluation, life prediction, and standardization of materials and properties for use in engineering, architecture, and scientific designs and projects.

Materials engineering work may include:

- original and/or applied research and development activities;
- processing and fabrication of materials; and
- designing or fabricating an equipment component to induce desired properties or eliminate detrimental properties.

Most federal materials engineers work in agriculture, defense, aviation, space exploration, health, nuclear energy, and transportation agencies. Their work frequently includes monitoring and administering activities through contracts and grants. These engineers also provide outreach and educational services to research, industrial, and private sectors expanding and promoting the use of new and improved materials.

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LANDSCAPE ARCHITECTURE, 0807		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional landscape architecture work to:</p> <ul style="list-style-type: none"> • create, preserve, design, rehabilitate, and provide stewardship for outdoor spaces and land; • research, interpret, and conserve historical, cultural, aesthetic, and natural resources; and • achieve safe, healthful, efficient, and aesthetically pleasing physical environments (e.g., parks, recreational areas, and public buildings) for human use and enjoyment. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Landscape Architect</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Landscape architecture work involves the generation and/or application of theories, principles, practical concepts, and processes related to:</p> <ul style="list-style-type: none"> • decorative arts, architecture, design, construction, civil engineering, and horticulture to: <ul style="list-style-type: none"> – recognize, determine, and interpret land use and development issues involving historical, cultural, aesthetic, and natural resources and their restoration, preservation, and conservation; and – create landscape architecture projects to ensure the public’s health, safety, and welfare; • essential aspects of form, plantings, color, dimension, space, climate, and function used to: <ul style="list-style-type: none"> – research, conserve, and recognize visualizations of aesthetic, cultural, natural, and historical resources; and – meet environmental, ecological, and sustainable development requirements; • the social sciences (e.g., economics, history, archeology, sociology, anthropology) and community planning; • critical inquiry, problem solving, analytical reasoning, and scientific methodology; • cost estimating and documentation including: <ul style="list-style-type: none"> – site designs, grading plans, urban designs, landscape planting plans, irrigation designs, and public design presentations; – preparing, reviewing, and executing plans and specifications; and – using hand drafting, computer-aided design systems, and the geographic information system; and • project management. 	

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LANDSCAPE ARCHITECTURE, 0807 (continued)	
Occupational Information (continued)	<p>Landscape architects principally work on projects and activities involved in the alignment and arrangement of sites, land uses, drainage, and vegetation. Landscape architects may work individually and/or with teams of design, construction, and contracting professionals.</p> <p>They may develop extensive plans, including comprehensive outdoor recreation, urban, regional landscape, land development, ecological, environmental restoration, sustainable development, and water resource recreation plans. This work requires knowledge of environmental and ecological compliance laws and policies and the requirements of ecosystems.</p> <p>Landscape architecture requires both the art of site and landscape design and skill in applying the science of architecture to site elements and materials.</p> <p><u>←BACK TO TABLE OF CONTENTS</u></p>

ARCHITECTURE, 0808		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional architecture work involving the art and science of conceptualizing, planning, developing, and implementing designs to ensure buildings and structures are:</p> <ul style="list-style-type: none"> • responsive to human activities and needs; • structurally sound and permanent; and • economical to acquire, operate, and maintain. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Architect</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Architecture involves the generation and/or application of theories, principles, practical concepts, and processes related to:</p> <ul style="list-style-type: none"> • architecture and architecture design, standards, codes, techniques, and practices; • traditional engineering science disciplines (e.g., civil, mechanical, and electrical), physical science disciplines (e.g., materials and physics), advanced mathematics, and social science disciplines (e.g., history and economics); • analytical reasoning and scientific methodology; • interpreting art and designs, including design manuals; • methods used to integrate the diverse human dimensions within designs of structures; and • the relationships among, and interactions of, aesthetics, function, space, technology, environment, and materials. <p>Architects typically collaborate with others on all phases of planning, designing, and constructing a project, from initial discussions with the client to the completion of the project.</p> <p>The practice of architecture emphasizes the art and science of designing structures as distinguished from the practical skills principally associated with construction activities. The architect merges the needs of society with aesthetic values.</p> <p>Architects design a wide variety of structures and complexes (e.g., medical centers, campuses, prisons, and industrial parks). Their work may specialize in one function or cover the whole process from conception through post-occupancy usage. Architects use computer-aided design and drafting technology to create and produce design documents or may render sketches and drawings by hand.</p> <p><u>←BACK TO TABLE OF CONTENTS</u></p>	

CIVIL ENGINEERING, 0810		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving:</p> <ul style="list-style-type: none"> • construction, renovation, inspection, decommissioning, and/or demolition of structures, infrastructures, and their environmental systems above or under the earth's surface; • investigation and evaluation of the earth's physical, natural, and man-made features; and • transportation, utilities, building and construction industries. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Civil Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p>Construction Management – Work primarily involving the performance and/or oversight of on-site construction work, including inspection and acceptance of facility or utility construction work performed by a contractor.</p> <p>Geotechnical – Work primarily involving:</p> <ul style="list-style-type: none"> • evaluation of soil, rock properties, slope stability, and seepage; • seismic analysis of soil, rock properties, and sub-surfaces; and • evaluation and design of earth retaining systems, embankment dams, structure foundations, and ground improvement projects. <p>Highway – Work primarily involving the design and construction of highways, road structures, and highway systems considering factors such as economics, route location, traffic behavior, and vehicle characteristics.</p> <p>Hydraulics – Work primarily involving the application of hydraulics and principles of fluid mechanics.</p> <p>Hydrologic – Work primarily involving applying the science of hydrology, including:</p> <ul style="list-style-type: none"> • analyzing flow characteristics; • designing drainage structures (e.g., bridges and culverts); and • evaluating facility (e.g., reservoirs, canals, pipelines, pumping plants) capacities and operation. <p>Structural – Work primarily involving the application of structural dynamics theories, including the distribution of loads, stresses resulting from loads, and strength of materials, such as for the design or construction of structures, bridge and tunnel design and construction, seismic analysis of structures, and inspection and condition rating of bridges.</p> <p>Transportation – Work primarily involving the planning and/or design of transportation systems including traffic engineering, route systems and modeling, and sensing systems, processes, and technology.</p>	

(continued)

CIVIL ENGINEERING, 0810 (continued)	
Occupational Information	<p>General Occupational Information</p> <p>Civil engineering work involves the generation and/or application of theories, principles, practical concepts, and processes related to:</p> <ul style="list-style-type: none"> • the science of civil engineering (including its materials, methods, systems, industry codes, and procedures) and the other traditional engineering science disciplines (e.g., mechanical, electrical, chemical); • the art, techniques, and engineering design standards for the building, transportation, public works, and construction industries; • physical science disciplines (e.g., physics, chemistry, and materials science), advanced mathematics, and social science disciplines (e.g., economics and community planning); and • critical inquiry and scientific methodology. <p>Primary concerns in civil engineering work include:</p> <ul style="list-style-type: none"> • site location; • planning, analysis, and design of systems and structures; • the nature of soils and rock for use in foundations, construction materials, channels, or retaining structures; • integration of design and construction activities and the implementation and oversight of engineering, architecture, and/or scientific requirements in contracts for design or construction projects; • operation, maintenance, and monitoring of structures and systems; and • the impact on social, economic, and natural resources. <p>Civil engineers typically provide advisory services in the planning and design process, and engineering management services for design, construction, sustainment, and decommissioning projects. Civil engineers interpret design documents and oversee the proper execution of construction work. Civil engineers are also involved in original and applied research activities conducted in laboratory settings or for organizations primarily concerned with testing, technology transfer activities, materials and instrumentation development, and modeling and computational analysis.</p> <p>Civil engineering work in the Federal Government includes the following specific functions:</p> <ul style="list-style-type: none"> • licensing and regulation of public utilities and land use; • policy guidance and oversight of surveying systems and mapping programs impacting the development of maps and related engineering data;

(continued)

CIVIL ENGINEERING, 0810 (continued)

Occupational Information (continued)

- guidance and control over the planning, designing, constructing, evaluating, inspecting, maintaining and operating, and decommissioning or demolition of structures, infrastructures, and systems under contract or the jurisdiction of external interested entities (e.g., individual State governments), which include projects and programs involving aids and grants:
 - from the Federal Government;
 - with federally-insured financing; or
 - under financing by the private interests involved;
- research and investigations of physical phenomena to develop programs and methods supporting the conservation of natural resources and pollution controls;
- design and analysis of designs, drawings, proposals, scopes of work, specifications, and cost estimates for projects and design changes during construction;
- layout and scheduling of operations to include inspection, quality control, and assurance activities for materials, methods, and equipment used in construction; and
- structural evaluation and maintenance involving:
 - inspecting the physical condition of structures, including post-catastrophic assessment;
 - analyzing the life-cycle of the infrastructures (i.e., effect on strength, carrying capacity); and
 - performing work to sustain the life-cycle and use of structures and systems.

Some examples of civil engineering work in the Federal Government include:

- airfields, bridges, and buildings (e.g., foundations, walls, and structural members);
- canals, dams, drainage systems, and earth dredging operations;
- transportation (e.g., highways, streets, and roads);
- recreation facilities (e.g., campgrounds, trailheads, interpretive sites, and visitor centers);
- irrigation systems and water supply facilities (e.g., reservoirs, purification and distribution systems);
- wastewater systems (e.g., sewers and treatment systems);
- stream restoration, including fish protection systems;
- railroads and tunnels;
- soil and rock structures (e.g., slopes, embankments, levees, or foundations); and
- storm and erosion protection systems for rivers, harbors, shores, and beaches.

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ENVIRONMENTAL ENGINEERING, 0819		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving environmental programs and projects in the areas of:</p> <ul style="list-style-type: none"> • environmental planning; • environmental compliance; • identification and cleanup of contamination; and • restoring and sustaining environmental conservation. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Environmental Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Air Pollution/Control – Work primarily involving air pollution control or abatement systems.</p> <p>Contamination Sites – Work primarily involving cleanup of contaminated sites.</p> <p>Mining/Industrial Operations – Work primarily involving cleanup of mining and industrial operations.</p> <p>Regulatory Compliance – Work primarily involving environmental impact and assessments, documentation, regulatory development, interpretation, compliance, and enforcement.</p> <p>Restoration – Work primarily involving restoration of environmental conditions including natural water and land habitats, such as wetlands.</p> <p>Wastewater – Work primarily involving domestic, storm, and industrial wastewater collection, treatment, and disposal facilities.</p> <p>Waste Systems – Work primarily involving refuse, solid, and hazardous waste collection and disposal systems.</p> <p>Water Systems – Work primarily involving water supply, treatment, and distribution systems.</p>	

(continued)

ENVIRONMENTAL ENGINEERING, 0819 (continued)

Occupational Information

General Occupational Information

The work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:

- environmental engineering and the traditional engineering science disciplines (e.g., chemical, civil, electrical, mechanical);
- environmental engineering design standards, codes, and practices;
- advanced mathematics and economics;
- biological and physical science disciplines; and
- critical inquiry, problem solving, and scientific methodology.

Environmental engineering work emphasizes mitigation or remediation of harmful environmental effects, recycling and recovery of natural resources, and ensuring public health and safety. The work also concerns ecology or the quality of the environment. These engineers work with diverse aspects of water, land, or air pollution.

Environmental engineering work in the Federal Government includes the following activities and functions:

- contract management and oversight of the engineering and scientific requirements in the contracted work;
- budget development for Federal programs;
- community outreach and education;
- regulatory and policy development and enforcement;
- environmental technology research, verification, and transfer;
- Federal disaster preparedness and emergency response;
- Federal assistance to foreign governments and programs; and
- Federal assistance to international agencies and organizations.

Environmental engineering in the Federal Government also encompasses a variety of unique work situations, such as:

- harbor, river, navigation, reservoir, and dam management;
- Federal land management;
- nuclear and other energy resource management;
- alternative energy development; and
- management of Federal facilities.

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MECHANICAL ENGINEERING, 0830		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work:</p> <ul style="list-style-type: none"> • involving the design, development, commission, manufacture, operation, maintenance, and disposal of mechanical devices and systems and their equipment and/or components; and • concerning the principles of motion, energy, force, and material properties to ensure mechanical devices and systems and their equipment and/or components function safely, reliably, efficiently, and economically. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Mechanical Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Controls – Work primarily involving industrial, commercial, and process controls including utility monitoring control systems and facility energy management control systems.</p> <p style="padding-left: 40px;">Energy/Economic Analyses – Work primarily involving energy and life cycle-costs analysis of mechanical systems and equipment.</p> <p style="padding-left: 40px;">HVAC/ Refrigeration – Work primarily involving designing, evaluating, constructing, commissioning, decommissioning, operating, and maintaining heating, ventilation, and air conditioning (HVAC) and refrigeration systems.</p> <p style="padding-left: 40px;">Hydropower – Work primarily involving the design, construction, and rehabilitation of mechanical equipment and systems in hydropower facilities.</p> <p style="padding-left: 40px;">Petroleum/Oils/ Lubricants – Work primarily involving designing, evaluating, developing, constructing, commissioning, decommissioning, operating, and maintaining petroleum, oil, and lubricant systems (e.g., aircraft fuels storage and hydrant refueling systems).</p> <p style="padding-left: 40px;">Plumbing – Work primarily involving designing, evaluating, developing, constructing, commissioning, decommissioning, operating, and maintaining plumbing and piping systems and equipment.</p>	

(continued)

MECHANICAL ENGINEERING, 0830 (continued)

Occupational Information

General Occupational Information

Mechanical engineering work involves the generation and/or application of theories, principles, practical concepts, systems, and processes related to:

- the science of mechanical engineering (e.g., design, fluid dynamics, manufacturing processes, machine design, thermodynamics, and heat transfer), design standards, industry codes, and techniques;
- traditional engineering science disciplines (e.g., civil, electrical, and chemical); and
- advanced mathematics, physical science disciplines (e.g., physics, chemistry, and materials science), environmental science, and social science disciplines (e.g., economics).

Mechanical engineers use a variety of materials and the physical laws governing them to produce mechanical systems and devices useful to societies and industries. The devices and systems are designed to function in a particular environment and/or under a wide range of conditions. Mechanical engineering contributes to the daily and extraordinary needs of societies, industries, and Government, and to new and extended theoretical knowledge and understanding of physical phenomena.

Mechanical engineers in the Federal Government also perform technical design and development project work, program management work for a significant technological field or particular emphasis area, and engineering advisory services. Work situations for these mechanical engineers usually include some of the following:

- providing agency program management for a mechanical engineering emphasis program area;
- performing and executing a variety of engineering projects from conception to completion;
- conducting in-depth studies and analyses of specific issues or specialty areas within the mechanical engineering discipline; and
- serving as a consultant and advisor on mechanical engineering science issues and concerns.

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NUCLEAR ENGINEERING, 0840		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving processes, instruments, and systems used to generate and/or control nuclear energy and radiation. The work relates directly to:</p> <ul style="list-style-type: none"> • nuclear reactors, other nuclear systems and their support systems, instruments, and equipment; • planning and design activities for specialized equipment and process systems of nuclear facilities; • protection of the public from hazardous radiation produced by nuclear reaction processes; and • harnessing nuclear energy for a wide variety of uses. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Nuclear Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Nuclear engineering involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of nuclear engineering and the traditional engineering science disciplines (e.g., civil, electrical, mechanical, and chemical), including heat transfer, thermodynamics, fluid dynamics, mechanics, and electrical theory; • nuclear engineering designs, standards, codes, techniques, practices, and technology; • physical science disciplines (e.g., materials science, physics, and chemistry) and computer science; • advanced mathematics, statistics, and economics; and • critical inquiry, problem solving, and scientific methodology. <p>In the Federal Government nuclear engineers are involved in a variety of projects and programs, such as:</p> <ul style="list-style-type: none"> • fuel cycle management program; • fuel development; • reactor design, operations, and maintenance; • oversight in research and development organizations; • control of manufacturing, repair, refueling, or maintenance processes; • licensing, safety, inspection, and incident analyses; • assuring compliance with, and reviewing, standards or contract provisions; • design, instrumentation, and test operations; • decommissioning, recycling, and disposal; and • transportation and storage of radioactive materials and waste. 	

(continued)

NUCLEAR ENGINEERING, 0840 (continued)

Occupational Information (continued)

Federal nuclear engineering work includes consideration of the safety, political, economic, and social implications of nuclear energy use and requires rigorous attention to techniques, equipment, and operations typically used in other engineering and science disciplines.

Many of the Federal Government nuclear engineers work in naval shipyards, department and agency headquarters, field offices located near national laboratories, or other field facilities operated under contract. Most of these nuclear engineers perform functions or activities associated with one or a combination of the following:

- design and determination of reactor core fuel loadings, fuel enrichments, power and neutron flux distributions in the core, control requirements, and behavior of equipment, instruments and materials during fuel burn-up;
- assessment of the safety and reliability of a plant, process, or a particular nuclear reactor ensuring:
 - its safe operation and the protection of the public and the environment; and
 - conformance with all specifications, regulations, and laws;
- analyses of potential incidents with radioactive materials to allow the consequences to be evaluated and procedures developed to prevent or mitigate the occurrence of the incident;
- research and development efforts involving the use of advanced calculations and theoretical methods for:
 - the development of alternate processes to utilize nuclear energy to benefit mankind; and
 - the selection and evaluation of specific materials for use in the fission and fusion process;
- studies of the nuclear fuel cycle aimed at the optimum use of fissionable resources for energy production as well as the selection and placement of specific fuel materials in a reactor core;
- use of nuclear reactors for propulsion;
- storage, handling, transportation, and disposal of radioactive waste products;
- operation, testing, and/or engineering monitoring of the nuclear-related portions of a facility or naval vessel;
- design, performance, and evaluation of tests for the nuclear portion of facilities to:
 - ensure operation within their engineered limits; or
 - institute corrective actions to mitigate reactor plant component damage and ensure personnel and general public safety;
- planning, directing, and authorizing the construction, overhaul, maintenance, repair, modification, operational tests, or refueling of nuclear power systems for naval vessels; and
- developing new or substantially improved nuclear processes, systems, and techniques.

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ELECTRICAL ENGINEERING, 0850		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work concerned with:</p> <ul style="list-style-type: none"> • utilizing and exploring electrical and electronic phenomena and the motion, emissions, conduction, and behavior of electrical energy currents; • designing electrical equipment, components, or systems; and • generating and transmitting electrical energy in an efficient manner. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Electrical Engineer</i>.</p>	
Occupational information	<p>General Occupational Information</p> <p>Electrical engineering involves the generation and/or application of theories, principles, practical concepts, processes, and systems relating to:</p> <ul style="list-style-type: none"> • properties of matter and energy in the investigation of electrical phenomena; • electrical circuits, circuit elements, equipment, and systems; • traditional engineering science disciplines (e.g., mechanical, chemical, and civil) and physical science disciplines (e.g., chemistry and physics); and • advanced mathematics, computer science, and economics. <p>Electrical engineers are concerned with the practical application of electricity. They design and develop electrical equipment and systems, including broadcast and communications systems, electric motors, machinery controls, lighting and wiring, radar and navigation systems, and power generating, controlling, and transmission devices. Electrical engineers design new products, write performance requirements, and develop maintenance schedules. They also test equipment, solve operating problems, and estimate the time and cost of engineering projects.</p> <p>Electrical engineers who support construction projects develop electrical designs and prepare construction drawings and specifications for electrical systems and equipment. They may perform work involving overhead and underground electrical distribution; interior lighting and power; street and floodlights; airfield night and navigational lighting; electrical generator installations for critical facilities and structures; electrical installations for dams and other civil works projects; communication and signal circuits; cathodic protection; and intrusion detection systems.</p>	

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ELECTRICAL ENGINEERING, 0850 (continued)

Occupational information (continued)

Some electrical engineers may perform power distribution/transport work focused on electrical energy, electrical devices (e.g., systems, equipment, and components), power stations, power generation and operations, utilities, circuit systems, and robotics. This work primarily concerns high-power electrical current transmission from the original central station along grids, wires, or cables to delivery points such as homes, businesses, and industries.

The work involves any or all of three major areas of emphasis:

- power conversion and production of electrical energy in the power station;
- means of distributing electrical power; and
- avenues for turning the power into usable forms (e.g., heating, lighting, and operating mechanical devices).

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COMPUTER ENGINEERING, 0854		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving the design, construction, and operation of computer systems, including hardware and software and their integration.</p> <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Computer Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Data Systems – Work primarily involving database relationships, data warehousing, and data mining systems.</p> <p style="padding-left: 40px;">Embedded Systems – Work primarily involving systems embedded in weapons, fire control hardware, monitoring systems, test systems, and manufacturing processes.</p> <p style="padding-left: 40px;">Networks – Work primarily involving activities related to network architecture, hardware, and software to include routers, servers, lines (e.g., fiber optic or twisted pairs), protocols, system domains, Wide Area Network, Local Area Network, Intranet, and Internet.</p> <p style="padding-left: 40px;">Simulations – Work primarily involving computational simulation and modeling of systems, scenarios, problems, and designs.</p>	
Occupational Information	<p>General Occupation Information</p> <p>Computer engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and methods related to:</p> <ul style="list-style-type: none"> • electrical engineering, computer science technology, and applications specific to: <ul style="list-style-type: none"> – computer programming languages; – computer hardware and software and their integration; and – integrated computer hardware and software systems; – computer systems design requirements, standards, codes, techniques, and practices; and – advanced mathematics, economics, physical science disciplines, and the traditional engineering science disciplines (e.g., civil, mechanical, electrical, and chemical). 	

(continued)

COMPUTER ENGINEERING, 0854 (continued)

Occupational Information (continued)

Computer engineering work involves the application of engineering and scientific theories and principles to complex computer-based systems. Computer engineers devise software to integrate a number of devices (e.g., systems, equipment, application programs, and components) into a computer system. They also design firmware defining the behavior of a system.

Project work may focus on a particular phase or the whole process from conception to completion. Federal computer engineering work exists in organizations having requirements for the development and use of unique systems such as:

- embedded computers in weapons or weapons-support systems;
- systems for complex scientific applications;
- simulation systems;
- communication systems;
- computer-aided engineering and design systems; and
- large-scale information systems with worldwide infrastructure.

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ELECTRONICS ENGINEERING, 0855		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving electronic circuits, circuit elements, equipment, systems, and associated phenomena concerned with electromagnetic or acoustical wave energy or electrical information for purposes such as communication, computation, sensing, control, measurement, and navigation.</p> <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Electronics Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Electronics engineering involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of electronics engineering and the traditional engineering science disciplines (e.g., mechanical and chemical); • physical science disciplines (e.g., chemistry and physics); and • advanced mathematics, computer science, and economics. <p>Electronics engineers research, develop, test, evaluate, operate, maintain, decommission, and/or direct the fabrication, manufacture, and installation of:</p> <ul style="list-style-type: none"> • electronic devices used in: <ul style="list-style-type: none"> – diverse technologies such as aviation, computing, transportation, commerce, and manufacturing; and – industrial, academic, entertainment, communications, business, residential, and healthcare environments; and • a broad range of products such as computer systems, navigational systems, programmable logic controls, sensors, magnetic imaging systems, and defense systems. <p>Electronics engineering work typically involves electromagnetic energy transmission for purposes such as sensor processing, remote sensing, communications, guidance and control, information processing, and defense work.</p> <p>Electronics engineers analyze and study performance requirements against an array of diverse considerations, such as:</p> <ul style="list-style-type: none"> • safety and human factors engineering; • technical risks; • functionality; • reliability; • failure analysis; 	

(continued)

ELECTRONICS ENGINEERING, 0855 (continued)

Occupational Information (continued)

- quality assurance;
- maintainability;
- affordability of each system and device; and
- impact on the environment.

Electronics engineers work on Federal electronic systems and devices including:

- satellites;
- flight systems (e.g., auto pilots, operational flights, instrument landing);
- communication systems, including radios and antenna systems;
- navigation systems, including global positioning systems;
- simulators;
- acoustical measurement systems;
- industrial robots;
- radar and sonar systems;
- tracking and scheduling systems;
- weapon systems, including target systems;
- data acquisition systems and control systems for test operations;
- display systems;
- diagnostic systems (e.g., Magnetic Resonance Imaging and Computerized Axial Tomography Scan); and
- automated logistics systems.

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BIOENGINEERING AND BIOMEDICAL ENGINEERING, 0858 [Qualification Standard](#)

Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work exploring and using biotechnology to:</p> <ul style="list-style-type: none"> • enrich practices, techniques, and knowledge in the medical, physiological, and biological sciences; • enhance and ensure the health, safety, and welfare of living (i.e., human and animal) systems; and • create and improve designs, instrumentation, materials, diagnostic and therapeutic devices, artificial organs, medical systems, and other devices (e.g., systems, equipment, application programs, and components) needed in the study and practice of medicine with living systems. <p>This series requires a <u>functional classification code</u>.</p>
Titling	<p>The basic titles for positions in this occupation are:</p> <p>Bioengineer – Work involving activities to improve life systems or to develop new microorganisms for beneficial ends by utilizing and enhancing advancements in the biotechnology disciplines (e.g., biochemical engineering and genetic engineering) involving the modification of life (animal or plant) system cells or cell parts.</p> <p>Biomedical Engineer – Work involving activities utilizing biotechnology to improve and provide healthcare systems and devices.</p> <p>In addition to the basic title, the following parenthetical titles may be used:</p> <p>Bioimaging – Work primarily involving application of knowledge and skills in using:</p> <ul style="list-style-type: none"> • the theories, principles, and practices of medical physics; • ultrasonic properties of tissues; • radiological properties; • ionizing and non-ionizing radiation methods of tissue and organ imaging; and • bioeffects of radiation. <p>Bioinformatics – Work primarily involving creating and developing advanced information and computational technologies to address problems in molecular biology.</p>

(continued)

BIOENGINEERING AND BIOMEDICAL ENGINEERING, 0858 (continued)

Titling (continued)

- Bioinstrumentation** – Work primarily involving the design of biomedical instrumentation, devices, and sensors to:
 - monitor signals (e.g., respiration, temperature) within the body;
 - discern biological signals (e.g., concentration of proteins, pH) and chemical variables; and
 - solve biomedical problems and concerns by measuring physical phenomena relevant to the medical and biological sciences.

- Biomaterials** – Work primarily involving the development and analysis of material properties (e.g., natural and synthetic as well as biological tissues) used to construct medical devices which come into contact with living tissues.

- Biomechanics** – Work primarily involving conceptualizing, developing, and analyzing the mechanics of a part or function of a living body or system, including the forces (i.e., motion, weight, gravity) exerted by or on a part or function of a living body or system.

- Biosystems** – Work primarily focusing on systems and control technologies such as those used in designing and developing:
 - smart prosthetic devices (e.g., cardiac pacemakers, defibrillators and neuromuscular prostheses for hand, arm, and leg motion);
 - biomedical imaging and signal processing applications;
 - models of neural and brain activity and muscle and cardiac electrophysiology; and
 - biomechanics.

- Clinical** – Work primarily involving applying biomedical engineering theories, principles, and practices directly within the hospital or clinical services arena to:
 - plan for and evaluate the acquisition of complex medical equipment;
 - manage the operation and maintenance of complex medical equipment; and
 - provide advisory services to the medical staff on the effectiveness and capabilities of complex medical equipment used in healthcare delivery services.

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BIOENGINEERING AND BIOMEDICAL ENGINEERING, 0858 (continued)**General Occupational Information**

Bioengineering and biomedical engineering work necessitates extensive research and collaboration to exchange and utilize engineering expertise with scientists and medical providers with the goal of exploring and devising practices, concepts, and theories impacting health, safety, and quality of life.

This work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:

- two or more traditional engineering science disciplines (e.g., chemical, mechanical, and electrical);
- biological, health, and medical science disciplines (e.g., microbiology, physiology, and anatomy);
- physical science disciplines (e.g., chemistry, health physics, materials science, and physics);
- advanced mathematics, computer science, and economics;
- critical inquiry, problem solving, and scientific methodology;
- an understanding of the practices and concepts of equipment design and development; and
- engineering design and its standards, codes, and practices.

Bioengineering and biomedical engineering work encompasses:

- integrating engineering and the various science disciplines (e.g., biology, physics, physiology, medicine, or chemistry) to enhance understanding of living systems and of existing medical practices and techniques; and
- generating and assessing new and extended healthcare practices, methods, and devices (e.g., systems, equipment, components, and programs).

Biomedical engineering work involves medical equipment budgeting, program planning, and advisory services on the strategic uses of medical equipment and program compliance with healthcare accreditation standards, such as:

- research and development of new and revised medical devices and new uses of existing medical devices;
- review and approval of the testing, evaluation, and manufacturing of medical devices; and
- application of human factors engineering in the design and operation of medical devices and healthcare delivery systems.

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Occupational Information

AEROSPACE ENGINEERING, 0861		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work concerning the integration of the aeronautics and astronautics sciences within the broad arena of aviation and space exploration. It includes related materials, equipment, systems, applications, and components.</p> <p>The aerospace engineering science discipline involves:</p> <ul style="list-style-type: none"> • increasing the knowledge and understanding of the aeronautical and astronautical sciences and their applications in aviation and space exploration; • improving manned and unmanned commercial, defense, and business aviation technology; and • creating, developing, testing, launching, operating, maintaining, remodeling, and decommissioning aeronautical vehicles and structures. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Aerospace Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Acoustics – Work primarily involving the development, testing, and evaluation of components, subsystems, and systems used to contain, produce, actuate, or carry sound.</p> <p style="padding-left: 40px;">Aerodynamics – Work primarily involving activities related to the properties responsible for resisting displacement and maintaining altitude of airborne vehicles.</p> <p style="padding-left: 40px;">Aerothermodynamics – Work primarily involving the flow of fluids at high speeds occurring in hypersonic flight, in missiles, and entry into planetary atmospheres. This work uses advanced computational methods to design physical models of significant phenomena, characterize the physics involved, and create the capability to calculate the flow of fluids.</p> <p style="padding-left: 40px;">Assemblies – Work primarily involving the development and testing of aircraft and spacecraft assemblies.</p> <p style="padding-left: 40px;">Flight Control – Work primarily involving flight control of real or simulated systems.</p> <p style="padding-left: 40px;">Flight Vehicles – Work primarily involving activities related to the entire flight vehicle (e.g., vehicle structure, aerodynamic configuration, crew compartment, propulsion system).</p>	

(continued)

AEROSPACE ENGINEERING, 0861 (continued)

Titling (continued)

Fuel Systems – Work primarily involving the development, testing, and evaluation of airborne and spaceborne vehicle fuel systems including aerial and space refueling systems, external tanks, internal tanks, and bladder tanks.

Heat Transfer – Work primarily involving:

- radiation, convection, and conduction heating of solids and fluids;
- measurement of heat flow; and
- movement of heat in various mediums (e.g., ducts, high speed flow, mechanical components, and engines).

Navigation, Guidance, and Control Systems – Work primarily involving vehicle flight dynamics and the definition, design, development, and evaluation of systems and subsystems to control or guide the vehicle in flight through the earth’s atmosphere and in outer space.

Orbital Mechanics – Work primarily involving activities associated with the properties for maneuvering in space.

Power Support – Work primarily involving activities related to electrical and electronic power supplies for aerospace vehicles.

Propulsion Systems – Work primarily involving:

- production, testing, and evaluation of thrust momentum or change of momentum required to sustain flight of aircraft and/or spacecraft; and/or
- reciprocating turbine, rocket, ramjet and scramjet engines or their variations.

Structural – Work primarily involving:

- activities related to assuring the structural integrity of aerospace vehicles (e.g., aircraft, spacecraft, helicopters, and missiles); and/or
- component structures such as wings, fuselage, empennage, rotors, landing gear, pylons, nacelles, engines, drive systems, and propellers.

(continued)

AEROSPACE ENGINEERING, 0861 (continued)

Occupational Information

General Occupational Information

Using expertise in aeronautical science and aviation technology, aerospace engineers develop, test, evaluate, research, operate, maintain, remodel, and decommission aircraft and/or spacecraft.

The work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:

- the science and practices of aeronautics involving designing, manufacturing, and operating airborne vehicles traversing the earth’s atmosphere;
- the science and practices of astronautics involving travel in outer space and the designing, manufacturing, and operation of space vehicles and space structures;
- engineering design and its standards, codes, techniques, and practices for aviation technology;
- traditional engineering science disciplines (e.g., mechanical, electrical, materials, industrial, and chemical) and the physical science disciplines (e.g., physics, chemistry, and materials);
- economics, computer science, and advanced mathematics including statistics and probability; and
- critical inquiry, problem solving, and scientific methodology.

The work requires knowledge of areas such as aerodynamics, aeroacoustics, astro-dynamics, computational fluid dynamics, fluid mechanics, flight dynamics, flight structures, thermodynamics, flight propulsion, and energy conversion and use.

Aerospace engineering involves the understanding, visualization, analysis, design, and operation of aerospace vehicles and structures operating within, above, and beyond the earth's atmosphere. The work includes: production, fabrication, operation, type certification, and/or maintenance of aerospace vehicles or integrally associated equipment. It also includes positions involved in investigating phenomena encountered in aerospace flight, monitoring and analyzing unknown or unfamiliar aerospace vehicles, piloting aerospace vehicles, and developing aviation safety standards and regulations.

Aerospace vehicles can be manned or unmanned and range from helicopters and other vertical take-off aircraft to high-speed spacecraft and space stations traveling to the atmospheres of earth, outer space, and other planets. Each kind of aerospace vehicle possesses unique characteristics, including its speed regime, flight environment, operational regime, and specific research, analysis, design, and operational problems.

(continued)

AEROSPACE ENGINEERING, 0861 (continued)

Occupational Information (continued)

Aerospace engineering covers multiple functions to include: planning, research, design, development, test and evaluation, cost analyses, program and project management, manufacturing, operation, quality management, aircraft flight safety certifications, airworthiness qualification determinations, sustainment, and disposal.

Federal projects and programs include not only these functional areas, but also the monitoring of contracted work either externally or on-site in the facility of the contractor. Often Federal aerospace engineers work alongside contract aerospace engineers to perform various duties to incorporate new technologies, improve reliability, extend the life of an aerospace vehicle, or reduce total ownership costs.

Federal aerospace engineers in aircraft certification programs ensure aerospace products (e.g., aircraft, aircraft engines, and propellers) developed for commercial markets comply with applicable laws concerning airworthiness designs, practices, standards, and safety.

Within the Defense agencies, aerospace engineers also determine aircraft worthiness qualifications for flight vehicles. These engineers conduct specialized studies on defense flight vehicles, including overall and individual major systems components, and additional airborne equipment encompassed in the structure, to ensure their safety, suitability, and effectiveness in operation.

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NAVAL ARCHITECTURE, 0871		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional architectural, engineering, and scientific work relating to:</p> <ul style="list-style-type: none"> • the form, strength, stability, performance, and operational characteristics of marine structures and waterborne vessels; and • all types of naval crafts and ships operating on, below, and just above the sea surface. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Naval Architect</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p>Arrangements – Work primarily involving the functional external and internal layout of a naval vessel or marine structure and encompassing:</p> <ul style="list-style-type: none"> • considerations for compartmentalization and access which involve the allocation of interior and exterior shipboard space; • functional studies of the stability and safety of the ship for various spaces (e.g., machinery rooms, repair shops, crew quarters; recreation spaces; storage and cargo spaces); and • determination of locations for deck machinery (such as winches, cranes, and cargo handling gear). <p>Construction Management – Work primarily involving the performance and/or oversight of on-site construction work, including inspection and acceptance of construction work performed by a contractor.</p> <p>Hydrodynamics – Work primarily involving the application of the scientific theories and principles in physics concerning motion, water, and/or liquids to:</p> <ul style="list-style-type: none"> • develop hydrodynamic design criteria for hull forms, ship appendages, and other marine devices used in surface and underwater structures; • conduct studies on such problems as: <ul style="list-style-type: none"> – resistance; – propulsion; – pressure distribution; – steering and turning; – propeller cavitation; and – propeller noise; and • investigate hydrodynamic issues, conditions, and problems. <p>Ship Design – Work primarily involving all design elements (e.g., structure, equipment, systems, and their components) of naval vessels (excluding small boats) to integrate the basic design features and the desired characteristics of the ship as a whole.</p>	

(continued)

NAVAL ARCHITECTURE, 0871 (continued)	
Titling (continued)	<p>Small Craft/Boat – Work primarily involving self-propelled boats or small craft (i.e., vessels up to 30 meters or 100 feet in length), including their hull, form, arrangements, weight control and displacement, and stability and trim.</p> <p>Stability – Work primarily focusing on the buoyancy and stability of ships, involving their design, construction, operation, and functionality, and including:</p> <ul style="list-style-type: none"> • stability studies for ships; • inclining experiments and trim dives; • reporting of damage control data; and • stability calculations and studies for launching, dry-docking, mooring, or towing vessels. <p>Structural – Work primarily involving structural engineering concerns for naval vessels and marine structures, including:</p> <ul style="list-style-type: none"> • ensuring materials used in primary and secondary structures are adequate for the loads imposed and meet standards; and • designing the structural and strength portions of the ship, such as: <ul style="list-style-type: none"> – hull forms or shells with the main structural connections (e.g., keels, inner-bottoms, decks, bulkheads, web frames, longitudinals, frames, beams, pillars, girders, armor, and other protective plating); – superstructure and deck houses; – masts and towers; – underwater ship appendages (e.g., propeller struts, bilge keels, and docking keels); and – foundations for machinery or other heavy equipment installed on shipboard.
Occupational Information	<p>General Occupational Information</p> <p>Naval architecture work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • marine, electrical, civil, or mechanical engineering sciences, in such areas as: <ul style="list-style-type: none"> – hydrodynamics, hydromechanics, and hydrostatics; – primary and secondary structural design; – structural mechanics and dynamics; – acoustics and vibratory phenomena; – energy conversion and power systems; – materials; and – electronics;

(continued)

NAVAL ARCHITECTURE, 0871 (continued)

Occupational Information (continued)

- design, standards, codes, techniques, and practices for naval vessels and marine structures;
- advanced mathematics, economics, and computer science;
- physical and biological sciences; and
- critical inquiry, analytical reasoning, problem solving, and scientific methodology.

Naval architecture is concerned with ship design as a whole, and not with the internal design of pieces of equipment placed in or on the ship. The work includes:

- design, construction, operation, remodeling, and decommissioning of whole entities;
- design, construction, and integration of internal and external shipboard systems and structures, including the arrangement and installation of equipment or systems; and
- establishing standards, safety regulations, and operational guidance and procedures.

Naval architecture work involves ship design and calculations for existing ships being altered (by means of conversion, rebuilding, modernization, or repair) and for new ships.

Naval architects determine the principal dimensions of the vessel in collaboration with ship operators or others who specify performance requirements. Once this determination has been made, naval architects prepare the preliminary ship design with the delineation of the lines, the displacement and stability calculations, general arrangement plans, weight calculations, and strength calculations. After the preliminary design is completed, the work involves building a physical model or models (particularly for new forms).

Naval architects prepare and/or evaluate contract plans and specifications, including:

- detailed working drawings of the ship's basic characteristics, mechanical systems, electrical installations and systems, hull piping and air conditioning, hull fitting arrangement, and interior arrangement;
- estimates of the amount of money the ship will cost and the time it will take to build; and
- provisions for the final trial and acceptance runs to test the ship's performance.

Naval architects also solve problems involving major design changes incidental to the conversion, alteration, repair, modernization, inactivation, and disposal of the vessel.

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MINING ENGINEERING, 0880		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work to explore, remove, and transport raw metals, nonmetallic minerals, and solid fuels from the earth. Mining engineering work involves:</p> <ul style="list-style-type: none"> • a variety of mineral substances to include metal ores; nonmetallic minerals; and solid fuels and energy sources; • working with mining systems, including underground mining; surface mining; solution mining; and placer mining; and • traditional mining activities, including the heavy construction industry (involving rock excavation and support for highways, tunnels, dams, power stations, and underground chambers) and exploration and development of mineral deposits located under large bodies of water. <p>This series requires a functional classification code.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Mining Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Mining engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of mining engineering including: <ul style="list-style-type: none"> – fluid mechanics, thermal analysis, and engineering mechanics; – rock mechanics, mineral economics, coal characteristics, and mineral processing principles; – mine safety, mine surveying and exploration, and mine ventilation; – mining power and drainage systems; and – land reclamation; • mining engineering design and its specific standards, codes, techniques and practices; • advanced mathematics and economics; • physical sciences (e.g., physics, chemistry, geology, metallurgy, materials science, and materials testing); and • critical inquiry, analytical reasoning, problem solving, and scientific methodology. <p>Mining engineers typically use geologic knowledge, highly sensitive instruments, and computational analyses to resolve issues, conditions, and problems involved in the development, production, and transportation of a mineral body. Their work in processing minerals emphasizes the efficient, economical, and safe separation of minerals from mined materials, and includes restoring the land to a useful condition after mining processes are completed.</p>	

(continued)

MINING ENGINEERING, 0880 (continued)

Occupational Information (continued)

Mining engineering work includes raw material production, as well as modern construction projects, underground openings for weapons systems and nuclear waste disposal, and land reclamation activities. Typically, mining engineering includes several of the following activities:

- exploration to identify, locate, and define mineral deposits;
- evaluation to determine the engineering, scientific, and economic feasibility of proposed and existing mining ventures;
- extraction to recover minerals from the earth using energy and materials handling systems;
- processing to separate the mineral component from the mined materials; and
- reclamation to design and implement operations enabling improved and safe post-mining land use.

Some of the projects mining engineers plan, design, and/or implement include:

- the location and appraisal of new ore deposits;
- open pit and underground mines;
- construction of mine shafts and tunnels (including highway tunnels);
- the safe, economical, and environmentally sound operation of mines;
- devising methods for transporting minerals to processing plants; and
- the development of new mining equipment or mineral processing operations.

Mining engineers may specialize in the mining of one mineral or metal (e.g., tin and gold), or in a particular emphasis (e.g., quarry, explosives, research, equipment, processing, and environmental concerns). Mining engineering also involves economic analyses including:

- the market price of metals and minerals produced by the mining industry;
- costs of material moving equipment and ore processing technologies; and
- the existing and future needs of the manufacturing and industrial undertakings.

In the Federal Government, mining engineers typically engage in one or more of the following activities:

- administering laws regulating the mining and leasing of public, Native American, and acquired lands containing mineral deposits;
- conducting studies and investigations to promote development and effective utilization of mineral deposits; or
- original and applied research directed toward the overall improvement of mining systems and components.

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PETROLEUM ENGINEERING, 0881		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involved in the discovery and recovery of oil, natural gas (e.g., methane, ethane, propane, and butane), and helium. The work includes:</p> <ul style="list-style-type: none"> • exploration and development of oil and natural gas fields; • production, transportation, and storage of petroleum, natural gas, and helium; • investigation, evaluation, and conservation of these resources; • regulation of the transportation and sale of natural gas; • valuation of production and distribution facilities for tax, regulatory, and other purposes; and • research on criteria, principles, methods, and equipment involved in exploration and development activities. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Petroleum Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Petroleum engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and methods related to:</p> <ul style="list-style-type: none"> • the science of petroleum engineering and the traditional engineering science disciplines (e.g., civil, mechanical, electrical, and chemical); • engineering design, standards, codes, techniques and practices; • advanced mathematics and economics; • physical science disciplines (e.g., geology, physics, chemistry, and materials); and • critical inquiry, analytical reasoning, problem solving, and scientific methodology. <p>Petroleum engineering work involves:</p> <ul style="list-style-type: none"> • exploration and discovery as part of the search for and development of new oil and gas fields; • understanding and determining the geologic formation and properties of the rock containing the reservoir; • determining the drilling methods to be used and monitoring drilling and production operations; • designing equipment and processes to achieve maximum profitable recovery of oil and gas, including the use of computer modeling and simulation of reservoir performance using different recovery techniques; 	

(continued)

PETROLEUM ENGINEERING, 0881 (continued)

- developing and using various enhanced recovery methods, such as:
 - injecting water, chemicals, gases, or steam into an oil reservoir to force more of the oil out; and
 - computer-controlled drilling or fracturing to connect a larger area of the reservoir to a single well;
- interpretation of data (obtained from electric-logs, radioactivity-logs, seismic testing, and core samples) to arrive at conclusions about oil and gas bearing strata, the porosity and permeability of reservoirs, and their productive capability and extent of the reserve; and
- oil field development and production aspects (i.e., using underground combustion techniques in the extraction of shale oil).

Occupational Information (continued)

Petroleum engineering work in the Federal Government may also involve one or more of the following activities:

- research and development to improve methods, equipment, and techniques aiding in the discovery, recovery, production, conservation, storage, and transportation of petroleum, natural gas, and helium;
- investigations to develop factual, scientific, and practical information about oil and gas deposits and reserves, including their potential and overall values to the industry and the economy;
- valuation engineering work to determine depletion of resources and depreciation of facilities to establish the fair worth of properties for regulatory taxation and other purposes;
- regulation of the transportation and sale of natural gas and its components, including establishing the rate structures for production and service areas;
- development, operation, and maintenance of facilities for the production, distribution, and storage of helium and helium-bearing natural gas;
- the discovery, preservation, conservation, management, and utilization of petroleum and natural gas resources on public, Native American, acquired, and offshore lands, including the regulation of the production of petroleum, natural gas, and helium from such lands and determination of royalties; and
- the preservation and maintenance of petroleum, natural gas, and helium resources in areas set aside as reserves.

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AGRICULTURAL ENGINEERING, 0890		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work resolving agricultural issues, problems, and conditions arising from the production and processing of food and fiber materials and management of natural resources in rural locales.</p> <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Agricultural Engineer</i>. In addition to the basic title, the following parenthetical titles may be used:</p> <p style="padding-left: 40px;">Drainage Systems – Work primarily involving the design of wetlands and water removal systems from cropland or communities.</p> <p style="padding-left: 40px;">Irrigation Systems – Work primarily involving the design of water management systems including irrigation scheduling and delivery, crop moisture requirements, and soil moisture-holding capacity projects.</p> <p style="padding-left: 40px;">Resource Planning – Work primarily involving area-wide planning, analysis, evaluation, and modeling projects (i.e., watershed protection systems and nutrient management).</p>	
Occupational Information	<p>General Occupational Information</p> <p>Agricultural engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of agricultural engineering; • traditional engineering science disciplines (e.g., mechanical, civil, electrical, and chemical); • engineering design codes, techniques, and practices to aid in the solution of agricultural and farming needs such as structures, equipment, systems, and processes; • physical science disciplines (e.g., physics, chemistry, and materials science); • advanced mathematics and social science disciplines (e.g., economics and community planning); and • critical inquiry, analytical reasoning, problem solving, and scientific methodology. <p>Agricultural engineers utilize agronomy and engineering, and physical sciences and technologies to improve the quality of rural and urban life through natural resources management and the production and distribution of food and fiber materials. These engineers, in collaboration with the farming industry and rural communities, explore and resolve issues, conditions, and problems impacting agricultural and natural resources.</p>	

(continued)

AGRICULTURAL ENGINEERING, 0890 (continued)

Occupational Information (continued)

In the Federal Government, agricultural engineering science work includes:

- providing engineering and scientific assistance and advice to:
 - farmers, ranchers, landowners, and others in the conservation and use of natural resources;
 - farm groups, rural communities, and other bodies regarding programs of financial assistance for the improvement of rural areas; and/or
 - managers of government-owned or government-leased lands; and
- research, development, and evaluation of:
 - crop production;
 - livestock production;
 - mechanical harvesting and processing of crops;
 - alternative energy resources for agricultural applications; and
 - farm structures for production, preparation, handling, and storage of farm products.

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CHEMICAL ENGINEERING, 0893		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work involving:</p> <ul style="list-style-type: none"> • chemical processes utilized by industries and scientific technologies to produce useful products and systems; and • the use of mass, momentum, and energy transfers together with thermodynamics and chemical kinetics to explore, extend, improve, and provide for existing and potential chemical and biochemical conversion processes. <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Chemical Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Chemical engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of chemical engineering and chemistry, such as: <ul style="list-style-type: none"> – material and energy balances; – thermodynamics and mechanics; – energy and mass transfer; – separations technologies; – chemical reactors and reactor design; and – chemical processes involved in the production, transformation, and transport of materials; • chemical and engineering design and related standards, codes, techniques, and practices; • advanced mathematics, statistics, computer science, and economics; • traditional engineering science disciplines (e.g., mechanical, electrical, materials, and industrial) and physical science disciplines (e.g., physics, chemistry, and materials); and • critical inquiry, analytical reasoning, problem solving, and scientific methodology. <p>Chemical engineering work requires a complete understanding of both the engineering and scientific principles underlying the chemical processes involved in production, transformation, and transport of materials.</p>	

(continued)

CHEMICAL ENGINEERING, 0893 (continued)

Occupational Information (continued)

Chemical engineers solve issues, conditions, and problems involving the production or use of chemicals in diverse activities, such as:

- large-scale chemical manufacturing;
- manufacturing products;
- oxidation or polymerization operations;
- pollution control, abatement, remediation, and waste management;
- corrosion control;
- safety and environmental resource management;
- energy conversion; electronic device fabrication, automation, and instrumentation;
- biochemical and biomedical engineering and biotechnology;
- polymers and plastics, ceramics, composites, and other advanced materials;
- systems engineering and data processing;
- food and pharmaceutical processing; and
- aerospace and nuclear materials.

Chemical engineers in the Federal Government are also engaged in a variety of functions such as research, development, production, pilot-plant operation, testing, weapons development, risk assessment, environmental protection, post-accident investigations, energy conversion, healthcare delivery systems, process controls, pharmaceuticals, electronics, and policy guidance for regulatory compliance.

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INDUSTRIAL ENGINEERING, 0896		<u>Qualification Standard</u>
Series Definition	<p>This series covers positions managing, supervising, leading, and/or performing professional engineering and scientific work to determine, evaluate, predict, and advise on effective ways for an organization to use its production factors (i.e., people, equipment, materials, information, and energy) to make or process a product or provide a service.</p> <p>This series requires a <u>functional classification code</u>.</p>	
Titling	<p>The basic title for positions in this occupation is <i>Industrial Engineer</i>.</p>	
Occupational Information	<p>General Occupational Information</p> <p>Industrial engineering work concerns the design, measurement, analysis, evaluation, and control of production and service operations and systems, and their associated management processes. These engineers examine and design the integration of people, information, equipment, automation methods, and materials to achieve optimum quality and productivity in the performance of operating systems. Their activities typically include such areas as production planning and control; quality and management control systems; financial planning and cost analyses; inventory, equipment, warehouse, and materials management; simulations and mathematical modeling; manufacturing systems; and work station design.</p> <p>Industrial engineering work involves the generation and/or application of theories, principles, practical concepts, processes, and systems related to:</p> <ul style="list-style-type: none"> • the science of industrial engineering as it applies to: <ul style="list-style-type: none"> – work measurement and methods engineering and human factors engineering; – operations research and statistical methods and processes; – manufacturing processes and inventory control; and – experimental design and facility layout; • industrial engineering design and its standards, codes, techniques and practices; • advanced mathematics and economics; • the traditional engineering science disciplines (e.g., mechanical, electrical, materials, civil, and chemical) and the physical science disciplines (e.g., physics, chemistry, materials); and • critical inquiry, analytical reasoning, problem solving, and scientific methodology. <p>Some industrial engineers provide technical advice to management and production officials on organizational patterns, systems, procedures, and planning of work, including:</p> <ul style="list-style-type: none"> • quality and cost controls; • organizational effectiveness; and • factors leading to operator fatigue or affecting operator safety. 	

(continued)

INDUSTRIAL ENGINEERING, 0896 (continued)	
Occupational Information (continued)	<p>Industrial engineering work in facilities layout involves:</p> <ul style="list-style-type: none">• planning or improving the arrangement of machines, equipment, processes, and service areas into a system to achieve the most efficient and economical operation;• identification and use of innovative concepts and tools to enhance the facility layout process; and• designing new plant buildings or altering existing buildings to support new processes or functions. <p>Industrial engineers perform systems analyses to improve efficiency and effectiveness. They apply statistical or other specialized techniques to assess and mitigate manufacturing and design risks related to costs, time, and quality constraints.</p> <p>Industrial engineers may work at contractor facilities where they can directly contribute to the production and development of work on-site.</p> <p><u>←BACK TO TABLE OF CONTENTS</u></p>

Impact of Automation

Automation, computers, information technology (IT), and their widely varied applications are valuable tools of engineering and architecture work.

Automation increases the capacity of engineers and architects to design and control a wide variety of devices, systems, and/or processes. Engineers and architects use new and improved automated tools and methods ranging in complexity and breadth from personal computers for business use to supercomputers for complex computational analyses and collaborative imagery applications for designing, modeling, and planning activities. The availability of these tools and methods provides additional dimensions of professional competency and expertise.

Engineers and architects use automation, computers, information technology, and their applications for:

- data collection, processing, and analysis;
- graphic design and imaging presentations, including imaging and graphic representation of computer-aided design and computer-aided manufacturing;
- numerical and computational analyses;
- simulation, modeling, and predictive assessments; and
- project tracking and documentation.

The information technology tools involved and the skill required to use them generally replace or supplement work previously done manually or by machines. Although computers are used to facilitate work within this job family, automation does not change the primary purpose of the work or the paramount knowledge required to perform the work. Proper classification of positions is based on the relevant knowledge and skills required to perform the primary duties of the position.

Distinguishing Between Management Work and Managerial Work

It is common to use the terms “management” and “managerial” within organizations, particularly in the human resources arena, to describe work, job duties, and responsibilities. For example, “management” used as a collective noun often denotes, as a group, those employees whose roles and responsibilities distinguish them from the general rank-and-file workforce, as in labor-management relations. As discussed below, this and other job family classification standards more typically use the term “managerial” in this context, particularly to describe high-level supervisory roles and responsibilities. These standards do not commonly use the term “management” to describe high-level supervision.

Management Work

One of the functional classification categories for professional scientific work is “management,” as defined in the [Introduction to the Position Classification Standards](#). The term “management” can also describe a kind of work that may or may not include supervisory responsibilities. Many engineer and architect positions include “management” responsibilities (i.e., “project management,” and “program management”). Here the meaning derives more from the task “to manage” than the role of “manager.” Managing and management involve activities like planning, monitoring, budgeting, reporting, assessing, overseeing, allocating, adjusting, controlling, preserving, advising, and evaluating with respect to the areas of accountability and responsibility (e.g., engineering, architecture, or scientific matters).

For example, occupations in this job family may have responsibility for the outcome of a particular design, construction, or research project. The informal description of such work is often “project engineer” or “project architect.” Employees in these positions do not necessarily have “managerial” responsibility, as discussed below. Rather, they apply the professional knowledge and expertise of their respective disciplines to achieve the desired outcome (i.e., product, end item, service, policy, or advice) while also ensuring its integrity, quality, economy, and reliability. Typically, their responsibility encompasses a project or program from conception through post-completion activities. These employees may use technicians, engineers, architects, scientists, and other staff and/or contracted firms to perform some of the work but retain the overall responsibility for management of the activities to ensure the successful achievement of the desired outcome.

Managerial Work

As noted above, the term “managerial” is generally used within the human resources arena in the context of high-level supervisory situations. Practitioners generally use “managerial” to describe at least second-level supervisory duties and responsibilities.

Additional Occupational Considerations	
<p>Some positions may include professional work requiring some knowledge and skills typically associated with the Engineering and Architecture Sciences Group, 0800P. In some cases, a closer look may reveal classification to a series in this job family may not always be appropriate.</p> <p>The General Series Determination Guidelines section of this JFS offers guidance on selecting the most appropriate series.</p>	
<p>The following table provides examples of work performed in the 0800P job family, but not to the extent the paramount knowledge required, the reason for the position’s existence, the mission and/or function of the organization, and the recruitment source for the best qualified candidates would warrant classification to a series in this JFS.</p> <p>Note: In the table below, the term job family position classification standard is abbreviated as JFS.</p>	
If Work Involves...	See This Standard or Series Definition:
<p>City, regional, or community planning relating to the broad social and economic growth and development of community services and facilities such as industry, commerce, transportation, streets, housing, utilities, and parks.</p>	<p>Community Planning, 0020</p>
<p>Developing and implementing environmental regulations, standards, and policies and securing compliance with them.</p>	<p>Environmental Protection Specialist, 0028</p>
<p>Performing safety program administration or advising on:</p> <ul style="list-style-type: none"> • social science research problems; • Federal laws concerning safety and safety regulations, standards, and programs, and investigation of safety problems; and/or • studies and/or analytical evaluations of specialized safety problems or programs. 	<p>Social Science, Psychology, and Welfare Group, 0100</p> <p>Motor Carrier Safety, 2123</p> <p>Highway Safety, 2125</p>
<p>Non-technical or non-scientific project management or program management duties not requiring professional knowledge of, and skill in applying, engineering science theories and/or architecture, concepts, principles, or practices.</p>	<p>Program Management, 0340</p>

(continued)

Additional Occupational Considerations (continued)	
If Work Involves...	See This Standard or Series Definition:
<ul style="list-style-type: none"> • Serving as an analyst and advisor to management in evaluating the effectiveness of non-technical/non-science based government programs and operations and productivity and efficiency in the management of Federal agencies; and/or • Applying comprehensive knowledge of the principles, methods, and processes of a field of management or program analysis in a particular program area. 	<p><u>Management and Program Analysis, 0343</u></p>
Planning, developing, acquisitioning, testing, integrating, installing, utilizing, or modifying telecommunications systems, facilities, services, and procedures.	<p><u>Telecommunications, 0391</u></p>
Applying professional knowledge and skill in any of the fields of science concerned with living organisms and their relationship to their environment, or with controlling, preserving, and/or evaluating a natural resource or natural resource function such as conservation, forest, rangeland, fisheries, or wildlife.	<p><u>JFS for Professional Work in the Natural Resources Management and Biological Sciences Group, 0400</u></p>
<ul style="list-style-type: none"> • Technician or assistance work in the biological, horticultural, environmental, or agricultural workplace; and/or • A general practical knowledge of natural science equipment, terminology, and an understanding of natural science plans and specifications. 	<p><u>Grade Level Guide for Aid and Technical Work in the Biological Sciences, 0400</u></p>
<ul style="list-style-type: none"> • Conducting technician activities performed in an engineering, architectural, research and development, or laboratory workplace; • Applying a general practical knowledge of engineering or architectural equipment and terminology, and an understanding of engineering or architectural plans and specifications; and/or • Applying a general administrative knowledge of engineering or architectural equipment, terminology, reports, and documentation, and a general understanding of engineering or architectural plans and specifications. 	<p><u>JFS for Technical Work in the Engineering and Architecture Group, 0800</u></p>
Designing the interior space of buildings and requires a thorough knowledge of, and skill in applying, the fundamental principles and practices of interior design.	<p><u>Interior Design, 1008</u></p>

(continued)

Additional Occupational Considerations (continued)	
If Work Involves...	See This Standard or Series Definition:
Applying architectural practices and techniques in the planning, constructing, installing, and operating of exhibits and/or gallery space; the preservation of historic buildings; or the restoration and preparation of exhibit items.	<u>Exhibits Specialist, 1010</u>
Applying knowledge of the oil and gas industry or utilities, including processing, distributing, transporting, and marketing petroleum and natural gas.	<u>Public Utilities Specialist, 1130</u>
Applying knowledge of the nature and operations of an industry or industries, and the materials, facilities and methods employed by the industry in producing commodities.	<u>Industrial Specialist, 1150</u>
Applying professional knowledge and skill in any of the following physical science disciplines: chemistry, health physics, physics, geophysics, hydrology, chemistry, materials science, metallurgy, astronomy and space, meteorology, geology, oceanography, cartography, geodesy, land surveying, forest products technology, food technology, textile technology, and photographic technology.	<u>JFS for Professional Work in the Physical Sciences Group, 1300</u>
Applying a general practical knowledge of physical science equipment and terminology, and an understanding of physical science processes, but not a theoretical knowledge and skills in the physical, mathematical, and engineering sciences.	<u>JFS for Technical Work in the Physical Sciences Group, 1300</u>
<ul style="list-style-type: none"> • Applying theoretical and professional knowledge and skills in the mathematical and statistical science disciplines (e.g., actuary, operations research, mathematics, mathematical statistics, and statistics); and/or • Conducting research on mathematical principles, methods, procedures, techniques, or relationships, including the development of mathematical models and methods. 	<u>JFS for Professional Work in the Mathematical Sciences Group, 1500</u>
<p>Applying theoretical and professional knowledge of computer theory, algorithms, data structures, programming concepts, programming languages, and architecture, and a working knowledge of computer hardware to:</p> <ul style="list-style-type: none"> • design, develop, test, or evaluate computer software; • solve problems in hardware-software interface; or • perform research to advance the knowledge of computer science. 	<u>Computer Science, 1550</u>

(continued)

Additional Occupational Considerations (continued)	
If Work Involves...	See This Standard or Series Definition:
Applying a general practical knowledge of mathematics and statistics terminology, but does not require theoretical knowledge and skills in the physical, mathematical, engineering, and architectural sciences.	Appropriate series for technician or assistant work in the Mathematics and Statistics Group, 1500
<ul style="list-style-type: none"> • Facilities management and administration; and/or • Collecting, analyzing, interpreting, and providing specialized information concerning the operation, maintenance, and use of equipment, shops, buildings, laundries, printing plants, power plants, cemeteries, or other government facilities; and requires a practical knowledge of trades, crafts, or manual labor operations. 	JFS for Administrative Work in the Equipment, Facilities, and Services Group, 1600
Developing, advising on, or interpreting mine safety and health laws, regulations, and practices to include underground and surface mining and milling operations associated with coal. Requires practical knowledge of mining and/or milling methods and processes; and applicable safety and health practices and principles to the mining industry.	Mine Safety and Health, 1822
Developing, administering, or enforcing regulations and standards concerning civil aviation safety to include airworthiness of aircrafts; competence of pilots and other airmen; and safety aspects of aviations facilities, equipment, and procedures. Requires practical knowledge of the operation, maintenance, or manufacture of aircraft.	Aviation Safety, 1825
Piloting or copiloting aircraft, providing ground and flight instruction, and inspecting and evaluating air navigation facilities and the environmental conditions affecting instrument flight procedures. This work requires the application of pilot knowledge and skills.	Aircraft Operations, 2181
Developing, delivering, and supporting information technology (IT) systems and services, and requires practical knowledge of IT principles, concepts, and methods.	JFS for Administrative Work in the Information Technology Group, 2200

Crosswalk to the Standard Occupational Classification					
<p>The Office of Management and Budget requires all Federal agencies to use the Standard Occupational Classification (SOC) system for statistical data reporting purposes. The Bureau of Labor Statistics uses SOC codes for the National Compensation Survey and other statistical reporting. OPM and other Federal agencies maintain a “crosswalk” between OPM authorized occupational series and the SOC codes to serve this need. These SOC codes and this requirement have no effect on the administration of any Federal human resources management system. The information in this table is for information only and has no direct impact on classifying positions covered by this job family standard. The SOC codes shown here generally apply only to nonsupervisory positions in these occupations. As changes occur to the SOC codes, OPM will update this table. More information about SOC is available at http://stats.bls.gov/soc.</p>					
Federal Occupational Series and Position Titles and Their Related Standard Occupational Classification System Codes					
Federal Occupational Series	Standard Occupational Classification Code Based on Occupational Series		Position Title	Standard Occupational Classification Code Based on Position Title	
General Engineering, 0801	17-2199	Engineers, All Other	(No specified title)	17-2199	Engineers, All Other
Safety Engineering, 0803	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	Safety Engineer	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
Fire Protection Engineering, 0804	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	Fire Protection Engineer	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors
Materials Engineering, 0806	17-2131	Materials Engineers	Materials Engineer	17-2131	Materials Engineers
Landscape Architecture, 0807	17-1012	Landscape Architects	Landscape Architect	17-1012	Landscape Architects
Architecture, 0808	17-1011	Architects, Except Landscape and Naval	Architect	17-1011	Architects, Except Landscape and Naval

(continued)

Crosswalk to the Standard Occupational Classification (continued)					
Federal Occupational Series and Position Titles and Their Related Standard Occupational Classification System Codes					
Federal Occupational Series	Standard Occupational Classification Code Based on Occupational Series		Position Title	Standard Occupational Classification Code Based on Position Title	
Civil Engineering, 0810	17-2051	Civil Engineers	Civil Engineer	17-2051	Civil Engineers
Environmental Engineering, 0819	17-2081	Environmental Engineers	Environmental Engineer	17-2081	Environmental Engineers
Mechanical Engineering, 0830	17-2141	Mechanical Engineers	Mechanical Engineer	17-2141	Mechanical Engineers
Nuclear Engineering, 0840	17-2161	Nuclear Engineers	Nuclear Engineer	17-2161	Nuclear Engineers
Electrical Engineering, 0850	17-2071	Electrical Engineers	Electrical Engineer	17-2071	Electrical Engineers
Computer Engineering, 0854	17-2061	Computer Hardware Engineers	Computer Engineer	17-2061	Computer Hardware Engineers
Electronics Engineering, 0855	17-2072	Electronics Engineers, Except Computer	Electronics Engineer	17-2072	Electronics Engineers, Except Computer
Bioengineering and Biomedical Engineering, 0858	17-2199	Engineers, All Other	Bio-engineer	17-2199	Engineers, All Other
	17-2031	Biomedical Engineers	Biomedical Engineer	17-2031	Biomedical Engineers
Aerospace Engineering, 0861	17-2011	Aerospace Engineers	Aerospace Engineer	17-2011	Aerospace Engineers
Naval Architecture, 0871	17-2121	Marine Engineers and Naval Architects	Naval Architect	17-2121	Marine Engineers and Naval Architects

(continued)

Crosswalk to the Standard Occupational Classification (continued)					
Federal Occupational Series and Position Titles and Their Related Standard Occupational Classification System Codes					
Federal Occupational Series	Standard Occupational Classification Code Based on Occupational Series		Position Title	Standard Occupational Classification Code Based on Position Title	
Mining Engineering, 0880	17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	Mining Engineer	17-2151	Mining and Geological Engineers, Including Mining Safety Engineers
Petroleum Engineering, 0881	17-2171	Petroleum Engineers	Petroleum Engineer	17-2171	Petroleum Engineers
Agricultural Engineering, 0890	17-2021	Agricultural Engineers	Agri-cultural Engineer	17-2021	Agricultural Engineers
Chemical Engineering, 0893	17-2041	Chemical Engineers	Chemical Engineer	17-2041	Chemical Engineers
Industrial Engineering, 0896	17-2112	Industrial Engineers	Industrial Engineer	17-2112	Industrial Engineers

PART II – GRADING INFORMATION

Part II provides grading information for use in determining the appropriate grade of nonresearch and nonsupervisory two-grade interval professional positions in the Engineering and Architecture Group, 0800. These grading criteria are applicable to General Schedule positions classified under chapter 51 of title 5, United States Code. They may also be used as appropriate to determine work levels for other Federal position classification systems. You will find more complete instructions for evaluating positions in the following OPM publications: [Introduction to the Position Classification Standards](#) and [The Classifier's Handbook](#).

How to Use This Grading Information

Evaluate positions on a factor-by-factor basis using the factor level descriptions (FLDs) provided in this JFS. Compare each factor in the position description to the appropriate FLDs and illustrations. If the factor information in the position description fully matches an FLD for the series and specialty, you may assign the level without reviewing the illustrations. FLDs are progressive or cumulative in nature. For example, each FLD for Factor 1 – Knowledge Required by the Position encompasses the knowledge and skills identified at the previous level. Use only designated point values.

The FLDs in this JFS cover nonsupervisory positions at grades 5 through 15. Evaluate supervisory, leader, research, equipment development, and test and evaluation positions by applying the appropriate [functional guide](#).

Use the occupation and specialty-specific [factor illustrations](#) following the FLDs as a frame of reference for applying factor level concepts. Do not rely solely on illustrations in evaluating positions because they reflect a limited range of actual work examples. The level of work described in some illustrations may be higher than the threshold for a particular factor level. If the factor information in the position description fails to fully match a relevant illustration, but does fully match the FLD, you may still assign the level.

For each factor, record the factor level used, the points assigned, and relevant comments on the [Position Evaluation Summary Worksheet](#). Convert the total points to a grade using the Grade Conversion Table, and record the grade in the Summary section of the Worksheet. The shaded portions of the table reflect the most commonly found grades in this job family.

GRADE CONVERSION TABLE

Point Range	GS Grade
855–1100	5
1105–1350	6
1355–1600	7
1605–1850	8
1855–2100	9
2105–2350	10
2355–2750	11
2755–3150	12
3155–3600	13
3605–4050	14
4055–up	15

Position Evaluation Summary Worksheet

Organization _____

Position # _____

Evaluation Factors	Factor Level Used (FL#, etc)	Points Assigned	Comments
1. Knowledge Required by the Position			
2. Supervisory Controls			
3. Guidelines			
4. Complexity			
5. Scope and Effect			
6/7. Personal Contacts and Purpose of Contacts			
8. Physical Demands			
9. Work Environment			
S U M M A R Y	Total Points		
	Grade Conversion		

Additional Remarks:

Title, Series, and Grade Assigned:

Prepared by: _____ Date: _____

Agencies may copy for local use.

Factor Level Descriptions (FLDs)

FACTOR 1 – KNOWLEDGE REQUIRED BY THE POSITION

Factor 1 measures the nature and extent of information or facts an employee must understand to do acceptable work (e.g., steps, procedures, practices, rules, policies, theories, principles, and concepts), and the nature and extent of the skills necessary to apply the knowledge. You should only select a factor level under this factor when the knowledge described is required and applied.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

	Level 1-5	750 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840	Industrial Engineering 0896
	Electrical Engineering 0850	
FLD	<p>Professional knowledge of, and skill in applying, basic theories, concepts, principles, and methodology for practicing the art and science of an engineering or architectural scientific discipline sufficient to:</p> <ul style="list-style-type: none"> • accomplish developmental assignments utilizing basic techniques, procedures, and methods; • understand and complete limited engineering or architectural designs and projects; • carry out, interpret, and explain basic computations and calculations; and • read, understand, manipulate, analyze, interpret, and convey findings. 	

Level 1-6		950 Points	
Series	General Engineering 0801		Computer Engineering 0854
	Safety Engineering 0803		Electronics Engineering 0855
	Fire Protection 0804		Bioengineering and 0858
	Engineering		Biomedical Engineering
	Materials Engineering 0806	<u>Illustration(s)</u>	Aerospace Engineering 0861
	Landscape 0807	<u>Illustration(s)</u>	Naval Architecture 0871
	Architecture		
	Architecture 0808	<u>Illustration(s)</u>	Mining Engineering 0880
	Civil Engineering 0810	<u>Illustration(s)</u>	Petroleum Engineering 0881
	Environmental 0819		Agricultural 0890
	Engineering		Engineering
	Mechanical 0830	<u>Illustration(s)</u>	Chemical Engineering 0893
	Engineering		
	Nuclear Engineering 0840	<u>Illustration(s)</u>	Industrial Engineering 0896
	Electrical Engineering 0850	<u>Illustration(s)</u>	
FLD	<p>Professional knowledge of, and skill in applying, theories, concepts, principles, and methodologies of an engineering or architectural discipline sufficient to:</p> <ul style="list-style-type: none"> • research, analyze, interpret, evaluate, and carry out difficult but conventional assignments; • determine relevancy and use of aesthetic, factual, economic and financial, engineering, architectural, and/or scientific information; • prepare, provide, and evaluate conventional plans, designs, design specifications, and related documentation; • perform and interpret calculations, analyses, and computations for unknown factors or relationships primarily in matters of a factual nature or involving well-understood mechanisms; • conduct analytical investigations using the scientific method; • use performance monitoring and quality assurance principles and methods; • research and apply accepted and relevant business, marketing, and organizational practices, as needed; and • articulate information through various venues such as discussions, meetings, fact sheets, reports, design documentation, briefings, and presentations. 		

Level 1-7		1250 Points
Series	General Engineering 0801	Computer Engineering 0854 <u>Illustration(s)</u>
	Safety Engineering 0803	Electronics Engineering 0855 <u>Illustration(s)</u>
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871 <u>Illustration(s)</u>
	Architecture	
	Architecture 0808 <u>Illustration(s)</u>	Mining Engineering 0880 <u>Illustration(s)</u>
	Civil Engineering 0810 <u>Illustration(s)</u>	Petroleum Engineering 0881 <u>Illustration(s)</u>
	Environmental 0819 <u>Illustration(s)</u>	Agricultural 0890 <u>Illustration(s)</u>
	Engineering	Engineering
	Mechanical 0830 <u>Illustration(s)</u>	Chemical Engineering 0893 <u>Illustration(s)</u>
	Engineering	
	Nuclear Engineering 0840 <u>Illustration(s)</u>	Industrial Engineering 0896 <u>Illustration(s)</u>
Electrical Engineering 0850 <u>Illustration(s)</u>		
FLD	<p>Broad professional knowledge of, and skill in applying, a wide range of engineering or architectural theories, concepts, principles, standards, and methods sufficient to:</p> <ul style="list-style-type: none"> • determine and/or execute actions for a wide range of assignments involving combinations of complex features; • devise, customize, operate, oversee, and/or evaluate specialized information technology systems, processes, and applications pertaining to the performed work and the delivery of its design, end products, or services; • formulate, execute, advise on, and explain recommendations or solutions to modify standard practices, equipment, devices, processes, and techniques and resolve a wide variety of complex problems; • adapt precedents or existing strategies to meet unusual needs or special demands; • act as a principal contributor on team-based projects or coordinate a team project and provide technical oversight and direction; and • prepare, present, and evaluate plans, designs, reports, and correspondence. 	

Level 1-8		1550 Points
Series	General Engineering 0801	Computer Engineering 0854 <u>Illustration(s)</u>
	Safety Engineering 0803 <u>Illustration(s)</u>	Electronics Engineering 0855 <u>Illustration(s)</u>
	Fire Protection 0804 <u>Illustration(s)</u>	Bioengineering and 0858 <u>Illustration(s)</u>
	Engineering	Biomedical Engineering
	Materials Engineering 0806 <u>Illustration(s)</u>	Aerospace Engineering 0861 <u>Illustration(s)</u>
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808 <u>Illustration(s)</u>	Mining Engineering 0880
	Civil Engineering 0810 <u>Illustration(s)</u>	Petroleum Engineering 0881
	Environmental 0819 <u>Illustration(s)</u>	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830 <u>Illustration(s)</u>	Chemical Engineering 0893 <u>Illustration(s)</u>
	Engineering	
	Nuclear Engineering 0840 <u>Illustration(s)</u>	Industrial Engineering 0896
	Electrical Engineering 0850 <u>Illustration(s)</u>	
FLD	<p>Mastery of, and skill in applying, expertise in advanced engineering or architectural theories, principles, concepts, standards, and methods sufficient to:</p> <ul style="list-style-type: none"> • apply experimental theories and/or new applications or developments to: <ul style="list-style-type: none"> – extend or modify theories, concepts, and assumptions; – resolve unique or novel problems, conditions, or issues; or – significantly alter standard practices, equipment, devices, processes, and known techniques; • provide expert advice to senior colleagues and/or agency officials responsible for broad program operations; • provide significant and innovative recommendations for advancing programs and/or methods; and • execute significant projects representing an important segment of the agency’s operating programs, or affecting the welfare of the public and/or the sustainability of natural resources and the environment. 	

LEVEL 1-9		1850 POINTS	
Series	General Engineering 0801	Computer Engineering 0854	
	Safety Engineering 0803	Electronics Engineering 0855	
	Fire Protection 0804	Bioengineering and 0858	
	Engineering	Biomedical Engineering	
	Materials Engineering 0806	Aerospace Engineering 0861	<u>Illustration(s)</u>
	Landscape 0807	Naval Architecture 0871	
	Architecture		
	Architecture 0808	Mining Engineering 0880	
	Civil Engineering 0810	Petroleum Engineering 0881	
	Environmental 0819	Agricultural 0890	<u>Illustration(s)</u>
	Engineering	Engineering	
	Mechanical 0830	Chemical Engineering 0893	
	Engineering		
	Nuclear Engineering 0840	Industrial Engineering 0896	
Electrical Engineering 0850			
FLD	Mastery of, and skill in applying, the art and science of a specialty area of an engineering or architectural discipline sufficient to:		
	<ul style="list-style-type: none"> • formulate, evaluate, nurture, and promote the generation and exchange of new theories, concepts, principles, methods, applications, and practices; • plan, evaluate, and execute short- and long-range programs which impact national or international issues; • serve as an authoritative expert and consultant on a broad program, a highly specialized field, or an industry which affects national or international interests, the well-being of the public and the nation, and/or the sustainability of natural resources and environments; and • extend the existing parameters of engineering or architecture knowledge and its application and practice. 		

FACTOR 2 – SUPERVISORY CONTROLS

This factor covers the nature and extent of direct or indirect controls exercised by the supervisor or a designated individual over the work performed, the employee’s responsibility, and the review of completed work. The supervisor determines what information the employee needs to perform the assignments (e.g., instructions, priorities, deadlines, objectives, and boundaries). The primary components of this factor are: **How Work Is Assigned**, **Employee Responsibility**, and **How Work Is Reviewed**.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

	Level 2-1	25 Points
FLD	<p>How Work Is Assigned – The supervisor or designated employee provides assignments with:</p> <ul style="list-style-type: none"> • developmental qualities to prepare the employee for higher level work; • detailed instructions on how to use and select specific methods, procedures, and techniques; and • deadlines and priorities. <p>Employee Responsibility – The employee:</p> <ul style="list-style-type: none"> • performs work as instructed; • consults with the supervisor or designated employee when clarification of instructions is necessary; and • receives guidance on problems and work methods not specifically covered by the original instructions. <p>How Work Is Reviewed – The supervisor or designated employee closely checks work in progress, results for accuracy, and evaluates the employee’s rate of development. As the employee progresses professionally and becomes more competent in certain work areas, supervisory control over work in progress relaxes gradually. However, the supervisor will continue to carefully review and evaluate work results for technical accuracy.</p>	

Level 2-2		125 Points
F.L.D.	<p>How Work Is Assigned – The supervisor or designated employee instructs the employee on the objectives of the assignment and its scope, limitations, expected deadlines, and priorities. The supervisor provides specific instructions on work methods and new assignments.</p> <p>Employee Responsibility – The employee:</p> <ul style="list-style-type: none"> • works independently, but within the framework established by the supervisor; • conforms with established practices and prescribed procedures; and • refers problems not covered by instructions or guides to the supervisor for help or a decision. <p>How Work Is Reviewed – The supervisor or designated employee:</p> <ul style="list-style-type: none"> • reviews completed work closely to verify accuracy and conformance to required procedures and any special instructions; • reviews findings and conclusions to ensure they are supported by facts; and • typically reviews the more difficult and/or unfamiliar work in greater detail. 	

Level 2-3		275 Points
F.L.D.	<p>How Work Is Assigned – The supervisor or designated employee outlines or discusses possible problem areas and defines objectives, plans, priorities, and deadlines. The supervisor or designated employee provides assistance on controversial or unusual situations without clear precedents.</p> <p>Employee Responsibility – The employee:</p> <ul style="list-style-type: none"> • independently plans and carries out the assignments in conformance with accepted policies and practices; • adheres to instructions, policies, precedents, and guidelines in exercising judgment to resolve commonly encountered work problems and deviations; and • brings controversial information or unusual findings to the supervisor’s attention for direction. <p>How Work Is Reviewed – The supervisor or designated employee reviews completed work for conformity with policy, technical soundness, adherence to deadlines, and accomplishment of objectives. The supervisor does not usually review methods used to complete the assignment.</p>	

Level 2-4		450 Points
F.L.D.	<p>How Work Is Assigned – The supervisor outlines overall objectives and available resources. The employee and supervisor, in consultation, discuss scope of the assignment, approaches, time frames, and possible execution phases.</p> <p>Employee Responsibility – The employee:</p> <ul style="list-style-type: none"> • plans and carries out the assignment; • resolves most conflicts independently; • coordinates the work with others as necessary; • interprets policy and regulatory requirements in terms of established objectives; • keeps the supervisor informed of progress and potentially controversial problems, concerns, issues, or other matters; • develops changes to plans and/or methodology; and • provides recommendations for improvements in order to meet program objectives. <p>How Work Is Reviewed – The supervisor reviews completed work for soundness of overall approach, effectiveness in meeting requirements or producing expected results, the feasibility of recommendations, and adherence to requirements.</p>	

Level 2-5		650 Points
F.L.D.	<p>How Work Is Assigned – The supervisor provides administrative and policy direction in terms of broadly defined missions or functions of the agency.</p> <p>Employee Responsibility – The employee:</p> <ul style="list-style-type: none"> • defines objectives; • interprets policies promulgated by authorities which are senior to the immediate supervisor and determines their effect on program needs; • independently plans, designs, and carries out work to be done; and • serves as a technical authority. <p>How Work Is Reviewed – The supervisor:</p> <ul style="list-style-type: none"> • reviews work for consistency with, and potential impact on, broad agency objectives and program goals, and for contribution to the advancement of the field; • normally accepts work as being technically authoritative; and • normally accepts work without significant change. 	

FACTOR 3 – GUIDELINES

This factor covers the nature of guidelines and the judgment employees need to apply them. Individual assignments may vary in the specificity, applicability, and availability of guidelines; thus, the judgment employees use similarly varies. The existence of detailed plans and other instructions may make innovation in planning and conducting work unnecessary or undesirable. However, in the absence of guidance provided by prior experience with the task at hand or when objectives are broadly stated, the employee may use considerable judgment in developing an approach or planning the work. The following are examples of guidelines used in professional work in the Engineering and Architectural Sciences Group, 0800:

- Federal and State statutes, regulations, policies, and procedures;
- County and local government ordinances and codes;
- Agency program manuals, policies, and procedures;
- Tribal Laws;
- Textbooks;
- Engineering, architectural, and scientific literature (i.e., journals, research reports, and technical reports), and precedents;
- Manufacturer’s catalogs and handbooks;
- Specialized dictionaries and models;
- Nationally and internationally recognized professional standards and codes;
- Treaties;
- Budget policies, practices, and procedures;
- Court decisions; and
- Foreign laws and regulations.

Do not confuse guidelines with the knowledge described under Factor 1 – Knowledge Required by the Position. The primary components of this factor are: **Guidelines Used** and **Judgment Needed**.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

Level 3-2		125 Points
FLD	<p>Guidelines Used – The employee uses a number of guidelines directly applicable to the assignment. Guidelines prescribe established procedures and techniques and provide clear precedents.</p> <p>Judgment Needed – The employee:</p> <ul style="list-style-type: none"> • uses judgment in selecting and applying the most appropriate guidelines and references available; • decides on the appropriateness of minor deviations within existing guidelines; and • refers to the supervisor any situations where existing guidelines cannot be applied or requiring significant deviations. 	

Level 3-3		275 Points
FLD	<p>Guidelines Used – The employee uses a wide variety of reference materials and manuals which are not always directly applicable to the work and may have gaps in specificity. Precedents are available outlining the preferred approach to more general problems or issues.</p> <p>Judgment Needed – The employee considers precedents and uses judgment to research, select, interpret, modify, adapt, and apply available guidelines to specific problems or issues.</p>	

Level 3-4		450 Points
FLD	<p>Guidelines Used – The employee uses very general guidelines and precedents which are often insufficient, inapplicable to the assignment, or have gaps in specificity requiring considerable interpretation and/or adaptation for application to the particular issues and problems.</p> <p>Judgment Needed – The employee uses judgment, initiative, and resourcefulness in deviating from established methods to:</p> <ul style="list-style-type: none"> • modify, adapt, and/or refine broader guidelines to resolve specific complex or intricate issues and problems; • research trends and patterns; • develop new methods and criteria; or • propose new policies and practices. 	

Level 3-5		650 Points
FLD	<p>Guidelines Used – The employee uses guidelines such as broad policy statements, basic legislation, recent scientific findings, or reports, often ambiguous in nature and requiring extensive interpretation.</p> <p>Judgment Needed – The employee uses judgment and ingenuity and exercises broad latitude to interpret new or revised professional standards and codes, guidelines, policy statements, or regulations.</p> <p>Top agency management officials and senior staff recognize the employee as a technical expert in the development and interpretation of professional guidelines.</p>	

FACTOR 4 – COMPLEXITY

This factor covers the nature, number, variety, and intricacy of tasks, steps, processes, or methods in the work performed; the difficulty in identifying what needs to be done; and the difficulty and originality involved in performing the work. The primary components of this factor are: **Nature of Assignment, What Needs To Be Done, and Difficulty and Originality Involved.**

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

Level 4-2		75 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808 <u>Illustration(s)</u>	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840	Industrial Engineering 0896
	Electrical Engineering 0850	
FLD	Nature of Assignment – Work involves performing related tasks which provide experience in the methods, practices, and procedures of the engineering or architecture field.	
	What Needs To Be Done – The employee decides what needs to be done by recognizing differences among a few easily distinguishable situations and then choosing a course of action from various standard steps, processes, methods, and procedures.	
	Difficulty and Originality Involved – The employee recognizes the differences among a few easily distinguishable situations.	

Level 4-3		150 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804 Engineering	Bioengineering and 0858 Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807 Architecture	Naval Architecture 0871
	Architecture 0808 Illustration(s)	Mining Engineering 0880
	Civil Engineering 0810 Illustration(s)	Petroleum Engineering 0881
	Environmental 0819 Illustration(s) Engineering	Agricultural 0890 Engineering
	Mechanical 0830 Illustration(s) Engineering	Chemical Engineering 0893
	Nuclear Engineering 0840 Illustration(s)	Industrial Engineering 0896
	Electrical Engineering 0850 Illustration(s)	
FLD	Nature of Assignment – Work consists of different and unrelated processes and methods.	
	What Needs To Be Done – The employee:	
	<ul style="list-style-type: none"> • analyzes and evaluates phases, subjects, issues, conditions, and/or problems related to the assignment; • selects the appropriate course of action from many acceptable alternatives; and • conducts technical analyses and field and/or laboratory work to achieve desired products or services. 	
Difficulty and Originality Involved – The employee exercises versatility, judgment, and perception to:		
<ul style="list-style-type: none"> • identify and interpret diverse factors, situations, and conditions; • understand interrelationships among different strategies, standards, and activities; • explain and justify determinations, recommendations, and implemented actions; and • assess implemented and planned actions for accuracy, feasibility, and/or adequacy in meeting objectives. 		

Level 4-4		225 Points
Series	General Engineering 0801	Computer Engineering 0854 Illustration(s)
	Safety Engineering 0803	Electronics Engineering 0855 Illustration(s)
	Fire Protection 0804 Engineering	Bioengineering and 0858 Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807 Illustration(s) Architecture	Naval Architecture 0871
	Architecture 0808 Illustration(s)	Mining Engineering 0880
	Civil Engineering 0810 Illustration(s)	Petroleum Engineering 0881
	Environmental 0819 Illustration(s) Engineering	Agricultural 0890 Engineering
	Mechanical 0830 Illustration(s) Engineering	Chemical Engineering 0893
	Nuclear Engineering 0840 Illustration(s)	Industrial Engineering 0896
	Electrical Engineering 0850 Illustration(s)	
	Nature of Assignment – Work consists of a variety of assignments involving many different and unrelated engineering or architecture processes and methods.	
	What Needs To Be Done – The employee decides what needs to be done by:	
	<ul style="list-style-type: none"> • researching, analyzing, testing, and evaluating information, unusual circumstances, unconventional issues, conditions, and problems; • considering different, incomplete, and often conflicting information and alternatives; and • determining efficient, effective, and feasible solutions to meet the project or situation requirements and constraints. 	
	Difficulty and Originality Involved – The employee exercises judgment and originality in:	
<ul style="list-style-type: none"> • planning and prioritizing the sequence, direction, and progress of the work; • devising solutions and actions to resolve issues, conditions, and problems; • justifying actions, determinations, and recommendations; and • modifying, adapting, and/or refining existing applications, processes, precedents, and techniques. 		

Level 4-5		325 Points	
Series	General Engineering 0801	Computer Engineering 0854 Illustration(s)	
	Safety Engineering 0803	Electronics Engineering 0855 Illustration(s)	
	Fire Protection 0804 Engineering	Bioengineering and 0858 Biomedical Engineering	
	Materials Engineering 0806	Aerospace Engineering 0861	
	Landscape 0807 Architecture	Naval Architecture 0871	
	Architecture 0808 Illustration(s)	Mining Engineering 0880	
	Civil Engineering 0810 Illustration(s)	Petroleum Engineering 0881	
	Environmental 0819 Illustration(s) Engineering	Agricultural 0890 Engineering	
	Mechanical 0830 Illustration(s) Engineering	Chemical Engineering 0893	
	Nuclear Engineering 0840 Illustration(s)	Industrial Engineering 0896	
	Electrical Engineering 0850 Illustration(s)		
	<p>Nature of Assignment – Work consists of a variety of duties requiring the application of many different and unrelated processes and methods to a broad range of activities, a key technological program or industrial emphasis area, or in-depth analysis of controversial or high visibility issues.</p>		
	<p>What Needs To Be Done – The employee makes decisions and executes and/or directs actions exploring, reconciling, and resolving major uncertainties, unique situations, obscure problems, or conflicting objectives typically resulting from:</p> <ul style="list-style-type: none"> • the abstract nature of the concepts or the existence of serious conflicts among scientific requirements, technological developments, standards, program direction, and administrative requirements; • reliance on inconclusive or variable facts or data, or rapid or continuing changes in program or work requirements; or • agency objectives with unusual demands or major constraints (e.g., funding, labor, materials, and scheduling). 		
	<p>Difficulty and Originality Involved – The employee exercises judgment and ingenuity in:</p> <ul style="list-style-type: none"> • evaluating the value and applicability of new or improved technology, strategies, trends, or applications; • investigating, predicting, and anticipating issues and conditions extending beyond a single specialty area, and affecting known standards, approaches, precedents, or concepts; • developing or collaborating in the formulation of new standards, applications, concepts, or theories changing existing knowledge and extending an understanding of phenomena; • assessing and carrying out strategies and actions to affirm the integrity, economy, quality, and effectiveness of engineering, architecture, or scientific programs; or • advocating recommendations, strategies, and actions to reconcile or resolve novel, conflicting, or controversial issues or policies. 		
	FLD		

Level 4-6		450 Points	
Series	<p>General Engineering 0801</p> <p>Safety Engineering 0803</p> <p>Fire Protection 0804 Engineering</p> <p>Materials Engineering 0806</p> <p>Landscape 0807 <u>Illustration(s)</u></p> <p>Architecture</p> <p>Architecture 0808 <u>Illustration(s)</u></p> <p>Civil Engineering 0810 <u>Illustration(s)</u></p> <p>Environmental 0819 <u>Illustration(s)</u> Engineering</p> <p>Mechanical 0830 Engineering</p> <p>Nuclear Engineering 0840 <u>Illustration(s)</u></p> <p>Electrical Engineering 0850</p>	<p>Computer Engineering 0854</p> <p>Electronics Engineering 0855</p> <p>Bioengineering and 0858 Biomedical Engineering</p> <p>Aerospace Engineering 0861</p> <p>Naval Architecture 0871</p> <p>Mining Engineering 0880</p> <p>Petroleum Engineering 0881</p> <p>Agricultural 0890 Engineering</p> <p>Chemical Engineering 0893</p> <p>Industrial Engineering 0896</p>	
	<p>Nature of Assignment – The work consists of major engineering, architecture, or scientific initiatives characterized by exceptional breadth, requiring intensity of effort, and consisting of multiple phases. The initiative may require multidisciplinary or cross-functional teams.</p>		
	<p>What Needs To Be Done – The employee decides on and advocates the direction and strategies for activities in an environment characterized by undefined factors and conditions. The employee must conduct extensive analyses of the nature and scope of problems to make those decisions.</p>		
	<p>Difficulty and Originality Involved – The employee exercises leadership, creativity, and imagination to:</p> <ul style="list-style-type: none"> • formulate and/or nurture policy, guidance, and activities; • develop and implement novel, far-reaching, and innovative strategies, applications, and concepts; • motivate and instigate improvements in the extension, advancement, and achievement of significant objectives in science and technology; or • overcome highly resistant or controversial issues, conditions, and problems. 		
	FLD		

FACTOR 5 – SCOPE AND EFFECT

This factor covers the relationships between the nature of work (i.e., the purpose, breadth, and depth of the assignment) and the effect of work products or services, both within and outside the organization. Effect measures whether the work output facilitates the work of others, provides timely services of a personal nature, or impacts the adequacy of research conclusions. The concept of effect alone does not provide sufficient information to properly understand and evaluate the impact of the position. The scope of the work completes the picture allowing consistent evaluations. Consider only the effect of properly performed work. The primary components of this factor are: **Scope of the Work** and **Effect of the Work**.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

Level 5-1		25 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830 Illustration(s)	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840	Industrial Engineering 0896
	Electrical Engineering 0850	
FLD	Scope of the Work – Work involves:	
	<ul style="list-style-type: none"> • specific and limited tasks intended to provide training in the occupation; and • assignments familiarizing the employee with the programs and services of the organization. 	
Effect of the Work – Work results facilitate the work of others but have little impact beyond the immediate organizational unit.		

Level 5-2		75 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819 <u>Illustration(s)</u>	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840 <u>Illustration(s)</u>	Industrial Engineering 0896
	Electrical Engineering 0850	
FLD	Scope of the Work – Work involves performing tasks:	
	<ul style="list-style-type: none"> • requiring application of specific standards, methods, and procedures; and • comprising a complete segment of an assignment or project with a broader scope. 	
Effect of the Work – The work assists other engineers, architects, or scientists by relieving them of detailed and routine work and contributes to the timeliness, reliability, acceptability, and accurate completion of the finished solutions, products, and services of the organizational unit.		

Level 5-3		150 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808 Illustration(s)	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819 Illustration(s)	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830 Illustration(s)	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840 Illustration(s)	Industrial Engineering 0896
	Electrical Engineering 0850 Illustration(s)	
FLD	Scope of the Work – Work involves applying precedents and established techniques to resolve a variety of conventional problems, issues, or conditions and provide routine customer service.	
	Effect of the Work – Work results affect the:	
	<ul style="list-style-type: none"> • design, operation, or safety of facilities, systems, or equipment; • effectiveness of engineering or architecture projects or programs; • well-being of the general public in the immediate vicinity; or • agency credibility with internal and external customers. 	

Level 5-4		225 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855 <u>Illustration(s)</u>
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807 <u>Illustration(s)</u>	Naval Architecture 0871
	Architecture	
	Architecture 0808 <u>Illustration(s)</u>	Mining Engineering 0880
	Civil Engineering 0810 <u>Illustration(s)</u>	Petroleum Engineering 0881
	Environmental 0819 <u>Illustration(s)</u>	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830 <u>Illustration(s)</u>	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840 <u>Illustration(s)</u>	Industrial Engineering 0896
	Electrical Engineering 0850 <u>Illustration(s)</u>	
FLD	Scope of the Work – Work involves:	
	<ul style="list-style-type: none"> • originating new and improved applications and strategies for engineering or architecture concepts, theories, and principles; • investigating, evaluating, advising on, and resolving unusual problems, issues, and conditions; • adapting precedents to unusual conditions and projects; • assessing project and program effectiveness; • developing criteria, procedures, or instructions for a particular functional or specialized area; or • providing consultant or advisory services on problems, conditions, programs, and functions to a broad customer base. 	
Effect of the Work – Work results affect the:		
<ul style="list-style-type: none"> • efficiency, feasibility, security, integrity, accuracy, adequacy, and safety of a wide range of agency activities, or the activities of other organizations within a regional or equivalent geographic area; • planning, completion, and direction of major engineering or architecture projects; or • ability of the agency to meet its goals and the needs of its customers. 		

Level 5-5		325 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808 <u>Illustration(s)</u>	Mining Engineering 0880
	Civil Engineering 0810 <u>Illustration(s)</u>	Petroleum Engineering 0881
	Environmental 0819 <u>Illustration(s)</u>	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830 <u>Illustration(s)</u>	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840 <u>Illustration(s)</u>	Industrial Engineering 0896
	Electrical Engineering 0850 <u>Illustration(s)</u>	
FLD	Scope of the Work – Work involves:	
	<ul style="list-style-type: none"> • isolating and defining unprecedented issues and unknown conditions; • formulating and exploring new theories and phenomena; • developing, testing, and advising on new technologies, methods, approaches, and guides; or • providing expertise and advice on program planning and policy-making functions covering a broad range of engineering, architecture, or scientific programs. 	
Effect of the Work – Work results affect the:		
<ul style="list-style-type: none"> • efficiency, feasibility, security, integrity, and safety of a wide range of agency activities and/or the activities of other organizations within several regions or a large geographic area; • work of other engineering, architecture, or scientific experts and high-level officials both within and outside the agency; • well-being of a substantial number of people; or • development of activities or achievement of desired outcomes for major aspects of the agency’s engineering, architecture, or scientific programs or missions. 		

Level 5-6		450 Points
Series	General Engineering 0801	Computer Engineering 0854
	Safety Engineering 0803	Electronics Engineering 0855
	Fire Protection 0804	Bioengineering and 0858
	Engineering	Biomedical Engineering
	Materials Engineering 0806	Aerospace Engineering 0861
	Landscape 0807	Naval Architecture 0871
	Architecture	
	Architecture 0808	Mining Engineering 0880
	Civil Engineering 0810	Petroleum Engineering 0881
	Environmental 0819	Agricultural 0890
	Engineering	Engineering
	Mechanical 0830	Chemical Engineering 0893
	Engineering	
	Nuclear Engineering 0840	Industrial Engineering 0896
	Electrical Engineering 0850	
		<p>Scope of the Work – Work involves planning, developing, advising on, and implementing crucial projects and segments of key agency programs, projects, or activities.</p> <p>Effect of the Work – Work results affect the:</p> <ul style="list-style-type: none"> • success and continuation of key programs essential to the agency’s mission; • vitality and integrity of engineering, architecture, or science-related programs on a long-term or continuing basis; • protection and quality of life, health, and/or property of large numbers of people; or • continuing advancement of science and technology in the Federal sector, private sector, research and industrial activities, and academia.
FLD		

**FACTOR 6 – PERSONAL CONTACTS
AND
FACTOR 7 – PURPOSE OF CONTACTS**

These factors include face-to-face and remote dialogue (e.g., telephone, e-mail, and video conference) with persons not in the supervisory chain. (Personal contacts with supervisors are under Factor 2 – Supervisory Controls.) The levels of these factors consider the work required to make the initial contact, the difficulty of communicating with those contacted, the setting in which the contact takes place, and the nature of the discourse. The setting describes how well the employee and those contacted recognize their relative roles and authorities. The nature of the discourse defines the reason for the communication and the context or environment in which the communication takes place. For example, the reason for communicating may be to exchange factual information or to negotiate. The communication may take place in an environment of significant controversy and/or with people of differing viewpoints, goals, and objectives.

Only credit points under Factors 6 and 7 for contacts essential for successfully performing the work and with a demonstrable impact on its difficulty and responsibility. Factors 6 and 7 are interdependent, so use the same personal contacts to evaluate both factors.

Determine the appropriate level for Personal Contacts and the corresponding level for Purpose of Contacts. Obtain the point value for these factors from the intersection of the two levels as shown on the [Point Assignment Chart](#) at the end of this section.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

PERSONAL CONTACTS	
Level 1	Other professionals, technicians, and support personnel in the immediate office or related units within the agency. Limited contacts with the general public and employees outside the office.
Level 2	Employees in the same agency and/or the general public in a moderately structured setting. Contacts may include professionals and specialists from other occupations or functions (e.g., scientists, legal professionals, contractors, and client organizational representatives). Contacts within the agency may be with people at various levels, such as headquarters or field offices.
Level 3	Individuals or groups from outside the agency, including consultants, contractors, or representatives of the media or professional associations, in moderately unstructured settings. This level may also include contacts with agency officials who are several managerial levels removed from the employee when contacts occur on an ad hoc basis. The employee must recognize or learn the role and authority of each party during the course of the meeting.

(continued)

PERSONAL CONTACTS (continued)	
Level 4	<p>High-ranking officials from outside the employing agency at national or international levels in highly unstructured settings. Typical contacts are:</p> <ul style="list-style-type: none"> • members of Congress; • Presidential advisors or cabinet-level appointees of major departments and agencies; • State governors or mayors of major cities; • presidents of large national or international firms; • national news media; or • leaders of national stakeholder or interest groups.

PURPOSE OF CONTACTS	
Level A	To obtain, clarify, or exchange information or facts needed to complete an assignment.
Level B	To plan, coordinate, or advise on work efforts, or to resolve issues or operating problems. Contacts involve influencing or persuading people who have a cooperative attitude and mutual goals. Discussions typically involve identifying options for resolving problems.
Level C	To influence and persuade persons or groups to comply with established policies or to accept established methods using persuasion or negotiation, or by establishing rapport to gain information. Contacts may require skill in dealing with fearful, skeptical, or uncooperative people to obtain the desired results.
Level D	To justify, defend, negotiate, or settle matters involving significant or controversial issues and/or programs. Work usually involves active participation in conferences, meetings, hearings, or presentations involving broad problems or issues of considerable consequence or importance. Persons contacted typically have diverse viewpoints, goals, or objectives requiring the employee to achieve a common understanding of the problems and a satisfactory solution by convincing them, arriving at a compromise, or developing suitable alternatives.

POINT ASSIGNMENT CHART					
		Purpose of Contacts			
		A	B	C	D
Personal Contacts	Level 1	30	60	130*	230*
	Level 2	45	75	145	245
	Level 3	80	110	180	280
	Level 4	130*	160	230	330

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***THIS COMBINATION IS UNLIKELY**

FACTOR 8 – PHYSICAL DEMANDS

This factor covers the requirements and physical demands placed on the employee by the work assignment. This includes physical characteristics and abilities (e.g., agility or dexterity requirements) and the physical exertion involved in the work (e.g., climbing, lifting, pushing, balancing, stooping, kneeling, crouching, crawling, or reaching). The frequency or intensity of physical exertion must also be considered.

NOTE: Laws and regulations governing pay for irregular or intermittent duty involving unusual physical hardship or hazard are in *section 5545(d), title 5, United States Code, and Subpart I of part 550, title 5, Code of Federal Regulations.*

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

Level 8-1		5 Points
FLD	The work is primarily sedentary. Some work may require periods of walking, standing, bending, climbing, or driving a motor vehicle in activities such as inspections of installed equipment and visits to construction sites and industrial, commercial, agricultural, and other business establishments. Employees may carry light items such as books, instruments, and other similar materials. The work does not require any special physical effort.	

Level 8-2		20 Points
FLD	The work requires some physical exertion, such as long periods of standing, or recurring and considerable walking, stooping, bending, crouching, and climbing such as in performing regular and periodic construction activities, field inspections, or to observe and study work operations in an industrial, storage, or comparable work area. Work may also include frequent lifting of moderately heavy items weighing less than 50 pounds (i.e., 23 kilograms), such as equipment and samples.	

Level 8-3		50 Points
FLD	The work requires frequent, considerable, and strenuous physical exertion such as: <ul style="list-style-type: none"> • lifting heavy objects over 50 pounds (i.e., 23 kilograms); • long periods of standing, walking, running, or driving over rough, rocky, uneven, and hazardous terrain; • crouching or crawling in restrictive areas such as culverts, mines, and tunnels; and • climbing fences, walls, and ladders. 	

FACTOR 9 – WORK ENVIRONMENT

This factor considers the discomfort and risk of danger in the employee’s physical surroundings and the safety precautions required. Although safety regulations and techniques can reduce or eliminate some discomfort and dangers, they typically place additional demands upon the employee.

NOTE: Laws and regulations governing pay for irregular or intermittent duty involving unusual physical hardship or hazard are in *section 5545(d), title 5, United States Code*, and *Subpart I of part 550, title 5, Code of Federal Regulations*.

Note: These factor level descriptions (FLDs) apply to all 0800P occupational series in this JFS.

	Level 9-1	5 Points
FLD	<p>The work is usually performed in an office setting. The work area:</p> <ul style="list-style-type: none"> • normally involves everyday risks or discomforts requiring safety precautions typical of offices or meeting and training rooms; or • may involve occasional exposure to conditions in production facilities, laboratories, or construction sites requiring normal safety precautions. 	

	Level 9-2	20 Points
FLD	<p>The work involves regular and recurring exposure to moderate risks, discomforts, and unpleasantness such as:</p> <ul style="list-style-type: none"> • high noise levels, infectious materials, or toxic or irritating chemicals; • dust, auto, and/or aircraft exhaust; • maritime docks; • climbing through ship cargo areas; • travel in safety approved small air and water craft; • high winds and low or high temperatures; • infestation by dangerous reptiles or by poisonous plants, snakes, and/or insects; • adverse weather conditions; • contagious diseases; • carcinogenic materials; • noxious fumes; • flammable liquids; • radiation; or • potentially pathogenic bacteria. <p>Special safety precautions such as protective clothing and gear are necessary.</p>	

	Level 9-3	50 Points
FLD	<p>The work involves high risks with exposure to:</p> <ul style="list-style-type: none">• extreme weather conditions;• heights of 100 or more feet above the ground;• hazardous chemicals; or• open tanks or structures devoid of oxygen, containing bacteria, or emitting hydrogen sulfide. <p>The employee must apply a wide range of safety precautions under uncontrolled conditions.</p>	

Factor Illustrations

Illustrations are provided in this part as a tool to give insight into the meaning of the Factor Level Descriptions (FLDs) for Factors 1, 4, and 5. Consider each illustration in its entirety and in conjunction with the FLDs. Do not rely solely on these illustrations in evaluating positions.

For additional information about the proper use of illustrations, see the [How to Use This Grading Information](#) section of this JFS.

FACTOR 1 ILLUSTRATIONS

LEVEL 1-5: MECHANICAL ENGINEER, 0830

Professional knowledge of basic mechanical engineering theories, concepts, and principles, and skill in using various types of computer hardware and software sufficient to:

- perform trainee level duties to assist higher-graded engineers in analyzing engineering technical requirements;
- search technical reports to obtain information relating to projects;
- apply basic formulas to routine calculations;
- prepare graphs, curves, and tables for other engineers; and
- perform drafting and minor detail design.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: MATERIALS ENGINEER, 0806

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of materials engineering and the engineering science disciplines, and knowledge of:

- scientific investigative techniques used in testing, evaluating, and exploring the properties and use of materials; and
- computer technology and its application programs relevant to engineering and materials science disciplines

sufficient to:

- determine various metals, alloys, and non-metallic materials in metallurgical testing operations;
- conduct metallographic studies on materials fabrication to resolve problems in the manufacturing process for shipyard components; and
- provide advice on the use of electron microscopy in metallurgical applications and casting manufacturing practices.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: LANDSCAPE ARCHITECT, 0807

Professional knowledge of, and skill in applying, the art, theories, principles, concepts, and design fundamentals of landscape architecture and the architecture science disciplines, and knowledge of:

- related engineering science disciplines (e.g., agricultural, civil, and environmental) and other science disciplines (e.g., hydrology, forestry, soils, and/or wildlife management) used in site management practices;
- scientific investigative techniques used in problem solving and scientific methodology; and
- computer technology and its application programs relevant to architecture, design, and construction

sufficient to:

- provide advisory services on conventional landscape management activities and concerns;
- research, evaluate, and explain agency policies, procedures, and statutory requirements for landscape management activities involving multiple use and sustained yield of forest resources; and
- participate in the development of routine agency land management decisions, and defining and performing the functional requirements of current projects.

FACTOR LEVEL DESCRIPTION**LEVEL 1-6: ARCHITECT, 0808**

Professional knowledge of, and skill in applying, the art, theories, principles, concepts, and design fundamentals of architecture and the architecture science disciplines, and knowledge of:

- construction and design standards and codes;
- scientific investigative techniques used in problem solving and scientific methodology; and
- computer technology and its application programs relevant to architecture, design, and construction

sufficient to:

- carry out projects with low construction costs, small size, and standardized architectural elements;
- produce a variety of architectural design studies such as graphic analysis charts, diagrammatic sketches, and schematic outlines; and
- determine, explain, and recommend alternative solutions responding to client requirements.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: CIVIL ENGINEER, 0810

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of civil engineering and related engineering and architecture science disciplines, and knowledge of:

- construction and design standards and codes;
- scientific investigative techniques used in problem solving and scientific methodology; and
- computer technology and its application programs relevant to civil engineering, design, and construction

sufficient to determine plans and designs for conventional and routine projects by performing the following:

- identifying project limits and providing design specifications to complete the work;
- preparing preliminary designs;
- making financial estimates on costs and conducting life-cycle analysis of existing structures; and
- selecting the best solution from several precedented alternatives to maintain, rehabilitate, or replace equipment and structures.

FACTOR LEVEL DESCRIPTION**LEVEL 1-6: MECHANICAL ENGINEER, 0830**

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of mechanical engineering and related engineering science disciplines, and knowledge of:

- design analysis;
- quality control principles; and
- production methods

sufficient to:

- identify requirements for parts or raw materials used in the production process;
- determine if new mechanical and electrical gauges are needed;
- establish the point in the production process at which items should be inspected;
- review inspection data to monitor product or process quality; and
- verify adequacy of the inspection plan and make changes, as necessary.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: NUCLEAR ENGINEER, 0840

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of nuclear engineering, and related engineering science disciplines, and knowledge of:

- conventional methodology and approaches for nuclear work in shipyards in areas such as evaluating radiation shielding, reactor plant fluid systems and components, reactor plant instrumentation and control systems, and reactor plant test programs;
- nationally recognized nuclear engineering standards;
- scientific investigative techniques used in problem solving and scientific methodology; and
- computer technology and its application programs relevant to engineering, design, and construction

sufficient to:

- record test data;
- make observations of conditions from the test control station;
- oversee plant operators' performance;
- prepare detailed work procedures, task sequences, instructions, and designs for standardized prefabricated containment facilities, installation of temporary lead shielding, and decontamination of tools, components, and conventional facilities;
- inspect completed installation of test equipment to ensure the equipment will safely perform the intended function and is satisfactory from an operational standpoint; and
- investigate routine reports of malfunctioning equipment and components of a nuclear propulsion system.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: ELECTRICAL ENGINEER, 0850

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of electrical engineering and knowledge of:

- electrical features of navigation and flood controls;
- electrical installations;
- availability of, and restrictions on, electrical power; and
- cost-benefit analysis

sufficient to:

- develop layout, detailed designs, and specifications for electrical equipment used in pumping plants and flood control dams;
- consult with power companies on the cost, availability, and adequacy of existing electrical service;
- select or adapt equipment to obtain the required voltages, controls, etc.;
- inspect electrical equipment at locks and flood control dams to determine physical condition and operating efficiency, and recommend actions to correct identified deficiencies; and
- analyze existing or proposed electrical installations and identify possible changes to cut costs or improve efficiency.

FACTOR LEVEL DESCRIPTION

LEVEL 1-6: AGRICULTURAL ENGINEER, 0890

Professional knowledge of, and skill in applying, the theories, principles, concepts, and design fundamentals of agricultural engineering and related engineering science disciplines, and knowledge of:

- electronic climatological instruments and electronic measurement equipment such as anemometers, torque transducers, and watt transducers;
- installation, operation, and adjustment techniques for equipment such as electric alternators and generators and large irrigation motors;
- water pumping systems and their operation;
- electronic control systems and their applications in wind turbines and photovoltaic systems;
- information technology and computer programs for data handling, statistical analysis, and control logic; and
- computer technology and its application programs relevant to engineering and agricultural engineering

sufficient to:

- plan and design studies concerning renewable energy systems for remote water pumping or for producing electric power for rural and remote areas;
- devise, evaluate, recommend, and implement new measurement techniques and instrumentation; and
- participate in and contribute to the preparation of data for scientific technical reports and manuscripts discussing studies and their results.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ARCHITECT, 0808 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, a wide range of theories, principles, concepts, computer applications, and methodology of the art and science of architecture relevant to the preservation, restoration, rehabilitation, and adaptive use of historic buildings such as custom houses, post offices, and train stations sufficient to:

- evaluate, advise on, and recommend acceptance of plans and designs submitted by interested parties (e.g., regional agency offices, contracted architect and engineering firms, and construction contractors) concerning conservation projects involving agency-controlled historic properties;
- evaluate and interpret documentary records (e.g., measured drawings, photographs) of historic fabrics, project drawings, and specifications;
- define and prescribe standard practices, techniques, and equipment in establishing design parameters for in-house or contracted work for developing plans and designs to preserve historic buildings;
- recommend appropriate action to correct undesirable conditions involving structure, finished materials, mechanical and electrical systems, safety and security provisions, and accessibility for those with disabilities;
- prescribe testing methods for materials to ensure retention of fabric as initially constructed;
- conduct studies and investigations concerning methods and techniques to preserve historic buildings; and
- explain and promote the agency's conservation program to historic organizations.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: ARCHITECT, 0808 (ILLUSTRATION 2)**

Professional knowledge of, and skill in applying, the theories, concepts, principles, computer systems applications, and methodology of the art and science of architecture relevant to the development of working drawings for the construction of a wide range of new or rehabilitation of existing institutional structures sufficient to:

- originate, develop, evaluate, and advise on working drawings;
- plan, execute, oversee, and direct a variety of project management and architectural activities;
- conduct site surveys and verify various dimensions;
- interpret preliminary design drawings and data from site visits into plans and designs;
- produce instructions, scope of work documentation, specifications, reports, and correspondence;
- coordinate with and integrate the work of other professional engineers and architects in their functional areas (e.g., heating, electrical systems, landscaping, and structural aspects) in design concepts and plans; and
- inspect completed construction projects to ensure architectural components are built and installed in compliance with contract provisions, specifications, and approved shop drawings.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: CIVIL ENGINEER, 0810 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, the theories, concepts, principles, computer systems applications, and methodology of the science of civil engineering relevant to large-scale construction activities sufficient to:

- originate, assess, and provide advice on concrete and reinforcing designs, engineering drawings, hydraulic designs, and soil and foundation mechanics;
- evaluate, advise on, oversee, and/or direct contracted work to ensure its quality and compliance with plans, designs, and specifications;
- conduct studies and develop plans, specifications, and construction requirements such as schedules, costs, labor, and materials;
- determine adequacy and validity of contractor data and compliance with safety requirements;
- track progress and status of projects and contractual change orders using various reporting mechanisms;
- negotiate cost of minor changes with contractor representatives; and
- anticipate, evaluate, and resolve problems and issues affecting the quality, scheduling, budgeting, or progress of work performed in completing projects.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: CIVIL ENGINEER, 0810 (ILLUSTRATION 2)

Professional knowledge of, and skill in applying, the theories, concepts, principles, computer systems applications, and methodology of the science of civil engineering relevant to the repair, operations, and maintenance of a wide range of facility and public works projects sufficient to:

- anticipate, investigate, evaluate, and resolve problems and issues involving a broad spectrum of facilities, systems, and equipment such as:
 - roofing systems, fire extinguishing systems, and/or pavements;
 - waterfront structures such as piers and quay walls;
 - elevators, towers, and/or antennas;
 - utility plants and/or utility distribution systems;
 - hospitals, research laboratories, air recirculation facilities, air stations, training centers, and industrial and administrative offices;
 - family housing units and/or grounds and recreation facilities;
 - hazardous waste disposal systems and/or trash and scrap metal collection systems; and
 - transportation infrastructure components such as rail and crane trackage, roads, and runways;
- execute project management and engineering practices such as:
 - evaluating, advising on, overseeing, and/or directing contracted work to ensure its quality and compliance with plans, designs, and specifications;
 - evaluating and advising on designs, cost estimates, and associated documentation presented by other engineers and architects within and outside the organization; and
 - preparing a variety of reports, contractual change orders, fact sheets, and correspondence; and
- anticipate, investigate, evaluate, and resolve problems and conditions affecting the quality, scheduling, budgeting, or progress of work performed in completing public works projects.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of environmental engineering relevant to the control or reduction of pollutants into the navigable waterways of a State, and knowledge of:

- sampling techniques, instruments, and devices (e.g., weirs, flumes, flow and current meters, flow recorders) used to measure the quantity and quality of industrial and municipal waste waterways; and
- laws, regulations, ordinances, and legal codes

sufficient to:

- evaluate and approve a variety of reports, inspections, and permits, determining whether:
 - a municipality or factory is in compliance or noncompliance; and
 - actions taken or proposed by State regulatory agencies are technically adequate;
- conduct studies or inspections, observe operations, gather and analyze facts and samples, evaluate efficiency of equipment and practices, perform calculations, and write reports of findings;
- identify the need for and recommend enforcement action on permit violators;
- confer with attorneys, congressional and State officials, community and factory representatives, and other engineers; and
- explain pollution abatement requirements.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 2)**

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of environmental engineering relevant to the operation, maintenance, and modification of sanitary facilities sufficient to:

- evaluate and ensure the adequacy of plans, designs, and specifications for the modification or improvement of existing sewage treatment, industrial waste, water supply, water distribution, and storage facilities;
- interpret, advise on, issue, and implement environmental engineering policies, standards, and programs for a government property or installation;
- serve on and advise contractor selection boards for architect and engineering firms, contract negotiation proceedings, and panels and committees of other Federal, State, or local government agencies and commercial organizations; and
- inspect, evaluate, and advise on sanitary facilities for a broad range of facilities (e.g., industrial, office, medical, housing, and recreational).

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 3)

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of environmental engineering relevant to the control and reduction of air pollutants, and knowledge of:

- standard pollutants (e.g., suspended particulates, sulfur oxides) and accepted methods of control (e.g., stack cleaning techniques and flue gas desulfurization) for a variety of industries and process operations;
- operational procedures and processes typically used in industrial, manufacturing, and commercial enterprises; and
- instruments and equipment (e.g., bag house type particulate collectors, cyclone or centrifugal collectors, packed towers, after burners, mechanical or electrostatic precipitators, and inertial separators) for measuring pollutants and/or controlling emissions from combustion processes

sufficient to:

- inspect, evaluate, and advise on air pollution control methods and abatement programs and their activities, identifying:
 - factors affecting progress to achieve established objectives;
 - situations of noncompliance with legal requirements by specific plants; and
 - solutions to resolve and/or mitigate specific problems or conditions;
- adapt environmental engineering guidelines, principles, and accepted methods for diverse geographical areas;
- advise State and local officials and representatives of industrial plants on interpretations and applications of agency policy and regulations;
- perform engineering and economic assessments of proposed pollution control methods and plans; and
- advise agency attorneys on litigation or serve as an expert witness for hearings and court proceedings.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, the theories, concepts, principles, computer systems applications, and methodology of the science of mechanical engineering relevant to a wide range of construction projects and mechanical utility systems sufficient to:

- develop engineering designs and plans for mechanical utility systems (e.g., heating, ventilating, air conditioning, and refrigeration) as a part of complex construction projects for government structures such as hospitals and laboratories;
- analyze mechanical needs, make calculations, and model alternatives to determine types of systems most suitable to meet the requirements of a structure;
- determine equipment capacity requirements to meet the facility's needs and conform with agency specifications and standards; and
- analyze, evaluate, confer on, and coordinate the engineering, design, and construction work performed by other engineers, architects, and contractors.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)**

Professional knowledge of, and skill in applying, the theories, concepts, principles, computer systems applications, and methodology of the science of mechanical engineering relevant to a wide range of construction projects involving different mechanical systems and equipment, and knowledge of:

- corollary design fundamentals and the concepts, principles, and methods for related engineering and architecture science disciplines (e.g., fire protection, safety, civil, environmental, chemical, and electrical); and
- business management practices for construction activities and contractual procedures and requirements

sufficient to:

- plan, evaluate, and advise on construction activities involving mechanical engineering systems and equipment (e.g., heating, ventilating, air conditioning, sprinklers, and plumbing) and their design, layout, construction, and installation within government buildings;
- oversee in-house and contracted construction projects (e.g., new, renovations, and additions) for large industrial and office buildings;
- prepare cost estimates, evaluate and advise on contractual proposals, and participate in negotiations with contractors for mechanical systems;
- investigate problems arising during construction and recommend solutions, coordinating with the designer and contractor in resolving problems;
- conduct field surveys to verify fulfillment of contractor's construction estimates used to determine monthly progress payments to the contractor;
- ensure contracted construction work complies with contract specifications, safety standards and programs, and requirements for documentation of records and drawings; and
- analyze, evaluate, confer on, and coordinate the engineering, design, and construction work performed by other engineers, architects, and contractors.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 3)

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of mechanical engineering relevant to designing mechanical systems and equipment for specialized floating marine structures, and knowledge of:

- ship design, ship operating conditions, marine environments, and naval construction concepts, principles, and methods; and
- business management practices for monitoring and administering construction activities and contract processes

sufficient to:

- design and evaluate designs for a variety of mechanical systems and equipment used aboard specialized floating marine structures;
- provide and evaluate cost estimates, complex calculations, preliminary engineering designs, specifications, and change order documentation;
- evaluate and recommend mechanical systems and equipment in manufacturers' catalogs and contractor proposals;
- survey existing marine structures, investigate a variety of problems and unconventional operating requirements, and determine and/or recommend solutions to improve the efficiency of mechanical systems and equipment;
- coordinate with other engineering and naval architect personnel, manufacturers, and contractors to resolve problems and design changes and participate in negotiations; and
- formulate test programs and operating procedures for mechanical machinery and equipment on floating marine structures.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of nuclear engineering, including knowledge of:

- nuclear reactor design concepts, fission and fusion reactor operations, systems engineering applications, and associated safety programs; and
- related engineering science disciplines (e.g., mechanical, chemical, materials, and electrical) and plasma physics

sufficient to:

- conduct systems studies to assess, develop, advise on, and recommend technological requirements and timing for overall fusion power activities;
- evaluate and approve conceptual designs of near-term major fusion devices;
- analyze and evaluate highly specialized information regarding the design, development, and demonstration of fusion reactor technology; and
- research, analyze, assess, and make recommendations regarding on-going and planned contractor research, development projects, and programs.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 2)**

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of nuclear engineering, including knowledge of:

- nuclear reactor systems and reactor servicing programs; and
- refueling operations for naval ships

sufficient to:

- plan refueling operations for naval ships with nuclear reactor systems;
- prepare engineering procedures and instructions;
- direct, evaluate, advise on, and assess the work of others in performing rigorous reactor servicing and refueling operations; and
- coordinate and oversee the engineering and scientific aspects of shipyard projects related to reactor servicing and refueling operations.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 3)

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, computer systems applications, and methodology of the science of nuclear engineering, and knowledge of:

- design and operation theories of pressurized water reactor plants;
- nuclear reactor theory (e.g., reactor physics, materials, thermal, and hydraulic) and design principles;
- theories in chemistry, corrosion, and basic nuclear physics regarding radiation and radiological controls;
- operation of electrical instrumentation and control equipment systems;
- design and operation of fluid system equipment;
- nuclear plant safety and overall plant operation;
- principles and practices of naval architecture and ship construction;
- theories, concepts, principles, and practices of related engineering science disciplines (e.g., mechanical and electrical); and
- nuclear plant systems and their operations, including possible hazards and equipment problems, the interrelationship and interoperability of the components and associated systems, and established corrective action precedents

sufficient to:

- direct and/or oversee nuclear plant operations involving rigorous acceptance tests or changes to the plant system in support of modifications or overhaul work projects;
- ensure the safe operation of the nuclear reactor plant by:
 - evaluating and verifying requests to perform authorized maintenance and repair work on reactor plant components (e.g., mechanical, electrical, and structural);
 - assuring all operations are performed in accordance with approved procedures;
 - evaluating the expected plant responses report by instrumentation or watch standers; and
 - evaluating problem responses and situations, implementing corrective actions to place the plant in a safe condition, and/or determining likely cause(s), and the advisability of continuing operations;
- provide formal detailed briefings to shipyard and ship personnel involved in reactor test operations;
- evaluate and accept formal reports from participating test personnel assuring test preparations are complete, inspected, and certified;
- direct, advise on, and evaluate “dry run” or actual operation in a step-by-step manner following rigorous application of operating procedures; and
- detect the need for and prepare detailed instructions or changes to procedures for the assembly and installation of test equipment, accomplishing tests or operations, and dialing schedules to sequence work, tests, and plant operations.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 1)

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of electrical engineering, and knowledge of:

- interrelationships among design, construction, and operation of facilities with electrical power systems and their related planning, design, maintenance, repair, construction, and cost estimating activities; and
- evaluating electrical and electronic power systems and their construction concerns through problem solving, simulation, quantitative analysis, and scientific methodology

sufficient to:

- analyze and evaluate electrical power capabilities in existing and proposed facilities, equipment, processes, and computer systems;
- develop, interpret, justify, and present electrical system designs, plans, drawings, and schematics to meet agency, national, and local building codes and requirements;
- plan, develop, and advise on available and proposed electrical and electronic power services for local use by the agency;
- estimate and plan for equipment and power requirement changes resulting from new equipment needs, construction projects, redesigns, and/or new processes and technology; and
- study, plan for, and advise on processes and activities to ensure uninterrupted, reliable, full-time (i.e., 24-hours/7 days a week) service of agency's local computer operations.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 2)

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of electrical engineering, and knowledge of:

- building, design, and construction technologies, including such areas as:
 - the interrelationships of design, construction, and operation of facilities with electrical power systems and their associated planning, design, maintenance, repair, construction, and cost estimating activities;
 - designing and evaluating electrical engineering schematics, drawings, plans, and specifications;
 - the interoperability of electrical systems as they relate to buildings, computer systems, and electronic equipment; and
 - engineering guidelines and codes and standards for building and equipment design and construction;
- techniques for investigating and troubleshooting electrical power systems; and
- engineering and architecture science disciplines (e.g., mechanical, civil, and computer) affiliated with building, design, and construction technologies

sufficient to:

- analyze and evaluate electrical systems supporting new construction, conversion, overhaul, and repair work in one or more of the following areas:
 - electrical power generation;
 - alternating current and direct current power distribution;
 - motor controllers;
 - electrical penetrations;
 - inboard and outboard cables;
 - interior/exterior lighting;
 - cableways, cable routing, and wireways;
 - batteries and battery charging and monitoring; or
 - communications;
- develop, interpret, and justify electrical system designs, plans, drawings, and schematics to meet agency, national, and local building codes, standards, and requirements;
- analyze and interpret builder, contractor, and/or agency's engineering specifications, working drawings, and new or existing designs;
- perform complex calculations and produce designs and specifications using a variety of computer software;
- conduct special studies of unconventional operating requirements or feasibility studies to determine novel or unique design solutions; and
- evaluate test results ensuring specifications and operating requirements are met.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: COMPUTER ENGINEER, 0854

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of computer engineering, including knowledge of:

- computer hardware;
- systems software;
- computer system integration; and
- advanced mathematics

sufficient to:

- perform studies to determine optical and data reduction hardware requirements for new systems;
- develop, design, test, evaluate, and install data reduction and conversion equipment and systems;
- design interface methods between peripheral equipment and computers used in data reduction systems;
- develop and implement facilities plans, operational security procedures, new measurement techniques, and control software to ensure delivery of turn-key data reduction hardware; and
- serve as technical advisor and consultant on digital hardware control techniques and data processing systems, providing authoritative advice on topics such as computer capacity and capability, mathematical and programming techniques, and system effectiveness.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: ELECTRONICS ENGINEER, 0855

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of electronics engineering, and knowledge of:

- mechanical and chemical engineering;
- advanced mathematics and computer science; and
- test and evaluation requirements

sufficient to:

- conduct pre-test surveys of sites to ascertain terrain and other physical conditions which have a bearing on electronic instrumentation and test facilities;
- identify adaptations needed to meet unique test conditions;
- advise and assist others in the installation, operation, and field maintenance of electronic equipment involved in test operations and in test methodology;
- evaluate test results, analyze operational failures and deficiencies, and recommend solutions;
- plan and design electronic circuitry, power supplies and distribution, electronic data collection, and transmission for instrumentation and test facilities working with chemical stimulants, and a variety of chemical, biological, and smoke and obscurant weapon systems;
- prepare technical specifications, design, and cost estimates for use by contractors in the development and fabrication of prototype and production items; and
- provide technical electronics engineering advice on a wide variety of electronic issues complicated by the chemical characteristics of various materials, or by the mechanical, structural, hydraulic features of equipment, instruments, or facilities.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: NAVAL ARCHITECTURE, 0871**

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, and practices in the science of naval architecture sufficient to:

- develop complex designs and specifications for naval vessels scheduled for alteration, repair, rebuilding, conversion, modernization, or rehabilitation;
- prepare test and inspection requirements for equipment on naval vessels (e.g., condensers, diesels, reduction gears, propellers, propulsion shafting, clutches, auxiliary propulsion machinery);
- review and approve designs for conventional marine propulsion systems to ensure compliance with established design standards and operational efficiency;
- ensure structural adequacy of materials and suitability of equipment to support load requirements;
- conduct functional studies of naval vessel stability and safety; and
- anticipate, evaluate, and resolve problems and issues affecting the quality, schedule, budget, or progress of work.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: MINING ENGINEERING, 0880

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, and practices in the science of mining engineering sufficient to:

- conduct independent field examinations and investigations of critical factors including:
 - geographical conditions;
 - native flora and fauna;
 - water and timber availability; and
 - infrastructure support;
- design plans for mine reclamation activities, considering alternative approaches;
- oversee and evaluate land reclamation and restoration activities, adjusting plans as needed, to restore land to useful condition; and
- advise environmental engineers, scientists, and interest groups on policies, standards, and regulations, and recommend solutions to resolve complex technical problems.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: PETROLEUM ENGINEER, 0881**

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of petroleum engineering sufficient to:

- plan, direct, oversee, and conduct engineering surveys and investigations involving the assembly, analysis, and interpretation of a wide variety of data concerning oil and gas fields;
- examine and resolve a variety of difficult engineering or scientific problems and conditions requiring analysis and evaluation of alternatives, and substantial modification of standard practices;
- provide petroleum engineering advice and assistance to a variety of interested parties such as client offices and agency officials, State and local government offices, and industry representatives;
- prepare, evaluate, and advise on engineering and scientific reports, correspondence, and supporting documentation; and
- assess and recommend engineering and scientific proposals based on effectiveness, accuracy, feasibility, and conformance with agency requirements.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: AGRICULTURAL ENGINEER, 0890

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of agricultural engineering sufficient to:

- plan, direct, oversee, and conduct, for a broad regional area, a wide variety of engineering surveys, construction activities, and investigations related to hydrologic activities, watershed, land treatment, and other similar resource management activities;
- assemble, analyze, interpret, and advise on diverse engineering and scientific data measuring the effects of soil conservation practices and water and soil conditions within the regional area;
- consult with and advise engineers, conservationists, technicians, State and local governments, farmers, and civic and community officials on soil conservation techniques for unstable soils, ground water pressure, structural limits of materials, and cost estimates for installation, operation, and maintenance;
- integrate the principles and practices of engineering with the methodologies and practices of agronomy, geology, soil science, economics, and related sciences to plan and implement the regional area's resource management program;
- advise on the adequacy and costs of agricultural engineering activities performed by contractors;
- prepare, evaluate, and advise on engineering and scientific reports, correspondence, and supporting documentation; and
- assess and recommend engineering and scientific proposals for accuracy, feasibility, and conformance with agency requirements.

FACTOR LEVEL DESCRIPTION**LEVEL 1-7: CHEMICAL ENGINEER, 0893**

Professional knowledge of, and skill in applying, a wide range of theories, concepts, principles, and practices in the science of chemical engineering sufficient to:

- design necessary chemical processing equipment and systems to support development of chemical warfare protective and weapon systems;
- control complex chemical change processes through hydrolysis, gasification, hydrogenation, fermentation, cracking, crushing, filtration, scrubbing, grinding, or nitration;
- plan and perform operational testing and evaluation of various chemical warfare protective and weapon systems, decontamination systems, equipment, and facilities;
- analyze test data on flow rates, operating pressures, and chemical composition; and
- review, advise on, and recommend alternatives to proposed chemical treatment methods and technical problems.

FACTOR LEVEL DESCRIPTION

LEVEL 1-7: INDUSTRIAL ENGINEER, 0896

Professional knowledge of, and skill in applying, advanced theories, concepts, and principles practiced in the science of industrial engineering sufficient to:

- plan the layout and design of a large, complex aircraft overhaul and repair facility;
- develop flowcharts for the facility, including work station layouts, for:
 - disassembly;
 - cleaning;
 - initial inspection;
 - reconditioning;
 - painting;
 - final inspection; and
 - final assembly; and
- judge adequacy of designs for mechanical equipment, instrumentation, and machinery.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: SAFETY ENGINEER, 0803**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional safety engineering sufficient to:

- provide authoritative interpretations of Federal safety standards to resolve conflicts, controversies, and disputes over the applicability of Federal standards, particularly where state policies conflict with Federal regulations;
- conduct onsite inspections, require immediate corrective actions, and recommend long-term enhancements to the safety program;
- serve as a technical safety expert to explore, evaluate, and incorporate new technology into construction program plans;
- evaluate potential construction hazards (e.g., strength, stability, failure modes, effects of stress and straining, current and voltage flows, grounding paths), develop controls and identify potential emergency resources; and
- review requests for proposals and contracts to ensure safety engineering criteria, principles, and techniques are considered in the development and procurement of contracted work.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: FIRE PROTECTION ENGINEER, 0804

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional fire protection engineering sufficient to:

- develop fire protection system plans, fire safety reports, assessments, analyses, correspondence, and authorization basis documents;
- investigate fires with unusual causes, develop corrective actions, track trends, and share lessons learned;
- interpret fire codes, standards, and directives and advise on industry best practices;
- provide fire safety support to emergency management elements in sites without fire protection engineering expertise;
- coordinate emergency management program review of agency directives, technical standards, and professional qualification criteria related to fire protection; and
- represent fire protection interests at emergency management meetings and at meetings with other Federal agencies, national laboratories, State and Federal environmental regulators, and other stakeholders.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: MATERIALS ENGINEER, 0806**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional materials engineering sufficient to:

- serve as the technical leader and authority over the applied materials science program;
- apply breadth of insight and technical expertise to a wide range of materials problems;
- advise senior program officials on new advances in materials impacting:
 - fatigue, fracture, deformation, dislocation, and other micro-mechanical phenomena;
 - behavior of materials under complex loading;
 - interaction of mechanical and environmental phenomena; and
 - thermomechanical processes;
- plan, review, and approve materials-related work, such as:
 - materials irradiation tests;
 - post-irradiation examination and tests; or
 - physical and chemical materials property tests;
- monitor the testing of the properties of materials to ascertain their appropriateness for use; and
- develop materials test methods and specifications, and evaluate test results in relation to the material.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: ARCHITECT, 0808

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional architecture sufficient to:

- provide authoritative interpretations of guidelines and practices used in the design and construction of new facilities or the repair, restoration, and alteration of existing facilities;
- serve as an architectural consultant, and provide expertise in developing project specifications and design criteria for major architectural and construction projects involving office buildings and public facilities;
- conduct investigations and studies to formulate and present special reports and formal briefings concerning the status and adequacy of agency architectural and construction projects (i.e., from the preliminary planning stage through project completion);
- provide expertise and recommendations to other engineers and architects on complex, unusual architectural designs, issues, and situations;
- interpret and explain advanced concepts and diverse information in related building and design professions such as landscape architecture or related engineering science disciplines (e.g., mechanical, electrical, structural, safety, and civil); and
- evaluate, advise on, and incorporate latest developments in the design and construction of office and public buildings into agency policy requirements and program objectives for design and construction activities.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: CIVIL ENGINEER, 0810 (ILLUSTRATION 1)**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional civil engineering sufficient to:

- serve as a regional engineering point of contact for agency design and construction projects to:
 - coordinate, plan, and oversee the commitment and work arrangements of the agency's regional engineering and equipment resources; and
 - formulate, establish, interpret, report, and advise on agency policy, guidelines, and standards for design and construction activities;
- devise, manage, and promote marketing strategies offering the agency's engineering expertise, project management services, and equipment resources in design and construction to a broad client base;
- advise on and collaborate in the development of short- and long-term plans, cost-sharing agreements, grants, and interagency partnerships considering available resources, services required, and associated costs to ensure efficient use of agency resources and client satisfaction;
- identify, coordinate, and integrate the various engineering, architecture, and other related disciplines necessary to deliver expert advisory services and accomplish cost-effective, high-quality design and construction activities; and
- advise on conflicting requirements involving client expectations, legislation, engineering requirements, socio-economic development, cultural sensitivity, and wildlife conservation.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: CIVIL ENGINEER, 0810 (ILLUSTRATION 2)

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional civil engineering sufficient to:

- serve as a project manager and authoritative consultant for remedial cleanup activities of agency properties contaminated with toxic and/or hazardous materials;
- design, perform, oversee, advise on, and direct investigations, endangerment assessments, feasibility studies, and remedial action strategies for contamination cleanup programs at various agency sites;
- evaluate and incorporate new applications and advanced theories, concepts, and practices of related engineering and architectural science disciplines (e.g., chemical, environmental, mechanical, and electrical), and physical science disciplines (e.g., chemistry and physics) involved in contamination cleanup and remediation work; and
- advise, coordinate with, direct, and oversee the combined efforts of contractors and other Federal agencies involved in remedial activities.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 1)**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional environmental engineering sufficient to:

- serve as an authoritative consultant and expert providing oversight, direction, and advisory services for the agency's national air quality enforcement program;
- explain, interpret, and advise on agency policy and regulatory guidance, return on investment evaluations of new and existing pollution control plans for new plants, and proposed emission control methods for removing undesirable gases from flue effluent;
- evaluate the effectiveness of air quality programs in controlling and reducing air pollutants from large stationary sources (e.g., coal, oil, or gas-fired power plants; petroleum refineries; smelters; asphalt, concrete, or cement plants) and advise on the need to devise new approaches, standards, and policies for enforcement of air quality controls;
- conceive, conduct, direct, and advise on environmental engineering studies investigating, evaluating, and reporting on the status of compliance and abatement efforts;
- explain, interpret, and promulgate agency decisions and determinations; and
- prepare, evaluate, and advise on complex air pollution and environmental engineering matters influencing current and future programs within the agency.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 2)

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional environmental engineering sufficient to:

- evaluate, approve, and advise on the adequacy of agency construction plans and designs for modifying or repairing existing, or carrying out the initial installation or construction of new industrial and domestic waste treatment and water supply, distribution, and storage facilities located worldwide;
- advise on, oversee, and direct the agency's planning and programmatic requirements for the operation and maintenance of these facilities;
- plan, design, and implement short- and long-term improvements to existing and proposed environmental engineering facilities and systems for rural and urban communities worldwide;
- evaluate and incorporate advanced concepts, principles, and design criteria used in related engineering science disciplines (e.g., electrical, mechanical, civil, and chemical) with similar practices and administrative programs involving construction programs and policy guidelines;
- explore, evaluate, test, and incorporate new applications and advances in technology resulting in improvements to the agency's plans for these facilities; and
- serve as an authoritative agency representative for the agency's environmental engineering program providing expertise and advisories explaining, interpreting, and promulgating the agency's policy and guidance to diverse parties representing opposing or conflicting opinions.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: MECHANICAL ENGINEER, 0830

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional mechanical engineering sufficient to:

- develop, revise, and publish agency policy, guidelines, regulations, and handbooks on engineering design specifications and design criteria for mechanical systems and equipment for use in a variety of government buildings;
- provide consultative and expert advisory services to agency regional offices, contract architecture and engineering firms, construction contractors, and other Federal agencies on agency requirements and mechanical engineering design criteria;
- conduct studies, investigations, and tests of new mechanical systems, equipment, devices, and materials for future applications in buildings, considering factors such as design, operation and maintenance costs, and the betterment of existing and proposed new structures;
- integrate advanced concepts and principles of related professional engineering and architecture science disciplines (e.g., civil, fire protection, safety, and electrical);
- provide testimony as an expert witness in court proceedings and public hearings;
- serve on various scientific and engineering committees internal and external to the agency; and
- formulate, evaluate, interpret, explain, and present engineering and scientific information for publication in technical journals and for discussions at professional scientific and engineering conferences.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 1)

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional nuclear engineering sufficient to:

- consult on proposed, newly developed, and/or installed nuclear reactor components and systems;
- assess, oversee, coordinate, direct, and advise on the design, development, acquisition, construction, testing, evaluation, operational maintenance, and safety features of reactor plant valves such as reactor plant gate valves and hydraulically operated valves used in nuclear propulsion plant systems for submarines, surface ships, land-based prototypes, and nuclear power plants;
- analyze, evaluate, and advise on:
 - performance and reliability standards for nuclear reactor plant valves;
 - nuclear reactor plant valve design specifications requiring exacting standards for environmental operating conditions, functional performance, structural integrity, and accelerated life testing;
 - contracts for designing, manufacturing, and quality conformance testing of nuclear reactor plant valves; and
 - best business and acquisition processes to ensure the ready stock availability of spare nuclear reactor plant valves and reactor plant canopy seal rings; and
- formulate, explain, interpret, advise on, and convey agency guidelines, policies, and determinations within and outside the agency through reports, fact sheets, instructions, guidelines, meetings, and presentations.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 2)

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional nuclear engineering sufficient to:

- serve as an agency consultant and expert providing engineering and scientific direction for the full range of processes or activities designing, developing, and testing nuclear reactor plant systems and reactor plant components such as:
 - liquid metal heat exchangers;
 - steam generators;
 - reactor core supports and restraints;
 - radioactive gas seals; and
 - fuel handling equipment;
- formulate, interpret, and advise on agency requirements for nuclear reactor plant systems and reactor component programs;
- perform program management activities, including:
 - determining program goals;
 - reviewing progress and results;
 - recommending additions, deletions, initiation, or termination of programs;
 - incorporating new applications and improved technologies for manufacturing state-of-the-art components for nuclear reactor plant systems; and
 - applying business practices (e.g., fiscal, contracting, and administrative processes) to achieve timely, economical, and successful completion of projects and objectives;
- oversee, coordinate, evaluate, and advise on design, development, and testing programs and projects performed by national laboratories and contractors for nuclear reactor plants and reactor plant components;
- evaluate, recommend, and advise on solutions to nuclear reactor problems and conditions impacting success of national nuclear power options;
- recommend and evaluate processes involved in the design, development, acquisition, construction, testing and evaluation, operational maintenance, and safety of nuclear reactor plant systems; and
- formulate, explain, interpret, advise on, and convey agency guidelines, policies, and determinations within and outside the agency through various venues such as reports, fact sheets, instructions and guidelines, meetings, contractual negotiations, and presentations.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: ELECTRICAL ENGINEER, 0850

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional electrical engineering sufficient to:

- serve as a consultant and expert advisor on the electrical engineering aspects of proposed and existing plans, designs, and construction activities for a wide range of agency facilities in a large regional area;
- design, assess, and inspect electrical systems and equipment such as those found in:
 - power distribution systems, power plants, and utility monitoring and control systems; and
 - interior wiring systems, lighting systems, and lighting protection systems;
- investigate and resolve problems and conditions in electrical systems and equipment impacting costs, efficiency, safety, and performance;
- provide electrical engineering oversight and expertise on related engineering science disciplines (e.g., mechanical, environmental, materials, safety, fire protection, chemical, and civil) affiliated with the design and construction of facilities and the building industry;
- assess, recommend, and apply business practices (e.g., financial, contracting, and administrative) to achieve timely, economical, and successful completion of projects and objectives;
- review plans, specifications, and drawings for electrical engineering features in designs for civil works and military projects;
- evaluate, recommend, and incorporate the latest developments in the fields of electrical engineering, construction, and materials into designs, existing and proposed facilities, and construction projects; and
- inspect and accept work on electrical engineering systems and equipment during and after construction projects.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: COMPUTER ENGINEER, 0854

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional computer engineering sufficient to:

- serve as a consultant and expert in electronic information systems and their systems engineering processes involving integration, testing, interoperability, and quality assurance;
- investigate, advise on, and resolve unusual and controversial problems relating to the interface and integration requirements for a broad range of existing and new electronic information systems and equipment with widely divergent national and international network systems;
- evaluate and advise on the feasibility of new technology and state-of-the-art equipment for incorporation into existing systems and equipment;
- conceive new approaches and modified strategies to meet novel interfacing and integration conditions;
- manage, coordinate, direct, and oversee critical operational and integration systems engineering efforts to establish, maintain, and/or improve information systems, national and international networks, and their hardware and software applications; and
- conduct and advise on testing operations for acceptance and operation of complete systems and equipment.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: ELECTRONICS ENGINEER, 0855**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional electronics engineering sufficient to:

- provide technical direction to industrial production programs for highly advanced equipment utilizing complicated circuitry and state-of-the-art components;
- advise on production facilities, machinery, materials, and standards;
- oversee the activities of, and lend technical assistance to, supporting production installations and contractor facilities on unusual problems and policy matters and resolve major performance deficiencies in the equipment;
- keep abreast of research and development by reviewing pertinent reports and other related data to ensure proper emphasis on design for production;
- anticipate problems and areas of major difficulty in the transition of the item from design to production, and guide production installations in their resolution;
- prepare policy instructions and guidance material for production installations and contractors;
- establish milestones for the production and delivery cycles; and
- recommend design changes to increase production.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: BIOMEDICAL ENGINEER, 0858 (ILLUSTRATION 1)

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional biomedical engineering, and knowledge of physiology and anatomy sufficient to:

- investigate problems and phenomena of living systems to advance the understanding of these systems and medical practices;
- develop materials, instruments, diagnostic and therapeutic devices, and other equipment applicable to the study of life systems; and
- apply new experimental theories and/or new applications or developments to improve health service delivery systems.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: BIOMEDICAL ENGINEER, 0858 (ILLUSTRATION 2)**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional biomedical engineering, and knowledge of the use of biotechnology, sufficient to:

- evaluate the impact of solid propellant guns and high explosives and detonation devices on human anatomy and physiology;
- plan, design, and oversee the development of special protective equipment; and
- provide authoritative technical expertise to military officials on issues involving protective equipment, and identify and respond to possible hazards associated with medical devices.

FACTOR LEVEL DESCRIPTION**LEVEL 1-8: AEROSPACE ENGINEER, 0861**

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional aerospace engineering sufficient to:

- serve as a consultant and expert advisor in the establishment of operational networks for major space flight programs;
- develop, analyze, perform, and lead flight and ground operations for a broad range of mission scenarios and flight systems such as future launch vehicles, upper stages, payloads, spacecraft, and space systems;
- participate in preliminary and critical design reviews, and determine, develop, and defend requirements; and
- evaluate technological trends and formulate overall design concepts and criteria to establish the baseline for state-of-the-art engineering developments.

FACTOR LEVEL DESCRIPTION

LEVEL 1-8: CHEMICAL ENGINEER, 0893

Mastery of, and skill in applying, advanced theories, concepts, principles, and practices in the science of professional chemical engineering sufficient to:

- develop new policies in chemical engineering and related areas regarding hazardous and toxic waste disposal;
- establish procedures for chemical unit operations, processes, and related methods to evaluate, remove, or isolate chemical contaminants in wastewater, soil, landfills, and groundwater;
- provide technical advice and guidance on the closure of historic hazardous waste sites and the mitigation of subsurface liquid or solid hazardous waste; and
- approve specifications for procurement and design of new equipment to meet unique needs for disposal of hazardous chemical waste.

FACTOR LEVEL DESCRIPTION**LEVEL 1-9: LANDSCAPE ARCHITECT, 0807**

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the art and science of professional landscape architecture sufficient to:

- serve as a national authority on landscape architecture and associated building, construction, and design activities and programs;
- conceive, plan, propose, oversee, and execute projects or studies advancing the state-of-the-art in design and development, construction, and landscape architecture;
- develop and publish construction and design standards, interpretations, and authoritative papers explaining the agency's views and objectives;
- represent the agency on interagency task forces, symposiums, and national and international engineering councils and conferences; and
- explore, justify decisions on, and/or resolve controversial and conflicting engineering, scientific, and socio-economic issues involving landscape architecture, building and construction activities, design standards and criteria, and related agency requirements.

FACTOR LEVEL DESCRIPTION

LEVEL 1-9: ARCHITECT, 0808

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the art and science of professional architecture sufficient to:

- serve as a national authority on architecture; building construction, renovation, and design; and facilities operation and maintenance activities for the agency's biomedical research, hospital, and clinical medical care delivery services;
- serve as project manager from the design concept stage to post-construction evaluation and occupancy for a major state-of-the-art healthcare facility construction project requiring:
 - development of new architectural design approaches;
 - management of and collaboration with myriad teams of in-house and contracted engineers, architects, and construction personnel;
 - determinations and decisions (e.g., budgeting, sequencing and scheduling of design and construction activities and materials, and aesthetics) directly affecting the progress and conclusion of the project; and
 - public and private sector partnerships; and
- explore, justify decisions on, and resolve controversial and conflicting engineering, scientific, environmental, and socio-economic issues involving architecture, building and construction activities, design standards and criteria, and contractual arrangements.

FACTOR LEVEL DESCRIPTION**LEVEL 1-9: CIVIL ENGINEER (STRUCTURAL), 0810**

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the science of professional civil engineering sufficient to:

- serve as a recognized national or international expert on the entire range of structural and construction work involving bridges, tunnels, and their related structures;
- conceive, propose, plan, advise on, oversee, and execute projects or studies advancing the state-of-the-art in bridge and tunnel structural engineering technology;
- develop and publish interpretations and authoritative papers explaining the agency's policies, standards, and goals in the structural field with regard to bridge and tunnel technology;
- identify, define, advise on, and respond to existing and future transportation needs and issues impacting the nation, individual States, and international interests;
- provide, direct, and oversee the performance of engineering consultative and advisory services to agency offices and clientele worldwide on issues involving structural adequacy, integrity, safety, durability, and security of bridges and tunnels as well as their existing and proposed designs, fabrication, construction, and rehabilitation;
- represent the agency on interagency task forces, symposiums, and national and international engineering councils and conferences; and
- explore, justify, and resolve controversial engineering, scientific, and socio-economic issues involving agency programs for bridge and tunnel design and construction.

FACTOR LEVEL DESCRIPTION

LEVEL 1-9: ENVIRONMENTAL ENGINEER, 0819

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the science of professional environmental engineering sufficient to:

- conceive, propose, plan, oversee, and execute environmental projects or studies to advance the state-of-the-art in recovery of energy value from solid municipal refuse or waste;
- develop and publish interpretations and authoritative papers explaining the agency's views and objectives and furthering the agency's energy recovery program;
- serve as a nationally recognized authority in the field of energy recovery;
- oversee and advise on energy recovery program features contained in contracts and grants of the agency;
- represent the agency on interagency task forces, symposiums, and national and international engineering councils and conferences; and
- defend, justify, and resolve controversial engineering, scientific, and socio-economic issues involving energy recovery systems, processes, and objectives.

FACTOR LEVEL DESCRIPTION**LEVEL 1-9: MECHANICAL ENGINEER, 0830**

Mastery of the theories and advanced state-of-the-art concepts and principles practiced in the science of professional mechanical engineering sufficient to:

- provide expert advisory services to explore and resolve highly complex technical problems related to the design and operation of existing and new self-sustained biomedical research facilities and the entire range of their mechanical and environmental engineering systems;
- serve as a nationally recognized expert on the application of mechanical engineering science to sustain and improve biomedical, research, and healthcare delivery facilities;
- apply cutting-edge technology to develop new models for simulating factors such as air flow and particulate dispersion; and
- analyze, formulate, explain, issue, and promulgate policies, concepts, designs, and standards on mechanical systems associated with central plant operations and biomedical research laboratory containment.

FACTOR LEVEL DESCRIPTION

LEVEL 1-9: NUCLEAR ENGINEER, 0840

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the science of professional nuclear engineering sufficient to:

- serve as a national authority in the broad areas of overhaul, maintenance, and refueling of submarine nuclear reactor plant systems;
- provide expert consulting and advisory services regarding first-of-a-kind nuclear submarine propulsion plants and their design, development, budgeting, scheduling, installation, testing, modification, and repair;
- evaluate, advise on, oversee, and execute short- and long-range plans implementing the agency's nuclear engineering programs and projects for:
 - accomplishing urgent repairs, maintenance, overhaul, and refueling of nuclear submarine propulsion plant systems; and
 - coordinating the design, development, budgeting, scheduling, installation, and testing of modifications and repairs to nuclear submarine propulsion plant systems;
- act as the agency's authorizing officer for contractual agreements to achieve the timely completion of urgent propulsion plant overhaul, maintenance, and refueling work; and
- oversee, advise on, and coordinate the issuance, revision, and interpretation of policy manuals and instructional materials affecting work on nuclear submarine propulsion plant systems.

FACTOR LEVEL DESCRIPTION**LEVEL 1-9: ELECTRICAL ENGINEER, 0850**

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the science of professional electrical engineering sufficient to:

- serve as a national and/or international authority for challenging design and construction activities involving electrical and electronic power systems in existing and proposed agency facilities, including aviation facilities;
- develop, issue, advocate, and advise on agency policy, guidance, engineering standards, and engineering objectives for electrical and electronic power systems during all phases of their planning, design, and construction activities;
- evaluate, advise on, and incorporate state-of-the-art technological improvements in electrical and electronic power systems used agency-wide; and
- provide expert electrical engineering advice or consultation regarding priorities in implementing agency design and construction activities as the designated agency representative on national and/or international committees.

FACTOR LEVEL DESCRIPTION

LEVEL 1-9: AEROSPACE ENGINEER, 0861

Mastery of, and skill in applying, advanced theories, concepts, and principles practiced in the science of professional aerospace engineering sufficient to:

- manage overall development efforts for all electronic and electrical systems in a variety of manned spacecraft;
- make substantial and continuing contributions to long-range mission plans and to the formulation, modification, and determination of overall objectives;
- serve as an authoritative source of information for decisions on changes in project objectives;
- coordinate with other offices to establish content, cost, and schedule of products, deliverables, and services; and
- serve as an expert consultant in the resolution of the most challenging aerospace engineering problems on projects of national scope and impact, characterized by the need for new theoretical treatments, instrumentation, equipment, and procedures.

FACTOR LEVEL DESCRIPTION**LEVEL 1-9: AGRICULTURAL ENGINEER, 0890**

Mastery of, and skill in applying, the theories and advanced state-of-the-art concepts and principles practiced in the science of professional agricultural engineering sufficient to:

- serve as a recognized authority for agricultural engineering and other soil science and resource assessment activities involved in the planning and implementation of the agency's nationwide natural resources conservation program;
- provide leadership and direction in the use of diverse technologies associated with soil erosion processes, technology transfer of models, development of engineering software, and the formulation and implementation of strategic plans;
- develop and promote national policy and guidelines for planning, investigating, designing, implementing, operating, and maintaining conservation engineering systems and practices that protect and conserve natural resources (i.e., soil, water, air, plant, and animal) and consider relevant human interests;
- develop, issue, advocate for, and advise on agency policy, guidance, engineering standards, and engineering objectives concerning agricultural engineering activities;
- evaluate, advise on, and incorporate state-of-the-art technological improvements in national agricultural programs; and
- consult on and provide expert agricultural engineering advice in implementing agency activities as a designated agency representative on a national and/or international committee.

FACTOR LEVEL DESCRIPTION

FACTOR 4 ILLUSTRATIONS

LEVEL 4-2: ARCHITECT, 0808

Nature of Assignment – Work consists of related tasks to provide exposure to practical applications of basic theories and principles of architecture.

What Needs To Be Done – To decide what needs to be done, the employee:

- drafts, sketches, or performs minor detail design of structures by hand or computer;
- computes areas and volumes and extends quantities for estimates;
- conducts office, library, and/or Internet searches for example plans and designs; and
- analyzes technical reports or manufacturers' catalogs to obtain information.

Difficulty and Originality Involved – Exercises judgment to:

- select and apply fundamental architecture concepts and techniques in conformance with accepted practices; and
- explain determinations, calculations, and findings.

[FACTOR LEVEL DESCRIPTION](#)

LEVEL 4-3: ARCHITECT, 0808

Nature of Assignment – Work consists of different, unrelated stages of projects to design and lay out renovations of structures requiring limited or routine preservation or rehabilitation work such as:

- rearranging interior space by removal of existing no-load bearing walls and installing new walls; painting exterior or interior; and
- repairing or replacing kitchen cabinets, metal siding and insulation, electrical wiring or plumbing fixtures, roofs, walls, or windows.

What Needs To Be Done – To decide what needs to be done, the employee analyzes and evaluates diverse information such as:

- data about each structure's condition, location, materials, and equipment;
- available plans and documents including previous specifications; and
- expectations and options desired by occupants and/or clients.

Difficulty and Originality Involved – Exercises judgment and creativity to:

- create and justify designs and solutions to meet most important expectations; and
- resolve problems by applying varied but standard and well-established methods and techniques.

[FACTOR LEVEL DESCRIPTION](#)

LEVEL 4-3: CIVIL ENGINEER, 0810

Nature of Assignment – Work consists of different, unrelated stages of projects involving road construction on public lands.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts preliminary surveys and site investigations to obtain baseline data on soils, topography, drainage, and existing structures and utilities;
- reviews plans and documents for similar projects; and
- prepares preliminary cost estimates to determine the most economical design to meet multiple use needs.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- identify the potential impact of the project on natural resources;
- determine the impact of changes in project scope on local recreational activities; and
- apply and adapt established techniques and methods to meet project needs.

FACTOR LEVEL DESCRIPTION

LEVEL 4-3: ENVIRONMENTAL ENGINEER, 0819

Nature of Assignment – Work consists of different, unrelated stages of projects involving conventional environmental engineering problems such as:

- improving industrial waste treatment facilities to protect receiving waters from degradation;
- sampling stack gases of industrial sources to detect type and quantity of pollutants released into the air; or
- investigating solid waste collection and disposal methods.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates design directives and site data to discern uses and special features;
- identifies chemical nature of waste or water and specific requirements such as location and size quantities;
- calculates pressures or pressure losses;
- prepares preliminary and final design analyses, drawings, quantity estimates, outlines, and project specifications;
- visits work sites to observe condition of systems, sewer main locations, water pressures, and plumbing layouts; and
- evaluates in-house and/or contracted designs and specifications by architecture and engineering firms for:
 - conformance with project requirements and budget;
 - economy, feasibility, and accuracy of design; and
 - recommendations to improve the economy.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- determine the most economical and effective solutions to meet project objectives and budget limitations;
- correlate theoretical considerations with observations, research, and calculations;
- apply precedents to new situations and problems, making minor engineering compromises to meet client expectations; and
- evaluate and advise on the work of other engineers and architects within and outside the organization.

FACTOR LEVEL DESCRIPTION

LEVEL 4-3: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)

Nature of Assignment – Work consists of varied, unrelated stages of projects providing diversified experience for future project responsibility.

What Needs To Be Done – To decide what needs to be done, the employee:

- prepares layout and detail drawings using specific instructions, notes, or sketches provided by engineering staff;
- performs calculations such as heat loss, required capacities, size of piping, and boiler size;
- searches for information on materials, equipment, and other pertinent data for developing specifications for mechanical installations;
- visits work sites to obtain information about environmental factors and conditions of existing structures;
- evaluates internal or contracted engineering and/or architectural work of minor complexity; and
- analyzes and evaluates contractor's shop drawings for adherence to contract specifications.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- decide the approach to solve relatively limited problems; and
- produce designs of mechanical systems (e.g., heating, ventilating, air conditioning, plumbing, refrigeration, sprinklers, and steam distribution) for government structures such as hospitals, office buildings, and penal institutions.

FACTOR LEVEL DESCRIPTION

LEVEL 4-3: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)

Nature of Assignment – Work consists of varied, unrelated stages of designing mechanical systems (e.g., plumbing, heating, air conditioning, sprinkler, and steam distribution) and working drawings for installing these systems in government structures.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates architectural working drawings and design commitments made to client agency;
- makes calculations and sizes the equipment, taking into consideration the facility's needs;
- assesses previous specifications, architectural plans, and building codes to gather supplementary data on which to base designs;
- visits work sites to gather information such as the condition of facilities, location of sewer mains, local water pressure, and plumbing layout;
- coordinates with structural and electrical engineers and architects to avoid interferences and ensure proper integration of systems;
- prepares preliminary and final designs of mechanical systems considering the needs of the user, space, capacities, and economy; and
- assesses shop drawings submitted by contractors to determine their conformance with agency specifications and to assess suitability of materials.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- solve problems using standard practices and techniques;
- study, evaluate, and select available reference information;
- make limited adaptations of established techniques and methods to meet the needs of the project; and
- produce designs, working drawings, and associated documentation for mechanical equipment systems.

FACTOR LEVEL DESCRIPTION

LEVEL 4-3: NUCLEAR ENGINEER, 0840

Nature of Assignment – Work consists of routine and conventional nuclear reactor plant testing on fluid, high pressure air, and electrical systems.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates procedures and specifications used to complete scheduled testing;
- inspects installation of test equipment to ensure safe performance;
- researches plans and operating manuals to determine isolation requirements for reactor plant components; and
- performs system lineup checks, observing performance data and reporting problems.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- plan, select, and carry out successive engineering steps and testing procedures; and
- resolve technical problems using standard methods by interpreting and applying precedents and experience to new situations.

FACTOR LEVEL DESCRIPTION

LEVEL 4-3: ELECTRICAL ENGINEER, 0850

Nature of Assignment – Work consists of analyzing, evaluating, designing, and advising on different, unrelated stages of the design of electrical power systems, electrical and electronic equipment, and computer operations in agency facilities.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates electrical designs and systems for facility and equipment modifications to ensure power for agency operations is uninterrupted;
- conducts site surveys, performs calculations, and observes the facility's layout for equipment and operational requirements;
- analyzes previous specifications, architectural plans, and building codes to gather supplementary data for new designs and evaluations;
- coordinates with structural and mechanical engineers and architects to ensure proper integration of systems and equipment;
- prepares and/or evaluates preliminary and final designs of electrical systems considering the needs of the user, space, capacities, and economy as well as the safety of the work environment; and
- assesses work and drawings submitted by contractors to determine their conformance with agency specifications, details, and ensures suitability of materials.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- solve problems using standard practices and techniques;
- troubleshoot maintenance problems;
- evaluate proposed modifications and new requirements for facilities and equipment;
- make limited adaptations of established techniques and methods to meet the needs of the project; and
- evaluate and produce designs, working drawings, and associated documentation for electrical and electronic equipment systems.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: LANDSCAPE ARCHITECT, 0807

Nature of Assignment – Work consists of evaluating, developing, managing, and overseeing a variety of multi-year projects (e.g., restroom facility, parking lot, trails, site and interpretive signing, and site lighting) for recreation areas.

What Needs To Be Done – To decide what needs to be done, the employee:

- examines and validates the need for the project;
- identifies the need for a survey crew to conduct a site survey;
- determines the architectural theme of the site and develops supporting design guidelines for all facilities;
- prepares preliminary cost estimates for each phase of the work to meet requirements under the National Environmental Policy Act (NEPA) and for contract development, construction, and contract administration;
- develops scheduling and funding parameters to accomplish all phases of the project such as NEPA documentation, site analysis, and facilities research;
- analyzes cultural, environmental, biological, and community concerns;
- evaluates accessibility designs to ensure compliance with current legal requirements, including Americans with Disabilities Act guidelines; and
- develops drawings and technical specifications for all parts of the project.

Difficulty and Originality Involved – Exercises judgment and creativity in:

- applying landscape architecture expertise in design areas such as:
 - interpretive services (e.g., digital photography processes used in exhibit displays);
 - accessibility requirements; and
 - new techniques and practices in the construction, fabrication, and design of facilities;
- advising regional, State, and local officials on the interpretation of agency policy, procedures, and regulations; and
- evaluating project design documents based on an understanding of construction industry standards.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: ARCHITECT, 0808

Nature of Assignment – Work consists of a number of diverse architectural projects involving design and construction of new and existing structures of varied sizes, styles, and ages, complicated by:

- obscure design criteria or architectural conflicts between agency and State or local requirements caused by complex architectural and socio-economic features; and
- conservation activities related to agency-controlled historic properties.

What Needs To Be Done – To decide what needs to be done, the employee:

- visits site locations and inspects existing properties to establish design parameters;
- assesses plans and designs submitted by regional offices, contract conservators, and architecture and engineering firms;
- evaluates documentary records (e.g., drawings and photographs) of historic fabric (e.g., paint and mortar) and project drawings and specifications; and
- conducts research on the best methods and techniques to preserve agency properties.

Difficulty and Originality Involved – Exercises judgment and creativity to:

- select, interpret, and apply guidelines, making compromises when necessary;
- coordinate the agency's building conservation programs for the assigned regions;
- advise regional, State, and local officials on the interpretation of agency policy, procedures, and regulations;
- apply standard preservation practices to new situations;
- recommend appropriate actions to correct undesirable conditions or problems involving structure, finished interior and exterior materials, mechanical and electrical systems, safety and security systems, and accessibility; and
- promote agency conservation program with local, State, and national historic organizations.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: CIVIL ENGINEER, 0810

Nature of Assignment – Work consists of planning, designing, and evaluating a variety of construction projects and engineering contractual provisions and overseeing construction projects for major recreational facilities (e.g., campgrounds, trailheads, and interpretive areas) in a national forest. Projects include complex features such as:

- difficult terrain;
- unique vegetation;
- remoteness;
- significant variations in rock and soil conditions; and
- a variety of facilities and structures (e.g., paved and gravel roads, water distribution systems, wells, water treatment facilities, waste systems, parking areas, picnic areas, and utility and restroom facilities).

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts project planning activities, including:
 - gathering site information such as site surveys, topography, and detailed soil information;
 - drawing detailed site plans and developing preliminary cost estimates; and
 - determining overall strategy for the project including scheduling, design criteria, and applicable standards;
- develops detailed design drawings and construction specifications using computer-aided design software; and
- coordinates project requirements and drawings with related engineering, architecture, and recreation offices.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- apply and adapt standard techniques and practices to new situations;
- make engineering and economic assessments of proposed design and construction projects;
- produce detailed designs, drawings, and construction documentation to complete the project; and
- advise contracting offices and contractors on the interpretation and application of contractual requirements and agency policy and regulations.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: ENVIRONMENTAL ENGINEER, 0819

Nature of Assignment – Work consists of overseeing and evaluating the adequacy of wastewater discharge permits issued by a State to control and/or reduce the amount of pollutants in discharges from factories or municipalities into the State’s navigable waters.

What Needs To Be Done – To decide what needs to be done, the employee:

- analyzes and evaluates reports, inspections, letters of inquiry or complaints, and litigation casework involving issues of compliance and corrective actions taken or contemplated by a State regulatory agency;
- inspects on-site locations to observe operations, gather facts and samples, and evaluate efficiency of equipment and practices; and
- consults with diverse interested parties (e.g., agency, State, and local officials; engineers; attorneys; congressional staff; factory managers; and community members).

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- apply and adapt standard techniques and practices to new situations;
- make engineering and economic assessments of proposed pollution control plans for new and existing factories or municipal operations; and
- advise State officials and other interested parties on interpretations and application of agency and regional policy and regulations.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)

Nature of Assignment – Work consists of evaluating and advising on mechanical engineering design projects for heating, ventilating, air conditioning, and refrigeration systems in new construction, including additions or renovations to existing hospitals, research facilities, and similar structures.

What Needs To Be Done – To decide what needs to be done, the employee:

- analyzes the design architect's working drawings and visits the site for information on building size, general layout and arrangement, and existing conditions;
- analyzes mechanical needs and makes calculations to determine types of systems most suitable to building requirements, agency specifications, and prescribed budget;
- coordinates project with other engineers and architects to ensure adequacy of features such as plumbing, lighting, power, and structures, and to ensure proper integration of the project;
- evaluates and advises on architecture and engineering plans and specifications for adequacy and feasibility;
- assesses and recommends approval of mechanical equipment, shop drawings, and associated data submitted by contractors; and
- participates in final on-site inspection to ensure conformance to contract specifications and design requirements.

Difficulty and Originality Involved – Exercises judgment and creativity to:

- adapt design criteria to projects involving different mechanical systems and equipment; and
- resolve complex problems dealing with specialized requirements for air and humidity control.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)

Nature of Assignment – Work consists of many different and unrelated processes and methods to ensure mechanical systems and equipment in buildings are constructed and installed as planned.

What Needs To Be Done – To decide what needs to be done, the employee:

- assesses contracted architecture and engineering firms' plans and specifications and recommends changes to ensure construction feasibility;
- prepares government estimates, evaluates construction contractor's proposals, and participates in negotiations with contractor regarding mechanical systems; and
- analyzes a variety of problems arising during construction.

Difficulty and Originality Involved – Exercises judgment and resourcefulness to:

- ensure mechanical systems (e.g., heating, ventilation and air-conditioning, water, sewerage, and sprinkler systems with related electrical or electronic control circuitry) are properly constructed and installed during construction of large industrial and office structures; and
- adapt and modify the original mechanical engineering design to:
 - eliminate interference between mechanization and other special features or systems in the building; and
 - schedule sequences for integrating various phases of the mechanical system work.

FACTOR LEVEL DESCRIPTION**LEVEL 4-4: NUCLEAR ENGINEER, 0840**

Nature of Assignment – Work involves performing various engineering activities for shipyard nuclear reactor refueling operations and reactor servicing programs.

What Needs To Be Done – To decide what needs to be done, the employee:

- plans and conducts radiation surveys of reactor secondary shielding;
- evaluates new or revised technical requirements for refueling operations and reactor servicing equipment; and
- monitors dockside and shipboard work activities.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- adapt and apply existing engineering theories to new nuclear reactor refueling and servicing practices;
- justify new work sequences, schedules, and costs; and
- interpret and ensure compliance with standards for performance and safe operation of nuclear power systems.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 1)

Nature of Assignment – Work consists of engineering studies and advisory services on electrical systems, equipment, and services used in the construction, repair, and maintenance of facilities such as medical centers and related support facilities.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates designs for modifications, alterations, additions, and repairs of electrical systems in facilities;
- analyzes and evaluates designs of high and low voltage electric power distribution and interior lighting systems;
- inspects electric equipment and systems to investigate and resolve malfunctions, failures, and safety problems; and
- conducts field inspections and engineering evaluations of on-going and completed electrical systems construction, repair, and maintenance work.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- devise effective and economical electrical systems and equipment;
- advise on the feasibility, design, installation, operation, maintenance, repair, and safe use of proposed and existing electrical systems, equipment, and services;
- adapt existing procedures to resolve malfunctions, failures, and safety problems identified while inspecting electrical systems and equipment at construction sites; and
- evaluate, advise on, and accept the adequacy of completed construction work involving electrical systems and equipment in facilities.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 2)

Nature of Assignment – Work consists of investigating and advising on problems and conditions affecting the safe usage of electrical systems and equipment (e.g., underground hoisting equipment) in mining operations and mines.

What Needs To Be Done – To decide what needs to be done, the employee:

- inspects electrical equipment, systems, and circuits both underground and on the surface;
- investigates disasters, fires, explosions, and fatal electrical accidents;
- analyzes problems and issues involved in the installation and use of new or existing electrical systems and equipment; and
- conducts experiments to determine the feasibility and advisability of installing new or modifying existing electrical systems and equipment.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- provide advice and assistance on the safe use of electrical systems and equipment in mines and mining operations;
- evaluate new or unusual electrical systems and equipment where traditional inspection procedures are inapplicable and safety implications are not well known; and
- investigate accidents and disasters involving malfunctioning, mishandling, or misuse of electrical systems or equipment where evidence is often destroyed and facts and data are incomplete or scanty.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: COMPUTER ENGINEER, 0854

Nature of Assignment – Work consists of integrating a variety of information systems into large wide area networks nationally and internationally for national defense purposes. This integration involves network systems management, circuit and packet switching, communications (e.g., satellite, microwave, troposcatter, fiber optics, and wire), networks, local area networks, audio and video, electromagnetic compatibility, and electromagnetic interference.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates the adequacy of facilities to accommodate electronic systems and subsystem requirements for equipment and systems used in military, national, and international networks;
- analyzes user operational requirements, assessing performance and cost trade-offs in making design recommendations; and
- evaluates in-house and contracted systems designs, interfaces, and integration work for effectiveness in resolving complex information systems engineering problems and requirements.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- provide advice on electronic information systems and equipment and their interfaces and integration into national and international networks;
- plan, advise on, and implement critical test methodology to assess conformance of systems and equipment with user requirements;
- evaluate and advise on work of other engineers and scientists within and outside the agency and in foreign governments; and
- confer on and resolve controversial problems with few precedents.

FACTOR LEVEL DESCRIPTION

LEVEL 4-4: ELECTRONICS ENGINEER, 0855

Nature of Assignment – Work consists of planning, organizing, and conducting projects to design and modify electrical circuits, circuit elements, and electronic equipment and systems for ballistic testing activities.

What Needs To Be Done – To decide what needs to be done, the employee:

- analyzes and evaluates electronic instrumentation devices to measure and acquire data associated with ballistic phenomena;
- researches the objectives of test directors or customer organizations;
- evaluates new techniques and methods in measurement devices and systems; and
- determines compatibility of alternative solutions with other instrumentation and equipment.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- adapt existing systems to measure and acquire data related to ballistic phenomena; and
- interpret and advise on the installation, feasibility, costs, and safe usage of new and modified electronic systems and equipment.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: ARCHITECT, 0808

Nature of Assignment – Work consists of projects involving the design, layout, and construction or renovation of structures featuring a number of essentially different architectural situations and problems:

- typical of large multi-story structures such as office buildings and medical or training facilities; and
- encompassing building or project sites with diverse climatic, geographic, and environmental conditions.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts investigations of project sites to determine feasibility of proposed work;
- incorporates salient features of gathered data into design considerations and solutions;
- evaluates design objectives and alternative solutions;
- produces in-house or evaluates contractors' design concepts, associated drawings, specifications and documentation, coordinating with other engineers or architects to incorporate their expertise into the design solutions; and
- analyzes and evaluates the work of other engineers or architects to ensure design concepts and solutions meet design criteria and demonstrate excellence.

Difficulty and Originality Involved – Exercises judgment, creativity, and resourcefulness to:

- solve architectural situations for which precedents are not directly applicable by adapting accepted techniques and methods, selecting or devising new approaches, or extending traditional techniques into newer approaches;
- recognize relationship of problems and conditions to those in related engineering science disciplines; and
- conceive, evaluate, and advise on a variety of designs, drawings, specifications, and supporting documents.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: CIVIL ENGINEER, 0810

Nature of Assignment – Work consists of providing civil engineering expertise to regional and area offices by advising on, explaining and interpreting, and developing standard operating procedures (SOPs) for operational and maintenance functions at agency dams and reservoirs.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates and responds to requests from regional and area offices for technical assistance in revising and updating SOPs for operating and maintenance functions at a dam and/or reservoir;
- reviews technical memoranda and previous examination reports to obtain, evaluate, and adapt latest technical information to the SOP requirements and existing dam and/or reservoir features;
- coordinates information with designers in other engineering science disciplines (e.g., mechanical and electrical) to resolve conflicting concerns and to obtain their expertise on latest developments relevant to the safe operation of the dam and/or reservoir;
- visits site to observe and determine solutions to problems encountered by operating personnel;
- solicits comments on draft SOPs from agency, regional, and area offices; and
- evaluates comments and suggestions for incorporation into the final SOP.

Difficulty and Originality Involved – Exercises judgment, creativity, and resourcefulness to:

- define, interpret, formulate, and advise on agency policy and guidance regarding operational and maintenance procedures used in its dams and/or reservoir facilities;
- evaluate new or improved engineering and operating concepts and principles in various technical publications to incorporate them into instructions and guidelines for use at agency facilities; and
- evaluate and advise on the work of other engineers and architects to resolve unusual and/or controversial issues, conditions, or conflicts involving management expectations, socio-economic concerns, and engineering practices.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: ENVIRONMENTAL ENGINEER, 0819

Nature of Assignment – Work consists of providing regional program oversight and engineering advisory services to engineers in other Federal, State, and local government offices and engineers and representatives of industries, municipalities, and agricultural concerns; and to identify and resolve especially critical problems for water quality programs and control of effluents in wastewater processes and discharges.

What Needs To Be Done – To decide what needs to be done, the employee:

- analyzes a wide range of complex, difficult, or sensitive problems concerning water quality programs; effective effluent treatment methods; and water pollution control techniques involving industries, municipalities, and agricultural concerns;
- consults with agency officials and engineering personnel, State and local government officials, congressional offices, corporate and legal staffs of industries and manufacturers, consultant engineers, agricultural entities, and the general public;
- plans and conducts studies of Federal and State water quality programs to advise on alternatives to contain environmental costs;
- conducts on-site visits to analyze leakage or spillage conditions; determines adequacy of treatment and control processes; and assesses the need for additional control modifications or equipment;
- initiates, conducts, and/or directs engineering studies by regional staff, other agency offices, and laboratories; and
- analyzes, investigates, and responds to alleged violation complaints from State officials, engineering consultants, congressional contacts, and the general public.

Difficulty and Originality Involved – Exercises judgment, creativity, and resourcefulness to:

- resolve critical problems concerning unconventional aspects of environmental engineering;
- deal with diverse industries, municipalities, and agricultural entities having conflicting interests and using different production processes (e.g., petrochemical, steel, food, and photochemical processing);
- correlate theoretical considerations in related engineering science disciplines with environmental engineering experience to devise, advise on, and negotiate engineering compromises; and
- apply latest technological advances in wastewater treatment.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)

Nature of Assignment – Work consists of developing one-of-a-kind or prototype designs for large hydraulic gates for existing dams to control the release of water from the reservoir.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates and provides advice on design objectives;
- determines the number and size of gates required at the facility;
- researches previous designs for incorporating salient factors into design considerations and solutions;
- determines types of materials to be used in each gate and physical dimensions necessary to ensure safe and optimum operation of the gates;
- performs calculations to determine the sizes and placement of the steel members of each gate;
- develops a set of drawings to illustrate in complete detail each gate design for use in the manufacturing process;
- prepares specifications and associated documentation necessary for the acquisition process;
- arranges for or conducts factory inspection and acceptance of the manufacture of the gates; and
- conducts or participates in the testing and final acceptance of the gate installation process.

Difficulty and Originality Involved – Exercises judgment, creativity, and resourcefulness to:

- produce new designs, design modifications, and requirements definitions by investigating the strengths and weaknesses of prior designs of similar gates;
- extend traditional design and engineering techniques or develop new ones to solve complex problems where established design criteria and precedents are inconsistent with project objectives;
- identify viable design solutions and select those meeting project objectives, minimizing costs, and facilitating the ease of manufacture, maintenance, and installing without compromising design and engineering principles; and
- analyze, evaluate, and advise on:
 - designs, design plans, specifications, and engineering evaluations performed by others;
 - in-house or contractor performance and progress in constructing and installing mechanical systems; and
 - performance problems with complex, large-scale mechanical systems and associated equipment.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)

Nature of Assignment – Work consists of simultaneously handling several major mechanical engineering projects such as:

- designing marine floating structures or dredging equipment; and
- developing in-house designs and/or evaluating designs from contractors to repair and improve existing mechanical systems and equipment aboard these structures; and for the design of new mechanical systems and equipment.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts studies to determine design solutions to unusual operating requirements or problems;
- performs, analyzes, and evaluates complex calculations;
- analyzes and evaluates designs and proposals submitted by others;
- consults with client agency officials, contractors, and equipment manufacturers and suppliers; and
- formulates test programs and operating procedures for mechanical machinery and equipment.

Difficulty and Originality Involved – Exercises judgment, creativity, and resourcefulness to:

- advise on innovations involving specialized dredging equipment for marine floating structures;
- devise new or improved techniques, applications, and methods;
- overcome difficult and unusual problems where precedents are not directly applicable; and
- apply latest technological advances relating to specialized dredging equipment and floating marine structures.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: NUCLEAR ENGINEER, 0840

Nature of Assignment – Work consists of duties to ensure the safe and proper operation of interrelated mechanical, electrical, and electronic systems in the high temperature, high pressure, and high radiation environment of a nuclear reactor plant at a shipyard.

What Needs To Be Done – To decide what needs to be done, the employee:

- assesses available information to determine reactor plant status at the start of the work shift;
- evaluates all requests to perform maintenance, repair, or overhaul work on reactor plant components;
- executes dry-run procedures and assesses unexpected responses;
- analyzes, evaluates, and corrects errors in operational changes or test procedures;
- provides final approval for commencement of the operational change or test;
- executes and verifies the performance of rigorous and exacting operational procedures;
- assesses expected plant responses against real-time data; and
- evaluates unpredicted responses and formulates corrective actions.

Difficulty and Originality Involved – Exercises judgment, ingenuity, and resourcefulness to:

- evaluate, authorize, and direct test procedures or operational changes to the plant;
- advise ship command personnel, shipyard offices, and other engineering offices on technical decisions and determinations; and
- decide on and direct cancellation of any test when safe operation of the reactor plant is at risk.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: ELECTRICAL ENGINEER, 0850

Nature of Assignment – Work consists of analyzing, evaluating, and providing electrical advisory services on existing and proposed power systems and the electrical power grid for an agency and its clientele.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts studies (e.g., fault, harmonic, stability, power flow, and transient and sub-transient reaction studies) of power systems and power and transmission planning activities;
- evaluates the performance and effectiveness of the agency's power systems, its power and transmission planning, and its protective relaying systems, recommending future direction of the program and the incorporation of new technology and technological advances in current and future designs and plans;
- investigates and evaluates electrical system failures, needs, and conditions; and
- prepares engineering papers, reports, designs, and drawings to document studies and test results.

Difficulty and Originality Involved – Exercises judgment, ingenuity, and resourcefulness to:

- analyze, evaluate, and provide expert advice on:
 - policy, guidance materials, and planning activities for power and transmission systems, protective relay systems, and related programs;
 - new power system technology and improved systems, equipment, materials, and techniques; and
 - devising and using computer modeling strategies in power system studies;
- evaluate and ensure the agency's power systems comply with legislative and regulatory requirements, nationally recognized standards and codes, industry practices, and power availability criteria; and
- resolve electrical power system and equipment failures, conditions, and problems when guidelines and precedents are often absent or obscure.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: COMPUTER ENGINEER, 0854 (ILLUSTRATION 1)

Nature of Assignment – Work consists of analyzing, evaluating, and providing advisory services on the use of control systems, automation systems, computer engineering systems, and software engineering applications for hydroelectric power plants.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts studies of power plant automation, multi-tasking real-time operating systems, and software applications for the operation of hydroelectric power plants;
- evaluates, develops, and designs real-time control systems and related software applications using modern automation methods and standards, data communications standards, control system theory, electronic circuit design, computer languages, hardware and software development tools, and computer industry practices; and
- prepares engineering papers, reports, designs, and drawings to document studies and test results.

Difficulty and Originality Involved – Exercises judgment, ingenuity, and resourcefulness to:

- evaluate, devise, and advise on control systems and computer automation systems used in hydroelectric power plants; and
- investigate, evaluate, and resolve computer system issues and concerns for hydroelectric power plants when guidelines and precedents are often absent or obscure; and conflicting engineering interests have to be coordinated and considered in integrating system requirements.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: COMPUTER ENGINEER, 0854 (ILLUSTRATION 2)

Nature of Assignment – Work consists of projects and expert consulting and advisory services on unusual and/or controversial systems, engineering problems, and conditions involving integration of a broad range of existing and proposed information systems with national and international electronic networks for national defense purposes. Integration efforts involve specialized fields such as network system management, command and control centers, office automation, switching (e.g., circuit and packet), communications (e.g., satellite, microwave, troposcatter, fiber optics, and wire), networks (e.g., local area networks and wide area networks), audio and video, electromagnetic compatibility, and electromagnetic interference.

What Needs To Be Done – To decide what needs to be done, the employee:

- evaluates a wide range of problems in the development, deployment, and improvement of information systems, networks, equipment, and hardware and software applications;
- identifies advances in telecommunication and automation technologies, state-of-the-art equipment, and applications for incorporation into existing and proposed electronic information systems;
- evaluates in-house and contracted systems designs, interfaces, and integration work for effectiveness in resolving complex information systems and engineering requirements; and
- directs and/or conducts studies on cost, interoperability, industry trends, performance, reliability, and functionality of systems and networks.

Difficulty and Originality Involved – Exercises judgment, ingenuity, and resourcefulness to:

- advise on efforts to establish, maintain, and improve existing and proposed information systems and networks and their operational capability, interoperability, efficiency, and effectiveness;
- evaluate and advise on the quality and adequacy of work of other engineers and scientists within and outside the agency and in foreign governments;
- conceive, evaluate, and develop new approaches and techniques for integration and interface requirements involving legacy and future systems and equipment; and
- provide advice on novel, controversial, and/or far-reaching issues entailing conflicting or incomplete data.

FACTOR LEVEL DESCRIPTION

LEVEL 4-5: ELECTRONICS ENGINEER, 0855

Nature of Assignment – Work consists of providing electronics engineering advisory services and project engineering management activities for test and demonstration studies involving systems engineering and integrated analytical strategies to assess systems, subsystems, and equipment (including interface formats and interoperability programs) in existing and proposed ballistic missile technology advancements.

What Needs To Be Done – To decide what needs to be done, the employee:

- confers on methods such as modeling, simulation and testing, complex mission analyses, system requirements analysis, and advanced design syntheses and analysis;
- prepares and produces project and acquisition documentation, test and demonstration plans, engineering reports, budget estimates and schedules, interagency support agreements, and correspondence;
- evaluates qualitative, quantitative, and time-sequenced engineering support requirements from technical support agencies, testing agencies, installation agencies, and contractors; and
- evaluates and advises on the adequacy and accuracy of contractor reports, analyses, simulations, and tests.

Difficulty and Originality Involved – Exercises judgment and ingenuity to:

- assess and validate ballistic missile technology proposals involving moderately complex electronic systems, subsystems, and equipment to be tested, demonstrated, and evaluated using systems engineering and integrated analytical strategies;
- resolve unique obstacles and/or unprecedented engineering management problems involving:
 - differing views of other engineers and scientists within and outside the agency or in foreign governments;
 - scheduling and funding issues; and
 - conflicting priorities and requirements of diverse interested parties; and
- ensure systems engineering integration and analysis processes are accomplished, comply with contractual requirements, and provide adequate information to assess the validity and feasibility of the proposals.

FACTOR LEVEL DESCRIPTION

LEVEL 4-6: LANDSCAPE ARCHITECT, 0807

Nature of Assignment – Work consists of providing advice to resolve a broad range of complex interrelated landscape architecture, engineering, architecture, and environmental issues and developing policies, standards, and programs for designing, constructing, improving, and maintaining defense and military installations throughout the world.

What Needs To Be Done – To decide what needs to be done, the employee:

- assesses proposals for constructing, improving, and maintaining defense and military installations and facilities;
- evaluates economic feasibility and the impact of proposals on historic preservation, environmental conservation, and cultural concerns;
- conceives and manages studies, plans, and programs involving landscape architecture, architecture, site planning and design, historic preservation, and interior design for a broad range of military and special-use facilities located worldwide;
- provides policy guidance and develops technical manuals, uniform standards, and design criteria to achieve aesthetic, cost-effective, durable, and functional facilities for defense and military use; and
- confers with senior agency offices and officials in other defense agencies, Congress, and other Federal agencies, to exchange and furnish technical expertise.

Difficulty and Originality Involved – Exercises judgment, creativity, foresight, and originality to:

- identify new and/or refine existing methods, concepts, and strategies for military and defense facilities for use in peacetime, emergency, or mobilization situations;
- develop policy guidance and uniform standards and procedures for landscape architecture design criteria and construction activities for defense and military facilities in worldwide locations; and
- provide expert opinions and advice on design and construction programs:
 - involving highly controversial issues;
 - having intense public interest and visibility;
 - in response to new legislative activities; or
 - driven by severe economic restraints.

FACTOR LEVEL DESCRIPTION

LEVEL 4-6: ARCHITECT, 0808

Nature of Assignment – Work consists of providing consultative and advisory services and project management for large state-of-the-art healthcare facility design and construction projects.

What Needs To Be Done – To decide what needs to be done, the employee:

- assesses requirements for health, safety, and security in existing and new complex state-of-the-art medical and research facilities;
- identifies new technologies, processes, and systems for constructing, improving, and maintaining medical research and clinical facilities; and
- conceives, plans, and implements new design approaches for a multi-year major facility design and construction project involving a multimillion dollar renovation of existing research and biomedical facilities.

Difficulty and Originality Involved – Exercises judgment, creativity, foresight, and originality to:

- explore, evaluate, and incorporate technological advances into the design of aesthetic, cost-effective, durable facilities to support medical and research activities;
- establish concepts, theories, and multi-dimensional approaches to resolve unyielding problems for which traditional methods are neither applicable nor easily adaptable;
- develop policy guidance and uniform standards and procedures for design criteria for the construction of medical and research facilities; and
- provide authoritative opinions and advice on design and construction projects.

FACTOR LEVEL DESCRIPTION

LEVEL 4-6: CIVIL ENGINEER (STRUCTURAL), 0810

Nature of Assignment – Work consists of formulating agency policy and guidance for improving the structural design, construction, rehabilitation, and operation of bridges, tunnels, and related structures.

What Needs To Be Done – To decide what needs to be done, the employee:

- explores, evaluates, and incorporates technological advances to resolve major, unusual, unprecedented, and complex problems affecting the adequacy, reliability, security, and safety of these structures;
- evaluates new standards, practices, and techniques for bridge and tunnel design, fabrication, inspection, rehabilitation, and construction; and
- coordinates and directs agency efforts in bridge and tunnel design, fabrication, and construction to:
 - improve the economy, durability, and safety of these structures; and
 - accommodate extreme events such as earthquakes, hurricanes, and bridge and ship collisions.

Difficulty and Originality Involved – Exercises judgment, creativity, foresight, and originality to:

- provide policy guidance for, and advice on, the design, fabrication, materials used, and construction of existing and proposed bridges, tunnels, and related structures worldwide;
- advise on and resolve unusual problems and conditions affecting the reliability, safety, and performance of bridges, tunnels, and their related structures; and
- provide authoritative advice to national and international engineering experts and renowned scientists on solutions to unyielding problems.

FACTOR LEVEL DESCRIPTION

LEVEL 4-6: ENVIRONMENTAL ENGINEER, 0819

Nature of Assignment – Work consists of developing a nationwide program for using solid waste to generate various energy forms (e.g., gaseous, liquid, solid fuel, steam, and electricity) and for recycling paper, magnetic materials, aluminum, glass, and other materials into new products.

What Needs To Be Done – To decide what needs to be done, the employee:

- conducts extensive research into the environmental impact of current recycling programs;
- assesses technologies, processes, systems, and components proposed for or used in energy recovery and recycling programs; and
- coordinates energy recovery and recycling programs with related activities of other government agencies to promote mutual cooperation.

Difficulty and Originality Involved – Exercises judgment, creativity, foresight, and originality to:

- develop new energy recovery and recycling strategies to resolve unprecedented program challenges;
- propose legislation, regulatory changes, and other solutions to ensure successful implementation; and
- provide expert opinions and advice on the design and construction of energy recovery systems.

FACTOR LEVEL DESCRIPTION

LEVEL 4-6: NUCLEAR ENGINEER, 0840

Nature of Assignment – Work consists of providing advisory services involving:

- developing and testing major nuclear reactors and reactor plant components;
- identifying, evaluating, and resolving complex problems impacting the success of nuclear systems; and
- improving the performance, reliability, safety, and cost-effectiveness of nuclear reactors nationwide.

What Needs To Be Done – To decide what needs to be done, the employee:

- plans, develops, evaluates, and advises on nuclear component development programs for liquid metal heat exchangers and steam generators, reactor core support and restraint, radioactive gas seals, and fuel handling equipments;
- assesses the performance and reliability of reactor plant components and their integration into nuclear plant systems; and
- oversees, advises on, and directs the design, development, and testing programs in national laboratories and with industrial contractors for major reactors and reactor plant components.

Difficulty and Originality Involved – Exercises judgment, creativity, foresight, and originality to:

- independently evaluate existing and proposed programs for nuclear reactor systems;
- resolve unusual and controversial problems which have little or no precedents;
- initiate new directions and program efforts; and
- advance or extend the knowledge of nuclear reactor systems.

FACTOR LEVEL DESCRIPTION

FACTOR 5 ILLUSTRATIONS

LEVEL 5-1: MECHANICAL ENGINEER, 0830

Scope of the Work – Work involves preparing routine engineering designs, layouts, and detail drawings.

Effect of the Work – Work results affect the work of more experienced engineers within the organization by reducing their involvement in routine work.

[FACTOR LEVEL DESCRIPTION](#)

LEVEL 5-2: ENVIRONMENTAL ENGINEER, 0819

Scope of the Work – Work involves serving on a regional office staff of a regulatory or enforcement agency:

- monitoring the adequacy of a State’s wastewater discharge permit program; and
- advising State officials on the agency’s regional policy and regulations.

Effect of the Work – Work results affect the:

- timeliness and accuracy of assessments of State pollution control plans; and
- success of the regional office in overseeing compliance with established standards.

[FACTOR LEVEL DESCRIPTION](#)

LEVEL 5-2: NUCLEAR ENGINEER, 0840

Scope of the Work – Work involves performing nuclear engineering tasks using standard equipment and procedures to conduct basic tests, prepare instructions, and review test results in support of nuclear engineering projects.

Effect of the Work – Work results affect the accuracy and reliability of nuclear reactor propulsion plant tests conducted by higher-graded engineers.

[FACTOR LEVEL DESCRIPTION](#)

LEVEL 5-3: ARCHITECT, 0808

Scope of the Work – Work involves a variety of conventional design, renovation, and maintenance projects for structures located on government installations.

Effect of the Work – Work results affect the efficiency, economy, safety, adequacy, and aesthetics of buildings.

FACTOR LEVEL DESCRIPTION**LEVEL 5-3: ENVIRONMENTAL ENGINEER, 0819**

Scope of the Work – Work involves designing improvements to existing construction for waste treatment facilities, pumping stations, and sanitary sewer systems, and water supply, distribution, and storage facilities on government installations.

Effect of the Work – Work results affect the:

- safety, economy, and efficiency of these facilities and systems;
- safety and welfare of the community receiving these services;
- work of other engineers and architects within the unit; and
- success of the organization in meeting client requirements.

FACTOR LEVEL DESCRIPTION**LEVEL 5-3: MECHANICAL ENGINEER, 0830**

Scope of the Work – Work involves preparing engineering designs, layouts, and detail drawings for mechanical equipment systems in government structures and includes resolving limited design problems occurring in additions and renovations to existing and new construction.

Effect of the Work – Work results affect the:

- capability of the organization to meet its design and construction program objectives; and
- safety, economy, efficiency, types, and sizes of mechanical systems and equipment to be installed.

FACTOR LEVEL DESCRIPTION**LEVEL 5-3: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 1)**

Scope of the Work – Work involves routine testing projects on nuclear reactor plants for naval ships.

Effect of the Work – Work results affect the safety, economy, efficiency, types, and sizes of nuclear reactor systems and equipment to be installed on naval ships.

FACTOR LEVEL DESCRIPTION

LEVEL 5-3: NUCLEAR ENGINEER, 0840 (ILLUSTRATION 2)

Scope of the Work – Work consists of routine engineering projects for a shipyard nuclear reactor servicing program and its refueling operations and safety procedures.

Effect of the Work – Work results affect the:

- safety and efficiency of the reactor overhaul work conducted in a shipyard and aboard ships; and
- performance and safe operation of nuclear reactor plants on marine structures.

FACTOR LEVEL DESCRIPTION**LEVEL 5-3: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 1)**

Scope of the Work – Work consists of routine electrical systems studies and advisory services associated with construction, repair, and maintenance of facilities such as medical centers or utilities.

Effect of the Work – Work results affect the:

- efficiency, cost, and performance requirements for electrical systems and equipment in serviced facilities; and
- adequacy and adaptability of new and existing electrical equipment and systems for current and future needs.

FACTOR LEVEL DESCRIPTION**LEVEL 5-3: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 2)**

Scope of the Work – Work consists of routine studies and advisory services for maintaining, improving, and repairing electrical power systems for agency facilities, equipment, electronic systems, and computer operations running on an uninterrupted schedule of 24-hours/7-days a week.

Effect of the Work – Work results affect the:

- reliable delivery of electrical power to agency facilities and their electrical and electronic systems and equipment;
- capability and reliability of agency computer operations to process data and information;
- safe operation of facilities and equipment operated by the agency; and
- delivery of information, monetary payments, and other services to the general public.

FACTOR LEVEL DESCRIPTION

LEVEL 5-4: LANDSCAPE ARCHITECT, 0807**Scope of the Work** – Work involves:

- architectural review, oversight, and guidance on designs, interpretations, practices, and recommendations of other engineers, landscape architects, and technicians;
- coordination among internal and external government agencies such as the State offices for transportation and recreation activities, the Federal Highway Administration, local county planning offices, and diverse field and regional offices within the agency; and
- resolving a variety of unusual landscape issues arising during the development, oversight, and post-evaluation phases of construction contracts.

Effect of the Work – Work results affect the:

- safety, attractiveness, and availability of facilities and services in parks and recreational areas for large geographic regions; and
- public's enjoyment of interpretive and recreation activities.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: ARCHITECT, 0808 (ILLUSTRATION 1)**

Scope of the Work – Work involves advising on, reviewing, evaluating, and coordinating the conservation activities of agency-controlled historic properties.

Effect of the Work – Work results affect the:

- conservation, preservation, and recreation activities within a region;
- work of other architects, engineers, and contracted personnel;
- agency's historic conservation program accomplishments; and
- efficiency, economy, safety, adequacy, and aesthetics of historic buildings.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: ARCHITECT, 0808 (ILLUSTRATION 2)**

Scope of the Work – Work involves architectural consultation and advisory services for a design and construction organization in developing studies, plans, and design criteria for repairs and alterations of structures (e.g., office buildings, warehouses, parking facilities, border stations, historic buildings, courts, and customs facilities).

Effect of the Work – Work results affect the:

- work of other architects and engineers within the agency and private architecture and engineering firms;
- project design and construction methods, materials, progress, costs, and other features; and
- efficiency, economy, safety, adequacy, and aesthetics of structures.

FACTOR LEVEL DESCRIPTION

LEVEL 5-4: CIVIL ENGINEER, 0810 (ILLUSTRATION 1)

Scope of the Work – Work involves performing project engineering functions and engineering advisory services for a broad range of public works projects associated with large water structures (e.g., dams, reservoirs, levees, water towers, and pools) and their construction, operations, and maintenance.

Effect of the Work – Work results affect the:

- adequacy, costs, scheduling, budgeting, safety, and completion of civil engineering work performed in-house or by contract; and
- successful operation of the organization’s public works program.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: CIVIL ENGINEER, 0810 (ILLUSTRATION 2)**

Scope of the Work – Work involves performing project engineering functions and engineering advisory services concerning the operation and maintenance of facilities and public works functions, maintenance service contracts, commercial activity analyses, and/or facilities support contracts.

Effect of the Work – Work results affect the:

- performance, cost, and effectiveness of agency public works functions and facilities;
- safety and working conditions of agency and contractor personnel; and
- quality, cost, and reliability of contracted work performed on agency facilities.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 1)**

Scope of the Work – Work involves:

- providing consultative and advisory services; and
- developing and implementing plans and designs for constructing different kinds of municipal secondary wastewater treatment facilities in areas where there are problems with controlling the water quality.

Effect of the Work – Work results affect the:

- State’s water quality programs;
- safety and quality of life of the residents within and around the affected municipalities;
- alteration and modernization of existing wastewater treatment facilities; and
- conservation and protection of natural resources exposed to the ecological and environmental impacts of wastewater treatment facilities.

FACTOR LEVEL DESCRIPTION

LEVEL 5-4: ENVIRONMENTAL ENGINEER, 0819 (ILLUSTRATION 2)

Scope of the Work – Work involves providing oversight, evaluation, and advisory services to a program responsible for controlling and resolving air pollution problems caused by large industrial stationary sources.

Effect of the Work – Work results affect the:

- adequacy of controls to reduce pollutants in the ambient air and protect public health and welfare;
- possible litigation against major industrial entities for noncompliance with regulatory requirements;
- economic viability and production processes of major industrial and manufacturing entities;
- living and working conditions of the residents in a particular area, State, or region; and
- agency’s nationwide stationary source air enforcement program.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)**

Scope of the Work – Work involves developing engineering designs and advising on design and contract proposals for different kinds of new mechanical systems and equipment for use in government facilities such as multi-story office buildings, steam plants, and hospitals.

Effect of the Work – Work results affect the:

- safety, economy, efficiency, and operations of government facilities;
- work of other engineers, architects, and contractors; and
- accomplishment of a wide range of agency construction projects.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)**

Scope of the Work – Work involves serving as a technical advisor in a regional engineering office overseeing, planning, directing, and coordinating a broad range of highly specialized mechanical engineering activities for a variety of civil works and agency construction projects.

Effect of the Work – Work results affect the:

- efficiency and effectiveness of mechanical engineering systems, equipment, and features used in government structures and projects;
- work of other engineers, architects, contract architecture and engineering firms, manufacturers, and construction contractors; and
- accomplishment of agency construction projects and objectives for mechanical engineering functions.

FACTOR LEVEL DESCRIPTION

LEVEL 5-4: NUCLEAR ENGINEER, 0840

Scope of the Work – Work involves developing exacting work instructions and procedures for the overhaul, testing, repair, and modification of nuclear components and systems (e.g., electrical, fluid, and mechanical) in naval surface ships, submarines, and shipyard shop work areas.

Effect of the Work – Work results affect the:

- health and safety of personnel in the shipyard and aboard naval vessels;
- safety, cost, and performance of the nuclear power plant and its equipment; and
- ship readiness.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: ELECTRICAL ENGINEER, 0850**

Scope of the Work – Work involves advising other professionals on the design and inspection of work performed on electrical systems and equipment (e.g., elevators, surveillance systems, and middle and low voltage electrical distribution systems) involved in construction projects on a large variety of existing and proposed facilities.

Effect of the Work – Work results affect the:

- quality of life, safety, and work of personnel in the facilities;
- safe operation, cost, and performance of the systems and equipment; and
- operations of other agencies.

FACTOR LEVEL DESCRIPTION**LEVEL 5-4: ELECTRONICS ENGINEER, 0855**

Scope of the Work – Work involves:

- designing, developing, and assessing electronic flight systems for experimental and demonstration evaluation in complex, highly integrated research flight vehicles; and
- modifying and integrating these flight systems components, subsystems, equipment, and test facilities to conduct extensive experiments and comprehensive evaluations.

Effect of the Work – Work results affect the:

- performance and conduct of tests, experiments, and demonstrations of electronic flight systems;
- determination of critical safety-of-flight parameters;
- cancellation or continuation of flight tests and demonstrations;
- safety, cost, and performance of new or modified flight systems; and
- safety of pilots and ground personnel involved in research flight evaluations.

FACTOR LEVEL DESCRIPTION

LEVEL 5-5: ARCHITECT, 0808

Scope of the Work – Work involves exercising approval authority and providing expert advisory services for the technological and economic feasibility of new and improved processes, systems, and equipment for use in the design and construction of new-generation hospitals and related structures.

Effect of the Work – Work results affect the:

- agency-wide policy for, and developments in, the design and construction of medical facilities;
- direction and scope of design studies conducted in-house and under contract to derive new functional designs; and
- work of other engineers, architects, scientists, and subject-matter experts within and outside the Federal Government.

FACTOR LEVEL DESCRIPTION**LEVEL 5-5: CIVIL ENGINEER, 0810**

Scope of the Work – Work involves providing expert engineering advice to solve critical problems in the remediation and cleanup of agency properties contaminated with hazardous materials.

Effect of the Work – Work results affect the:

- day-to-day activities of a project, including its safety, methods and practices, materials, progress, and costs;
- quality of life and safety of a substantial number of people;
- work of other engineers, architects, scientists, and subject-matter experts within and outside the Federal Government; and
- successful completion of agency's objectives to remediate and clean up contaminated properties (e.g., facilities, land, water, and utilities) in compliance with Federal legislation and policy.

FACTOR LEVEL DESCRIPTION

LEVEL 5-5: ENVIRONMENTAL ENGINEER, 0819

Scope of the Work – Work involves providing regional expertise through advisory services and policy guidance on regulatory and enforcement issues concerning highly complex construction projects for industrial, municipal, or agricultural wastewater treatment processes.

Effect of the Work – Work results affect the:

- integrity and adequacy of wastewater treatment processes and facilities in large metropolitan areas, industrial parks, and/or adjacent rural and urban communities;
- work and objectives of diverse interested parties such as agency engineering personnel; other Federal, State, and local government offices; environmental programs; industries; manufacturers; construction contractors; and vendors;
- quality of life, public safety, and conservation and protection of natural resources; and
- acceptance and understanding of the role, policy, and regulations of the agency and its regional offices.

FACTOR LEVEL DESCRIPTION

LEVEL 5-5: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 1)

Scope of the Work – Work involves providing advisory services and policy guidance on new and existing mechanical systems, equipment, and materials for government structures, including issuing technical publications and guidelines.

Effect of the Work – Work results affect the:

- nationwide work of agency mechanical engineers and architects;
- agency construction programs and mechanical engineering activities in other Federal agencies, manufacturing and industry, contract architecture and engineering firms, and construction organizations; and
- advancement and improvement of mechanical engineering design, systems, equipment, and materials.

FACTOR LEVEL DESCRIPTION

LEVEL 5-5: MECHANICAL ENGINEER, 0830 (ILLUSTRATION 2)

Scope of the Work – Work involves investigating, evaluating, and providing expertise and engineering advisory services on mechanical engineering aspects of an agency’s construction program for different kinds of facilities with unusual dimensions, complex features, and varying environmental conditions such as tropical and arctic climates. The agency’s construction program includes clients from other agencies and military facilities.

Effect of the Work – Work results affect the:

- work of other engineers and architects within and outside the agency, construction contractors, manufacturers, and suppliers;
- advancement and improvement of mechanical engineering activities and construction work performed for the agency and client agencies; and
- accomplishment of the agency’s construction program mission.

FACTOR LEVEL DESCRIPTION**LEVEL 5-5: NUCLEAR ENGINEER, 0840**

Scope of the Work – Work involves evaluating technological advances affecting nuclear policy issues and providing expert engineering advisory services on the overall direction of and integrated program planning for existing and proposed nuclear systems, power, fuel, facilities, and their associated devices, services, and uses.

Effect of the Work – Work results affect the:

- work of other engineers and scientists in Federal agencies, State and local governments, academia, and private industry; and
- agency goals and national defense activities.

FACTOR LEVEL DESCRIPTION**LEVEL 5-5: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 1)**

Scope of the Work – Work involves assessing, inspecting, and improving work performed on electrical and electronic systems and equipment involved in construction and modification of facilities across a large geographic area covering several States, island territories, or foreign countries. Systems and equipment include middle and low voltage electrical distribution systems, illumination systems, communication facilities, petroleum distribution and handling facilities, family housing and schools, central utility plants, treatment facilities, medical facilities, surveillance systems, and fire alarm systems.

Effect of the Work – Work results affect the:

- health, safety, and work of personnel in the facilities;
- design, safety, cost, and performance of electrical systems and equipment;
- work of engineers and architects within and outside the agency; and
- ability of the agency to meet its mission.

FACTOR LEVEL DESCRIPTION

LEVEL 5-5: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 2)

Scope of the Work – Work involves providing electrical engineering authoritative expertise for an agency’s nationwide program on safety in:

- elimination, control, or minimization of electrical hazards in the workplace; and
- operation and maintenance of electrical systems, equipment, and materials associated with the transmission, generation, distribution, and use of energy.

Effect of the Work – Work results affect the:

- health, safety, and work of personnel in the workplace;
- design, safety, and work practices for operating and maintaining electrical systems, equipment, and materials;
- work of other engineers and scientists within and outside the agency, manufacturers, and other Federal and State government offices;
- development and incorporation of advancements in electrical engineering designs, systems, equipment, and materials; and
- ability of the agency to meet its mission.

FACTOR LEVEL DESCRIPTION**LEVEL 5-5: ELECTRICAL ENGINEER, 0850 (ILLUSTRATION 3)**

Scope of the Work – Work involves serving as an agency’s electrical engineering authoritative expert in the areas of:

- power and transmission planning;
- power system studies;
- compliance with legislative and regulatory requirements related to power transport; and
- design criteria for electrical facilities, systems, and equipment.

Effect of the Work – Work results affect the:

- reliability of the national power grid;
- availability of electrical power for use by the agency and its outside clientele;
- agency’s compliance with legislative and regulatory requirements;
- safety of the general public and employees of the agency;
- work of other engineers, architects, and scientists within and outside the agency;
- development and incorporation of advancements in electrical and electronic engineering designs, systems, equipment, and materials; and
- ability of the agency to accomplish its mission.

FACTOR LEVEL DESCRIPTION

LEVEL 5-6: ARCHITECT, 0808

Scope of the Work – Work involves managing projects and providing authoritative architectural, construction, and design expertise for the design, fabrication, construction, and renovation of complex large-scale medical and research facilities.

Effect of the Work – Work results affect the:

- current and proposed architectural research and planning efforts and advances concerned with the design and construction of facilities for healthcare delivery services and biomedical research;
- aesthetics, structural integrity, usage, and durability of these structures as well as their costs, safety, and security;
- safety and well-being of occupants, visitors, and nearby communities and environments;
- national and international design and construction policies and standards for medical, clinical, and research facilities; and
- success of the agency by ensuring the quality and adequacy of facilities to support the conduct of unique biomedical research and the delivery of nationally and internationally recognized healthcare services.

FACTOR LEVEL DESCRIPTION**LEVEL 5-6: CIVIL ENGINEER (STRUCTURAL), 0810**

Scope of the Work – Work involves consulting and providing civil engineering expertise and advisory services to agency officials and clientele worldwide on the design, fabrication, construction, and rehabilitation of bridges, tunnels, and related structures.

Effect of the Work – Work results affect the:

- current and proposed research efforts and advances in various technologies concerned with bridge and tunnel design, fabrication, construction, and rehabilitation;
- structural integrity and durability of these structures as well as their costs, safety, and security;
- existing knowledge and understanding of bridge and tunnel structures, their materials, and underlying theoretical concepts;
- safety and well-being of travelers, vehicles, and nearby communities and environments; and
- availability of viable transportation venues for the nation.

FACTOR LEVEL DESCRIPTION

LEVEL 5-6: MECHANICAL ENGINEER, 0830

Scope of the Work – Work involves providing mechanical engineering expertise and advisory services for the design, construction, installation, and operation of mechanical, energy, and environmental systems in facilities for scientific and biomedical research and healthcare delivery.

Effect of the Work – Work results affect the:

- successful performance of research, biomedical, and healthcare missions of the agency;
- development and issuance of national and international design standards for mechanical, energy, and environmental systems in research, biomedical, and healthcare facilities;
- long-range and continuing plans for projects involving construction, repair, renovation, and improvement of agency research, biomedical, and healthcare facilities; and
- safety, health, and security of facility employees and clients.

FACTOR LEVEL DESCRIPTION**LEVEL 5-6: NUCLEAR ENGINEER, 0840**

Scope of the Work – Work involves providing nuclear engineering expertise and advisory services for a broad program for the development and testing of major nuclear reactor and reactor plant components.

Effect of the Work – Work results affect the:

- performance, reliability, safety and cost-effectiveness of future national energy solutions; and
- vital national defense issues and conditions including institutional arrangements among Federal, State, and local governments.

FACTOR LEVEL DESCRIPTION**LEVEL 5-6: ELECTRICAL ENGINEER, 0850**

Scope of the Work – Work involves interpreting, influencing, and promulgating policy and guidance for planning, designing, and constructing:

- defense agency facilities worldwide, including airfield and/or aviation structures; and
- a full range of electrical systems, equipment, materials, and design criteria.

Effect of the Work – Work results affect the:

- agency's engineering policy, standards, and guidance for designing, installing, and operating electrical power systems, equipment, and materials in facilities located worldwide;
- existing and future construction and design projects for defense activities;
- quality of life, safety, and security of the general public; and
- successful accomplishment of national defense missions.

FACTOR LEVEL DESCRIPTION

PART III

Part III describes the development of this job family standard (JFS) and addresses concerns expressed by reviewing agencies.

KEY DATES AND MILESTONES

In 1999, the U.S. Office of Personnel Management (OPM) notified agencies of a project to develop a JFS for professional engineering work. Between 1999 and 2002, we collected information from 15 agencies and visited more than 50 worksites. In early 2002, to conform to a decision limiting the annual release of standards to reduce the burden on agencies, we deferred work on the project.

In February 2008, after reviewing and updating the material previously collected, we released the draft JFS. We designated two agencies, the Department of Defense and the National Aeronautics and Space Administration, as lead agencies, and required them to test apply the draft standards. In addition to the lead agencies, we encouraged all agencies to comment on the draft JFS.

RESULTS OF AGENCY REVIEW

Agencies tested the draft JFS on 662 positions and reported no significant grade impact. One agency reported the downgrade of a position as a result of language in one of our illustrations for Factor Level Description (FLD) 5-4, Scope and Effect. We have revised the illustration to conform to the language of the FLD. Another agency reported the downgrade of several positions as a result of language in FLD 3-4, Guidelines. FLD 3-4 is consistent with the primary standard and previous classification guidance for the engineering group. Therefore, we anticipate no change to the grades of properly classified positions as a result of application of this final JFS.

When we issued the draft JFS, we requested agency comments on a number of specific issues. Agencies also commented on several additional issues. A summary of agency comments on the draft and our response to those comments follows.

1. Parenthetical Specialty Titles

Agency Comments: Agencies requested we better distinguish between the Fire Protection Engineering Series, 0804, and the “Fire Protection” specialty in the Mechanical Engineering Series, 0830; clarify the difference between the specialty of “Computer Systems” in the proposed Electrical Engineering Series, 0855, and the Computer Engineering Series, 0854; and remove the 16 general specialties in the Official Titling Provisions. Users commented the general specialties did not add value to the recruitment process and hindered the assignment of competitive level codes.

Our Response: We eliminated the “Fire Protection” specialty from the Mechanical Engineering Series, because fire protection engineering work is appropriately covered by the Fire Protection Engineering Series. We revised the Computer Engineering occupational information to emphasize the integrated hardware and software aspects of computer engineering work, and we eliminated the “Computer Systems” specialty from the Electrical Engineering Series. Finally, we eliminated all of the general specialties and several of the series-specific specialties.

2. Including Architecture Work in the 0801 Series

Agency Comments: Users were opposed to broadening the 0801 series to include architectural work, in part, because the fields of engineering and architecture have very distinct and different qualifications standards.

Our Response: We agree with the comments and have modified the 0801 series definition to exclude architecture work. We also removed architecture from the proposed series name, reverting to the current series name “General Engineering.”

3. Consolidating the Electrical Engineering Series, 0850, and the Electronics Series, 0855

Agency Comments: Agencies requested we not combine the Electrical Engineering Series, 0850, and the Electronics Engineering Series, 0855, into one series, as these two occupations perform different work and have separate and distinct requirements.

Our Response: After careful review, we have determined there are no significant benefits to be gained by consolidating electrical with electronics engineering work, and therefore have not combined the occupations.

4. Canceling the Grade Evaluation Guide for Hospital Engineer

Agency Comments: One agency requested we keep the Grade Evaluation Guide for Hospital Engineer because the functions described in the Guide are not addressed in the draft JFS.

Our Response: We retained the Grade Evaluation Guide for Hospital Engineer.

5. Canceling the Welding Engineering Series, 0894

Agency Comments: Agencies supported our proposal to cancel the Welding Engineering Series, 0894. Some agencies suggested we add the welding engineering work to the Materials Engineering Series, 0806.

Our Response: We determined it would not be appropriate to combine welding engineering with materials engineering work in the 0806 series. The Materials Engineering Series is primarily concerned with the composition of materials, while welding engineering involves welding equipment and processes and metallic joining or cutting processes allied with welding.

Welding engineering positions previously classified in the 0894 series should be classified to another engineering series if the work meets the intent of the series, or to the 0801 series if no other series is appropriate. The title of Welding Engineer may be used in the 0801 series.

6. Renaming the Agricultural Engineering Series, 0890

Agency Comments: We proposed changing the name of the 0890 series from “Agricultural Engineering” to “Biological and Agricultural Engineering.” Agencies commented the current name better reflects the work covered by the series and requested we keep the current name, Agricultural Engineering.

Our Response: We retained the existing series name, Agricultural Engineering.

7. Factor Level Descriptions (FLDs) and Illustrations

Agency Comments: Many agencies requested additional illustrations. We also received requests to change “and” to “and/or” in the bulleted lists provided in the FLDs and Illustrations.

Our Response: Illustrations in the standard provide examples of work to assist the reader in distinguishing between factor levels. We remind users that illustrations do not cover all possible work situations at a given factor level. The factor level descriptors are broadly written to provide the grading criteria needed to evaluate the grade level of positions in multiple occupations.

Nevertheless, in response to requests received, we increased the number of illustrations for Factor 1, Knowledge Required by the Position. Every series, with the exception of the 0801, now has at least one illustration. We have not provided illustrations for the 0801 series because, by definition, the work in this occupational series is undefined. We have reviewed the bulleted lists provided in the FLDs and Illustrations and have made changes where appropriate.

8. New Emerging Specialty Engineering or Architecture Areas

Agency Comments: Several commenters noted their support for an informal proposal by another agency for a new series for Construction Management. The proposing agency, however, had not fully vetted the concept internally, chose not to submit to OPM, and asked that we not consider the proposal at this time.

Our Response: If an agency submits a formal request, we will consider it at that time. However, we note this work requires a general administrative knowledge of engineering and architecture equipment, terminology, reports, and documentation, and a general understanding of architectural plans and specifications, and thus is inappropriate for inclusion in this professional JFS. In the future, this work and other similar proposals may serve as the basis for further study of the need for 0800 administrative occupations.