

# **Nuclear Workforce Survey Report**

For

**Savannah River Site Community  
Reuse Organization**

June 8, 2009

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## 1. Background and Objectives of the Nuclear Workforce Survey

### Background

Over the last decade the U.S. commercial nuclear power industry began planning for a new building program after a very long period of inactivity. Although a global leader in nuclear power, with more operating nuclear reactors than any other nation, the U.S. industry has lost most of its new construction infrastructure and particularly the specialized workforce capable of designing, constructing and operating nuclear power plants.

The impact of an expanding role for nuclear power plants has dramatic implications for the Central Savannah River Area (CSRA) and the two-state region of Georgia and South Carolina. Georgia's four nuclear units (Plant Hatch and Plant Vogtle) account for more than one-fourth of the state's electricity generation. South Carolina's five nuclear units (V.C. Summer, Oconee and H.B. Robinson) supply about half of that state's electricity demand. Southern Company (at Plant Vogtle) and SCANA (at V.C. Summer) both plan to start construction of new 2 unit nuclear power plants and these new units will most likely be the first new nuclear plants built in the U.S..

To add to the impact on the Central Savannah River Area, the Department of Energy's Savannah River Site (currently a very large job-producing nuclear site) is currently constructing new facilities such as the Mixed Oxide Fuel (MOX) facility and the Salt Waste Processing Facility (SWPF), further adding to the demand for new nuclear workers.

Industry studies have consistently estimated a very large gap between the demand for nuclear-related jobs (as many as 65,000 in Georgia and South Carolina over the next 20 years) and the ability for traditional sources to supply them. New nuclear power plants as well as existing units will need construction workers, engineers, health physicists, power plant operators, and maintenance staff. The Savannah River Site will also need nuclear scientists and engineers, nuclear physicists, nuclear chemists, radio chemists, health physicists, mathematicians and computer scientists.

The CSRA will need a unified, regional strategy that encompasses all relevant private, governmental and educational institutions along with appropriate economic development entities and elected officials. These groups should work together toward the single-minded goal of ensuring that an adequately trained workforce is ready in sufficient numbers to meet the challenges posed by the demand for a new nuclear workforce.

As the U.S. Department of Energy's designated Community Reuse Organization, the Savannah River Site Community Reuse Organization (SRSCRO) is charged with

developing and implementing a comprehensive strategy to diversify the economy of the five-county SRSCRO region in the CSRA. At the SRSCRO 2008 strategic planning meeting, the Board approved the development of a strategic plan for creating a trained local workforce to support the pending nuclear “renaissance”. A position paper on this subject was issued in January 2009 and concluded that regional entities should work together on a four-pronged program that includes identifying stakeholders and parties of influence, convening a regional nuclear workforce summit, identifying and aggressively pursuing state and federal funding sources and increasing public awareness of workforce needs.

The SRSCRO recognized that existing industry nuclear workforce studies were focused on the entire U.S. industry at a relatively high level with the smallest “slice” covering the entire Southeast U.S.. The SRSCRO decided to support an in-depth nuclear workforce survey focused on their local region as part of it’s regional economic mission. Early in 2009, the SRSCRO chose Booz Allen Hamilton, a consulting firm experienced in the nuclear industry, to conduct a more detailed analysis of the current and projected regional nuclear workforce needs over the next decade.

Booz Allen Hamilton used interviews and a data collection questionnaire to survey the eight regional nuclear companies working in the local region to develop the nuclear workforce survey report. The survey scope included only those jobs identified as key job classifications (e.g., requires specialized education or training, long lead times to educate and train new workers or a recognized lack of sufficient quantity of new workers). Both new jobs created and jobs vacated by retirements and attrition were included in the survey data.

The methodology used to conduct the survey provided the necessary level of detail to facilitate the SRSCRO’s goal of working with nuclear employers, educational institutions, local economic development entities and local and state elected officials to facilitate the identification of needs and resources and developing a long term nuclear workforce educational and training strategy. The survey was not intended to identify any immediate new job opportunities such as jobs created in response to the American Recovery and Reinvestment Act programs at SRS. In fact, many of the future new hires identified by the survey will be ultimately filled by today’s middle and high school students.

### **Survey Objectives**

The SRSCRO’s main objective for initiating the nuclear workforce survey was to obtain credible estimates of the quantity and timing of the demand for new nuclear workers needed to operate and build nuclear power plants and SRS facilities over the next

decade (both to fill new positions and replacements for vacated jobs due to retirements and attrition).

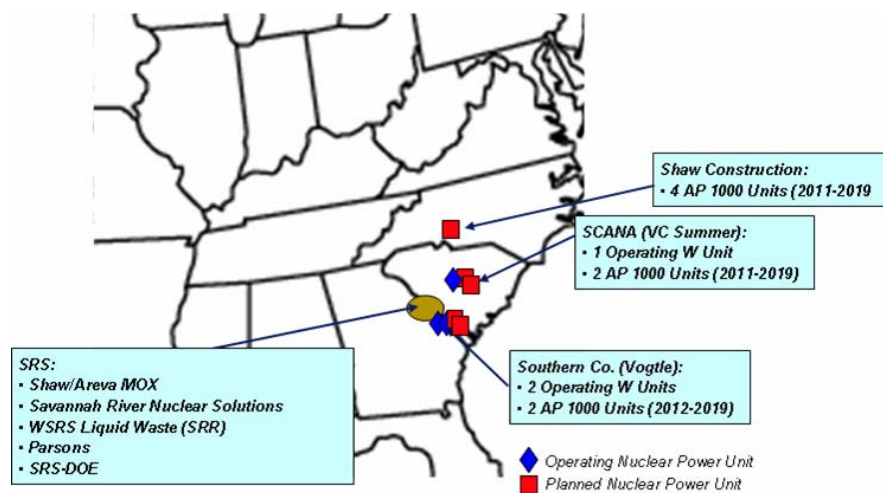
The SRSCRO also expects that the survey data will help regional companies identify education and training requirements, develop regional collaborations to provide needed education and training and provide the necessary background to justify sources of Federal or other funding for energy-related workforce development.

## 2. Scope of the Survey

### Participating Companies

Eight regional nuclear companies participated in the workforce survey from February through May 2009 (Figure 1).

Figure 1 - Survey Participating Companies



- SCANA operates the V.C. Summer single unit nuclear power plant near Columbia, South Carolina and is planning to construct 2 additional Westinghouse AP-1000 designed units on the same site.
- Southern Company operates the Plant Vogtle dual unit nuclear power plant near Augusta, Georgia and is also planning to construct 2 additional Westinghouse AP-1000 designed units on the same site.
- Shaw Construction is based in Charlotte, North Carolina and will be the main constructor of the 4 new units at V.C. Summer and Plant Vogtle.
- Shaw/Areva MOX is currently constructing the Mixed Oxide Fuel facility at the Savannah River Site.

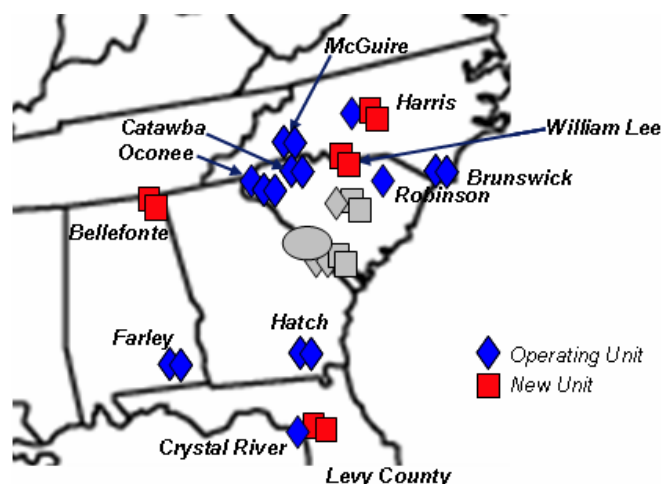
- Savannah River Nuclear Solutions is the Management and Operating contractor for the Savannah River Site and also manages the Savannah River National Laboratory.
- WSRS Liquid Waste (Savannah River Restoration) operates the liquid waste tank farms, the Defense Waste Processing Facility, and the Saltstone Facility.
- Parsons is currently constructing the Salt Waste Processing Facility at the Savannah River Site
- SRS DOE is DOE's site office providing oversight and administration for the Savannah River Site.

Each of the surveyed companies completed a detailed workforce survey document to estimate the number of job losses due to retirements and attrition and new hires needed over the 2010-2020 period. Interviews were also conducted with each of the survey participants to explain the objectives of the survey, answer questions and examine the major drivers behind the need for new nuclear workers. All survey data from the participating companies was kept confidential by Booz Allen Hamilton and individual company data was not shared with any participant including the SRSCRO.

### Nuclear Workers Demand Beyond the SRSCRO Region

Although the nuclear workforce survey scope was focused on the needs of the local region nuclear companies, the SRSCRO recognizes that there will be an even larger demand for new nuclear workers in the neighboring region to operate the 16 current nuclear power units and build and operate as many as 8 new nuclear power units (Figure 2). These nuclear power plant locations are close enough to the SRSCRO region to compete for any of the new nuclear jobs identified by the survey, which adds to the urgency and magnitude of the challenge to provide for the new nuclear workforce.

Figure 2 - Neighboring Operating and New Nuclear Power Units



## Key Job Classifications

The nuclear workforce survey scope included 57 individual key job classifications organized into 4 general categories (Professional, Technician, Engineer and Craft) and are listed in Table 1. A key job classification is defined as a nuclear related job that meets one or more of the following criteria:

- Requires specialized education or training
- Long lead times to educate and train new workers
- Industry sources have identified a significant gap between expected demand and available sources of new hires for 5 or more years

The Appendix to this report contains definitions for each key job classification.

Table 1 - Key Job Classifications

### **Professional Category**

Chemist  
 Craft/Technician Training  
 Emergency Management  
 Health Physicist  
 Information Technologist  
 Licensed Operator  
 Occupational Safety Specialist  
 Operator Training Specialist  
 Planner  
 Plant Operator  
 Project Controls  
 Project Manager  
 Quality Assurance Specialist  
 Radiochemist  
 Records Management  
 Scientist/Engineer  
 Software Developer

### **Engineer Category**

Chemical Engineer  
 Civil/Structural Engineer  
 Computer Engineer  
 D&D Engineer  
 Electrical Engineer  
 Environmental Engineer  
 Fire Protection Engineer  
 General Engineer  
 I&C Engineer  
 Materials Engineer  
 Mechanical Engineer  
 Nuclear Engineer  
 Systems Engineer

### **Technician Category**

Chemistry Technician  
 Electrical Technician  
 Engineering Draftsman  
 Environmental Technician  
 Health Physics Technician  
 I&C Technician  
 Laborer (Nuclear Technician)  
 Mechanical Technician  
 NDE Technician  
 QC Technician

### **Craft Category**

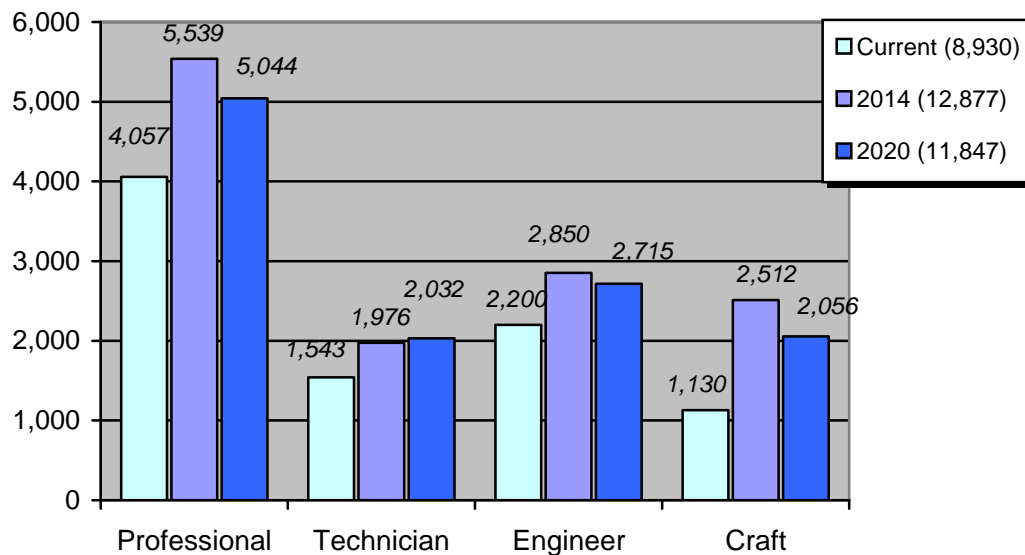
Boilermaker  
 Carpenter  
 Cement Mason  
 Electrician  
 Heavy Equipment Operator  
 Insulator  
 Iron worker  
 Laborer  
 Machinist  
 Millwright  
 Pipefitter  
 Rebar Worker  
 Sheet Metal Worker  
 Teamster  
 Welder (General)  
 Welder (Nuclear)

### 3. Survey Results

#### Growth in Total Staffing Levels

The combined survey results for the participating companies indicate that the peak staffing level for key job classifications will grow about 45% from the current level of 8,930 to a peak level of 12,877 by 2014 and then will level out to 11,847 by 2020 as shown in Figure 3. All of the key job classifications categories indicate significant growth with the largest percentage growth in the Craft category.

Figure 3 - Combined Staffing Levels Growth by Category

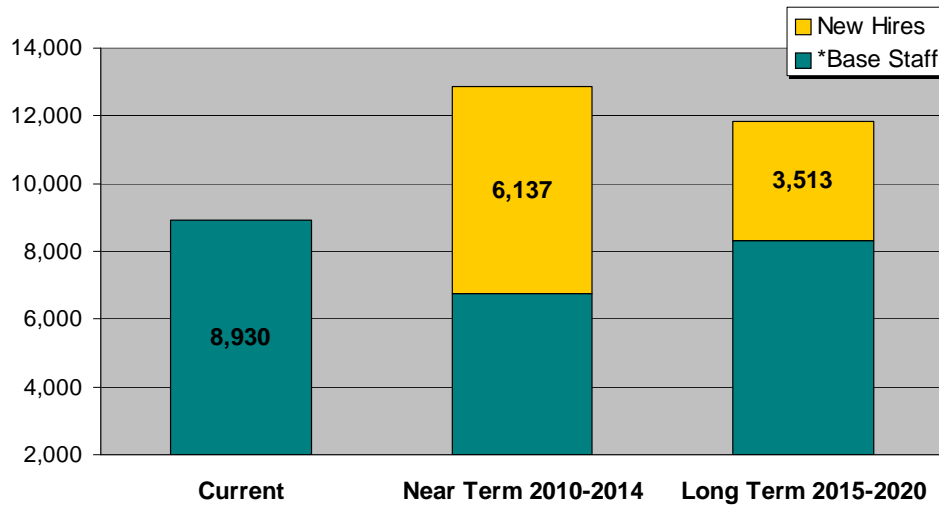


#### Estimated New Hires 2010 – 2020

The survey results indicated that about 9,650 key job classification new hires will be needed by the combined companies over the next decade to fill new positions and replace losses due to attrition and retirements. The majority of the new hires will be needed in the near term as shown in Figure 4.



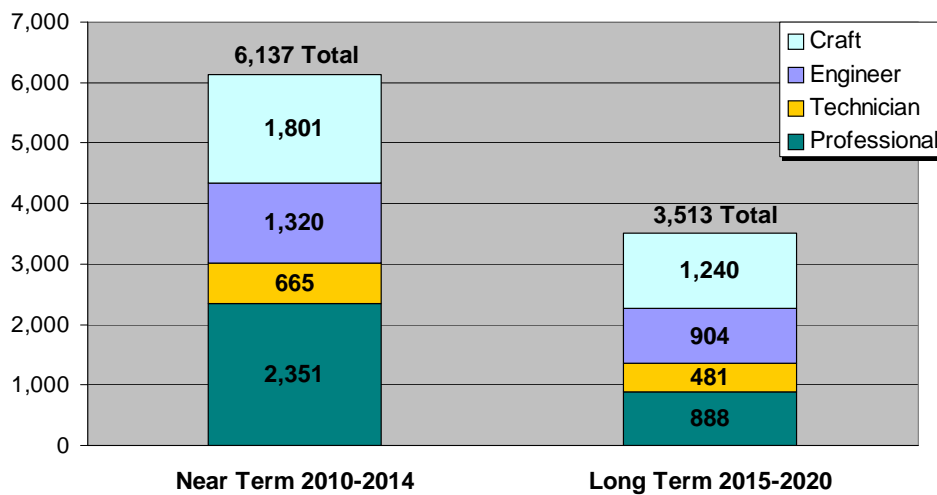
Figure 4 – Total Estimated New Hires for Combined Companies



\* Base staff is existing staff for the period less losses due to retirements and attrition

The Professional, Craft and Engineer categories will have most of the demand for new hires in the near term as shown in Figure 5.

Figure 5 – Total Estimated New Hires for Combined Companies by Category



### Estimated New Hires By Key Job Classifications

The survey results for the combined participating companies also estimate the new hires needed for each job classification for the near term (2010-2014) and the long term (2015-2020).

Table 2 lists the survey results for the Professional category. There will be a large demand for Scientists / Engineers while plans for new nuclear plant construction will result in large demand for Licensed Operators (for commercial nuclear power plants) and Plant Operators (both for commercial nuclear power plants and SRS facilities). The results also indicate a steady demand for Information Technologists, Operator Trainers, Craft/Technician Trainers and Quality Assurance staff.

Table 2 - Estimated New Hires: Professional Category

<i>Professional Category</i>	<i>Total 2010 - 2020</i>	<i>Near Term 2010 - 2014</i>	<i>Long Term 2015 - 2020</i>
Scientist/ Engineer	1,222	820	402
Plant Operator	918	736	182
Licensed Operator	217	152	65
Project Manager	207	153	54
Information Technologist	149	115	34
Operator Training	130	98	32
Quality Assurance	105	74	31
Craft/Technician Training	84	58	26
Occupational Safety	42	31	11
Health Physicist	39	26	13
Planner / Scheduler	34	12	22
Records Management	27	20	7
Emergency Management	16	14	2
Organizational Performance	13	6	7
Radio chemist	11	11	0

<i>Professional Category</i>	<i>Total 2010 - 2020</i>	<i>Near Term 2010 - 2014</i>	<i>Long Term 2015 - 2020</i>
Software Developer	10	10	0
Chemist	8	8	0
Project Controls	7	7	0
<b>Totals</b>	<b>3,239</b>	<b>2,351</b>	<b>888</b>

Table 3 lists the survey results for the Technician category. The results show a large demand for Health Physics Technicians as well as Mechanical, Electrical and Instrumentation & Control Technicians (both for commercial nuclear power plants and SRS facilities).

Table 3 - Estimated New Hires: Technician Category

<i>Technician Category</i>	<i>Total 2010 - 2020</i>	<i>Near Term 2010- 2014</i>	<i>Long Term 2015-2020</i>
Health Physics Technician	273	137	136
Mechanical Technician	264	156	108
Instrumentation & Control Technician	188	108	80
Electrical Technician	160	101	59
Chemistry Technician	126	90	36
QC Technician	59	32	27
Laborer (Nuc Technician)	58	31	27
Environmental Technician	10	8	2
Engineering Draftsman	6	2	4
NDE Technician	2	0	2
<b>Totals</b>	<b>1,146</b>	<b>665</b>	<b>481</b>

Table 4 lists the survey results for the Engineer category. The results indicate a large demand for Mechanical, Electrical and Chemical Engineers through about 2014 followed by an increased demand for Nuclear, Civil and Instrumentation and Controls Engineers

Table 4 - Estimated New Hires: Engineer Category

<i>Engineer Category</i>	<i>Total 2010 - 2020</i>	<i>Near Term 2010- 2014</i>	<i>Long Term 2015-2020</i>
Mechanical Engineer	541	381	160
Electrical Engineer	423	249	174
Chemical Engineer	330	235	95
Nuclear Engineer	205	69	136
Instrumentation & Controls Engineer	137	61	76
Systems Engineer	121	92	29
Civil/Structural Engineer	121	57	64
General Engineer	91	50	41
Environmental Engineer	84	40	44
Materials Engineer	82	32	50
Computer Engineer	46	31	15
Fire Protection Engineer	36	20	16
D&D Engineer	7	3	4
<b>Totals</b>	<b>2,224</b>	<b>1,320</b>	<b>904</b>

Table 5 lists the survey results for the Craft category. The results show a strong near term demand for Laborers, Electricians, Pipefitters, Welders, Iron Workers and Carpenters followed by longer term demand for Millwrights, Insulators and Nuclear Welders.

Table 5 - Estimated New Hires: Craft Category

<i>Craft Category</i>	<i>Total 2010 - 2020</i>	<i>Near Term 2010- 2014</i>	<i>Long Term 2015-2020</i>
Pipefitter	438	238	200
Electrician	436	256	180
Laborer	408	328	80
Iron worker	302	202	100
Millwright	292	42	250
Welder (General)	210	210	0
Welder (Nuclear)	206	6	200
Carpenter	181	161	20
Insulator	163	13	150
Cement Mason	110	80	30
Heavy Equipment Operator	98	98	0
Rebar Worker	80	50	30
Machinist	54	54	0
Boilermaker	41	41	0
Teamster	12	12	0
Sheet Metal Worker	10	10	0
<b>Totals</b>	<b>3,041</b>	<b>1,801</b>	<b>1,240</b>

## 4. Conclusions and Recommendations

### Conclusions

The nuclear workforce survey results clearly indicate a significant demand for thousands of new nuclear workers for the Central Savannah River Area and the two-state region of Georgia and South Carolina. The demand will average about a 1,000 new hires per year over the next ten years. This demand encompasses Professional, Technician, Engineer and Craft job categories.

The private, governmental and educational institutions in the region along with economic development entities have a significant challenge to plan and implement new educational and training programs to ensure that an adequately trained and available workforce is ready in sufficient numbers to meet this demand.

### Recommendations

The SRSCRO should continue its role to convene the appropriate regional stakeholders and facilitate the development of a long term strategy to increase the educational and training capabilities within the region. The following specific recommendations are provided:

1. Work with the survey participating companies to determine their expectations for sources for future new hires (internal reassignments, industry pools, educational institutions, etc.), and identify gaps that new regional initiatives can address.
2. Develop a priority ranking of key job classifications that regional initiatives may be able to supply based on level of demand and capabilities of the regional institutions.
3. Work with the surveyed companies to determine updates to or new curricula to suggest to educational institutions to meet specific job skill needs.
4. Consider supporting the expansion of basic engineering programs at regional educational institutions to act as a feeder into university engineering programs.
5. Consider supporting programs to work with regional nuclear power plant owners to provide the prerequisite math, science, and technology courses for their Plant Operator, Licensed Operator and Maintenance Technician curricula.
6. Consider supporting a program for regional educational institutions to formally partner with the new nuclear plant construction vendors to become a dedicated supplier of craft new hires with guaranteed hiring agreements. (Construction vendors prefer to hire locally and can provide direct input into course development).

7. Consider working with other industry nuclear workforce development organizations such as the Carolinas Nuclear Cluster, the Nuclear Energy Institute, the CASEnergy Coalition and the Center for Energy Workforce Development to support initiatives, share lessons learned and cooperate on program development.
8. Consider working with the Nuclear Energy Institute in support of their *Skilled Workforce Initiative* to develop two-year degree programs for key nuclear jobs.

## **Appendix - Key Job Classification Definitions**



## Nuclear Workforce Key Job Classifications

### **Boilermaker**

Skilled craft who make, install, and repair boilers, closed vats, and other large vessels or containers that hold liquids and gases. Install and maintain boilers and other vessels, and help erect and repair air pollution equipment, blast furnaces, water treatment plants, storage and process tanks, and smoke stacks.

### **Carpenter**

Skilled craft who construct, erect, install, and repair structures and fixtures made from wood and other materials. Includes constructing wooden forms for pouring concrete, erecting scaffolding and building tunnel bracing.

### **Cement Mason/Concrete Finisher**

Skilled craft who place and finish concrete, fabricate concrete beams, columns, and panels and set the forms for holding the concrete and properly align them.

### **Chemist**

Coordination of all aspects of a chemistry program and providing guidance on chemistry standards; conducting evaluations of plant chemistry programs; and addressing and resolving chemistry operating problems.

### **Chemistry Technician**

Performance of normal shift functions such as chemical additions and laboratory routines including chemical analyses.

### **Chemical Engineer**

Designs and supports installation and operation of chemical processing systems and equipment.

### **Civil/Structural Engineer**

Designs and oversees site buildings, roads, bridges, and waterfront structures. Performs soils and foundations analyses, and reviews and approves hanger and support locations. Provides stress analysis and support evaluation services. Provides architecture and site layout services.

### **Computer Engineer**

Responsible for hardware and software engineering associated with process computers, radiation monitoring system and other operational and support computer systems

### **Craft/Technician Training Specialist**

Provides or coordinates all formal training for craft or technician staff including all regulatory required programs. Provides for instructor training and development and instructional system design and implementation.

**D&D Engineer**

Specializing in planning and execution of deactivation and decommissioning of nuclear systems, equipment and facilities.

**Electrical Engineer**

Designs and oversees the installation of high, medium and low voltage distribution systems (including DC and instrument power), related components (including motors, circuit breakers, transformers, batteries, chargers and inverters)

**Electrical Technician**

All activities associated with electrical maintenance and minor modification work within the power block. This includes routine electrical preventive maintenance, corrective maintenance and predictive maintenance.

**Electrician**

Skilled craft who install wiring systems, switchgear, breakers and motor control centers and conduct cable pulling.

**Emergency Management Specialist**

Responsible for developing and maintaining emergency management programs to comply with regulatory requirements.

**Engineering Draftsman**

Performs manual and computer-aided design functions. Resolves field questions, and maintains piping and instrument diagrams and electric power line diagrams.

**Environmental Engineer**

Responsible for establishing environmental programs conforming with regulations policy and implementing required monitoring program and related requirements such as environmental licenses, permits and audits.

**Environmental Technician**

Performs environmental monitoring, sampling and analysis activities to ensure conformance with the site environmental program.

**Fire Protection Engineer**

Administer the fire protection program including inspection and surveillance activities.

**General Engineer**

Engineers specializing in work planning, project management support, waste management and security activities.

**Health Physicist**

Responsible for technical support and oversight of health physics programs including the ALARA, respiratory protection and dosimetry programs. Also includes performing and evaluating radiation dose and shielding calculations.

**Health Physics Technician**

Includes radiation protection technicians, involved with such activities as routine and special radiation surveys, data reading and analysis and radiation area job coverage. Also includes persons collecting and analyzing radiation system samples and routine decontamination activities.

**Heavy Equipment Operator**

Operates specialized large construction equipment and vehicles such as graders, cranes, scrapers and shovels. Requires specialized training in equipment operations and safety.

**Information Technologist**

Responsible for dedicated software support for and data base management. Provides operations and system administration resources for hosts and servers. Also provides system hardware design, revisions, and user information services.

**Instrumentation & Control Engineer**

Designs and oversees the installation of safety and non-safety instrumentation and control systems and components.

**Instrumentation & Control Technician**

All activities associated with I&C maintenance and minor modification work within the power block. This includes routine I&C preventive maintenance, corrective

maintenance, and predictive maintenance.

**Insulator**

Skilled craft who install new insulation around pipes and industrial machinery, and staple fiberglass or rock-wool batts to exterior walls and ceilings before drywall, paneling, or plaster walls are put in place.

**Iron worker**

Skilled craft who erect steel frames and assemble the cranes and derricks that move structural steel, reinforcing bars, buckets of concrete, lumber, and other materials and equipment around a construction site. Also includes connecting steel columns, beams, and girders and installing reinforcing iron and rebar.

**Laborer**

Skilled craft who clean and prepare construction sites, tend pumps, compressors and generators and build forms for pouring concrete. They also erect and disassemble scaffolding and other temporary structures.

**Laborer (Nuclear Technician)**

Specialized technician supporting nuclear maintenance work activities

**Licensed Operator**

Includes persons responsible for operating plant primary and secondary systems from the main control room in conformance with the plant operating license and for implementing alarm and emergency response procedures.

**Operator Training Specialist**

Provides or coordinates all formal training for licensed and plant (non-licensed) operators including initial licensing and requalification training. Provides for instructor training and development and instructional system design and implementation. Includes simulator training.

**Machinist**

Skilled craft who use machine tools, such as lathes, milling machines, and machining centers, to produce precision metal parts.

**Materials Engineer**

Performs complex materials analysis and design activities with focus on nuclear power components and materials such as high temperature alloys and stainless steel.

**Mechanical Engineer**

Designs and oversees the installation of mechanical primary, secondary, and auxiliary systems, and their associated components including pumps, piping, insulation and hangers.

**Mechanical Technician**

All activities associated with mechanical maintenance and minor modification work within the power block. This includes routine mechanical preventive maintenance, corrective maintenance, and predictive maintenance.

**Millwright**

Skilled craft who install, replace, dismantle, and repair machinery and heavy equipment. Also includes determination of the optimal placement of machinery in the plant and preparation of foundations.

**NDE Technician**

All activities associated with the non-destructive examination program including radiography, ultrasonic, eddy current, liquid penetrant and magnetic particle examinations.

**Nuclear Engineer**

Performs thermal, hydraulic and transient analyses for nuclear steam supply systems. Also conducts core reload safety evaluation and design analyses, estimates radiological inventories and performs radiation dose and shielding calculations.

**Occupational Safety Specialist**

All activities related to the preparation, research and interpretation of OSHA regulations, and implementation of safety procedures, industrial hygiene programs and medical services.

**Pipefitter**

Skilled craft who install and repair high-pressure and low-pressure pipe systems. They also install automatic controls used to regulate these systems.

**Planner**

Produces maintenance work packages and coordinates maintenance work schedules.

**Plant Operator**

Non-licensed operators responsible for operating primary, secondary, radwaste and auxiliary systems.

**Project Manager**

Directs, controls and monitors construction contractors. Establishes and monitors project milestone schedules and budgets.

**Project Controls**

Skilled craft who install wiring systems, switchgear, breakers and motor control centers and conduct cable pulling.

**QC Technician**

Implements inspection hold point program and performs associated inspections of on-going construction and maintenance activities. Reviews work activities to ensure compliance with QA program requirements. Performs receipt inspections for QA program materials. Analyzes non-destructive examination test results.

**Quality Assurance Specialist**

Develops and maintains required QA procedures and manuals. Reviews work activities to ensure compliance with QA program requirements. Includes reviews of operational and regulatory related documents; reviews of industry event reports for applicability and lessons learned. Includes self-assessment activities to identify areas for improvement.

**Radio Chemist**

Performance of normal shift functions such as chemical additions and laboratory routines specializing in radio-chemical analyses.

**Rebar Worker**

Skilled craft specializing in installation of rebar reinforced steel structures.

**Records Management Specialist**

Receives, prepares, and electronically captures plant quality and safety-related records and drawings. Controls and distributes plant controlled documents. Coordinates other aspects of document processing, record management, and central files and libraries.

**Scientist/Engineer**

Advanced degree specialty scientist or engineer directly supporting R&D programs.

**Sheet Metal Worker**

Skilled craft who make, install, and maintain heating, ventilation, and air-conditioning duct systems; roofs; and siding. May work with fiberglass and plastic materials.

**Software Developer**

Provides software related system design, revision, user information services and dedicated software support.

**Systems Engineer**

Evaluates plant systems and components operating performance and provides engineering assistance to improve performance. Responsible for coordination of system and component testing programs.

**Teamster**

Non specialized craft labor including riggers, demolition workers, landscapers, pipeline construction workers, warehouse specialists, and heavy and light trucks operators.

**Welder (General)**

Skilled craft who uses appropriated techniques to join plant sub-assemblies, piping and other structures during installation of plant systems and components.

**Welder (Nuclear)**

Skilled craft who uses appropriated techniques to join plant sub-assemblies, piping and other structures during installation of plant systems and components.