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# Leveraging the Nuclear Workforce to Develop Synergistic Industries

## Technical Memorandum

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## Overview

The purpose of this technical memorandum is to provide communities with a foundation in economic impact analysis and to demonstrate the specific economic impacts of potential nuclear plant closure and how a shifting nuclear energy market relates to changes in the local job market. This memorandum discusses the concept of economics and multipliers, the types of multipliers specific to nuclear facilities, national and local profiles, and findings and key takeaways for future analysis.

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## Economic Impact Analysis

Broadly speaking, economic impact analysis identifies the flows of money, production, and employment in a regional economy based on a change to its economic base. It is mostly used to identify the number of jobs created by major capital projects and to analyze patterns in regional employment.

The U.S. Bureau of Economic Analysis provides what are known as “input-output” tables, which enable analysis of economic multipliers across U.S. regions. This data identifies, for example, how many units of input (in dollar terms) across every industry are needed to create one unit of output in any given industry. The data sets also identify these relationships in terms of employees.

When there is a shock to a regional economy due to an increase (or decrease) in product output or employment, we identify what are known as “multiplier effects,” which is how spending in one industry impacts product output and employment across the rest of the regional economy. These impacts are widely known as “direct,” “indirect,” and “induced” effects.

To distinguish these, we use the example of a cookie factory. Let’s suppose that a person wants to start a cookie factory, which we would identify as being in the “food manufacturing” industry. To begin operations, the proprietor would need to spend direct money on a factory, line employees, and managers. This direct spending – employment at the factory – is the **direct effect**. Direct effects are the immediate consequences of an activity within a sector. They are the initial changes occurring in the sectors to which final demand change (i.e. a change in spending) is made.

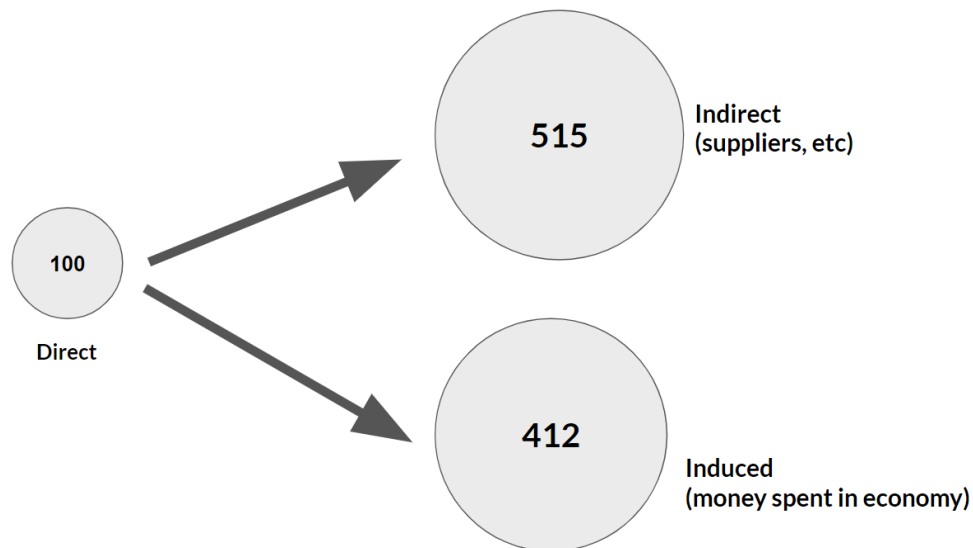
Beyond initial capital spending, the person opening the cookie factory needs various supplies. They would need to purchase things like flour, sugar, butter, and other ingredients for the cookies. The business would also spend money on real estate, legal services, office supplies, computers, and generally other expenditures required to run a business. These are the **indirect effects**: effects that occur when the initial (direct) spending leads to further economic activity in other sectors through increased orders elsewhere. This, in turn, can lead to more jobs and economic activity in supply sectors. Finally, the employees at the cookie factory, and the employees at suppliers supported by the factory, spend their money in the local economy. They spend their earnings on everything people spend on: rent, housing, cars, groceries, entertainment, and so on. This spending

constitutes the **induced effects**: the economic results of spending of income earned from direct and indirect effects. This spending stimulates further economic activity in the region.

## Multipliers for Nuclear Plants

For the nuclear industry (part of the “utilities industry,” or NAICS code 22), we identify the multipliers in indirect and induced terms. For every 100 jobs produced in this industry, the economy observes 515 additional indirect jobs elsewhere through suppliers and vendors. Moreover, the employment earnings spending produces an additional 412 jobs in induced effects. This suggests that employment at nuclear facilities has an approximate employment multiplier of 9.27 jobs for every 1 job at the facility itself. These effects work in both directions, including in the event of a plant closure. It therefore follows that nuclear plant closures have large ripple effects on impacted local and regional economies.

**Figure 1. Employment Multipliers for the Nuclear Industry (Utilities Industry)**



*Source: Economics Policy Institute; US BEA; Utilities industry (NAICS 22)*

## Profile of Nuclear Power Plants

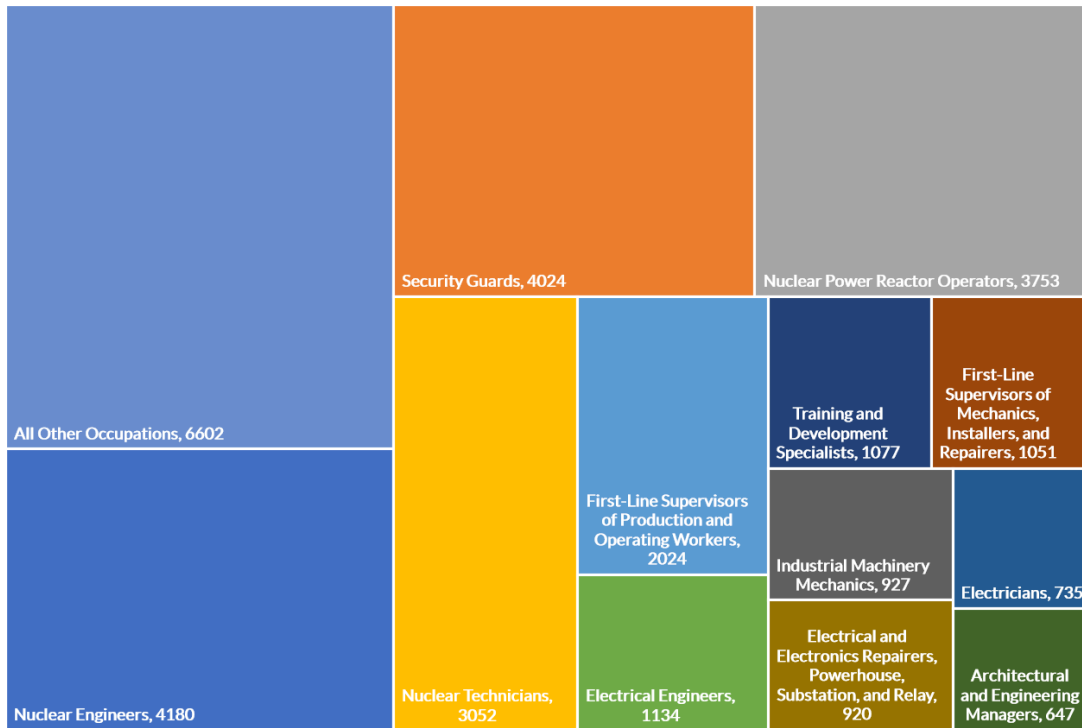
### Jobs at Nuclear Facilities: U.S.

We identify two broad categories of employment at nuclear facilities. First, nuclear facilities contain technical jobs, including positions like nuclear engineers, field technicians, and other specialty-trained labor. The second group of jobs, support jobs, are more numerous and include everything from warehouse forklift operators to security guards and machinery mechanics.

Across the nuclear industry in the U.S. we identify that nuclear engineers are the largest single occupation category, followed by security guards. Of course, the collection of “all other occupations” constitutes the majority. From an economic impact perspective, especially with respect to induced effects, “architectural and engineering managers” are among those making the

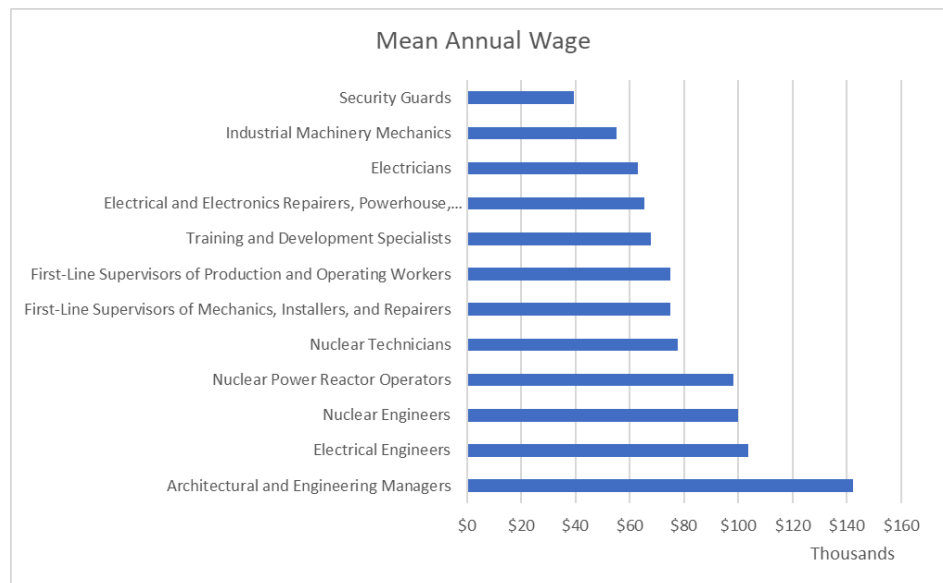
highest annual wage, around \$142,000 annually on average. Security guards, while numerous, make much lower average wages of around \$40,000 per year.

**Figure 2. Employment Profile in the U.S. Nuclear Power Industry**



Source: Lightcast; Smart Growth America; U.S. Bureau of Economic Analysis

**Figure 3. Wages in the U.S. Nuclear Power Industry**



Source: U.S. Bureau of Economic Analysis

Finally, using data from [Lightcast](#), an economics data provider, we can find where potential employment from a closed nuclear plant would go. This estimate is based on Lightcast’s concept of an “absorption index.” The absorption index, scaled from 0 to 1, identifies the quality of an employment match between one occupation and another based on skills requirements and the availability of jobs in the new occupation category.

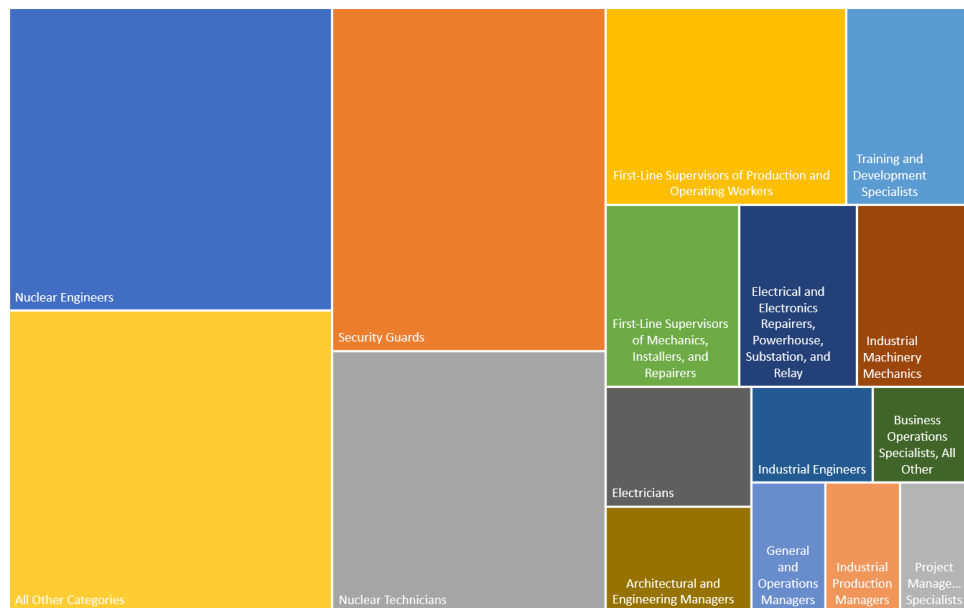
According to this data (Appendix A), nuclear engineers find their best fit as nuclear engineers in other industries outside of power plants. This makes sense as they can work as nuclear technicians for the military and other research and development areas outside of power generation. Other potential employment matches include industries like pharmaceutical and chemical companies. Overall, the data suggest that a negative shock to nuclear facility employment would cause employees to transition into the same occupation in new industries or some combination of a related occupation in new industries.

## Jobs at Nuclear Facilities: Plant in U.S. South

At a sample nuclear plant in the U.S. South, we identify the specific employment profile of its workers and see that it somewhat follows the broader U.S. pattern. In this region, there may be more nuclear engineers and technicians, and fewer reactor operators. Nonetheless, the overall employment profile remains similar.

For employment matches in this area of the country, where the population is more spread out, we see more cross-industry movement (Appendix B). For example, nuclear engineers may need to transition to being managers at physicians' offices and hospitals due to a lack of nearby operational nuclear plants, for example. Security guards, on the other hand, are more likely to find cross-match employment for their occupation, although still in other industries. What emerges as a pattern is the prevalence of the healthcare and education industries absorbing more of these employees.

**Figure 4. Employment Profile in the Nuclear Power Industry, U.S. South Sample**

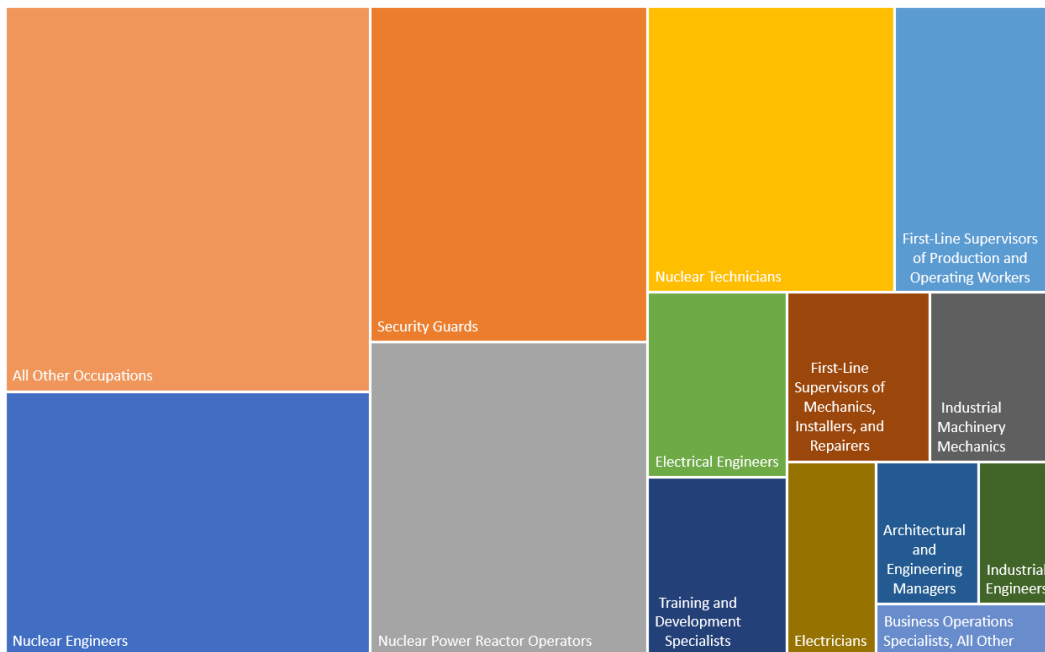


Source: Lightcast; Smart Growth America; U.S. Bureau of Economic Analysis

## Jobs at Nuclear Facilities: Plant in U.S. Northwest

Our sample plant in the U.S. Northwest also has a profile commensurate with the overarching nuclear power industry in the U.S. There aren't broad differences in this profile, but some slight changes in internal composition. We see that a “thicker” local labor market affords more opportunities for employees to find similar matches without major changes to industry (Appendix C). Here, nuclear engineers might find a better match as nuclear engineers in other services (likely in military-related applications), and technicians have opportunities in healthcare, waste treatment, architecture, and engineering services.

**Figure 5. Employment Profile in the Nuclear Power Industry, U.S. Northwest Sample**

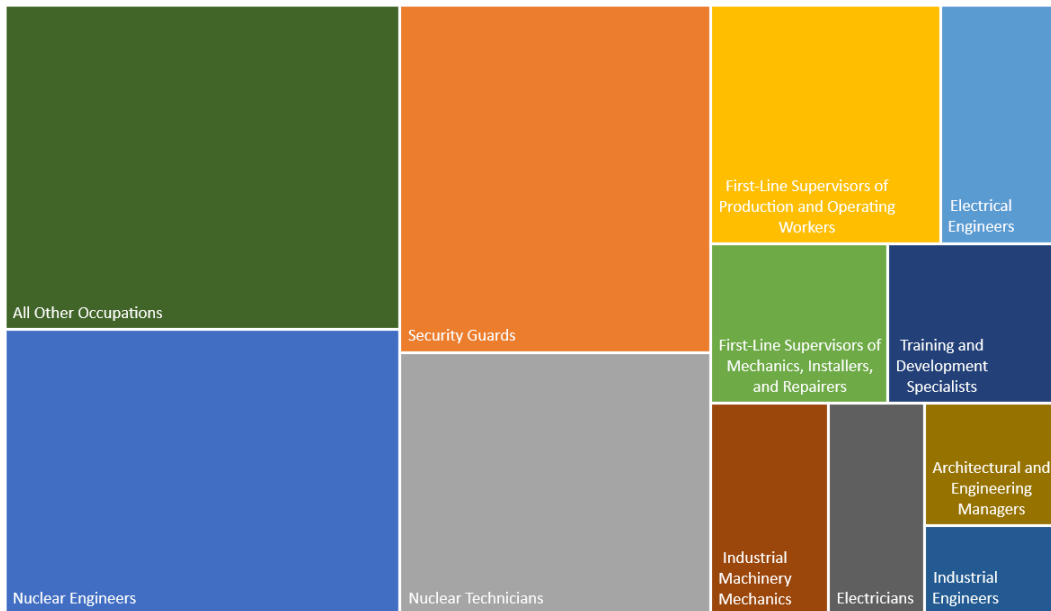


Source: Lightcast; Smart Growth America; U.S. Bureau of Economic Analysis

## Jobs at Nuclear Facilities: Plant in U.S. Midwest

Finally, in the U.S. Midwest, the overall employment profile within a sample nuclear facility appears commensurate with other plants and the U.S. as a whole. When identifying potential employment matches, this area also has a thicker labor market with nuclear engineers going to scientific R&D services and technicians finding employment in machinery and aviation industries. Earlier trends hold for workers in other categories, including security guards and trades workers.

**Figure 6. Employment Profile in the Nuclear Power Industry, U.S. Midwest Sample**



Source: Lightcast; Smart Growth America; U.S. Bureau of Economic Analysis

## Economic Implications

Given the data observed in industry profiles at nuclear facilities, and cross-industry employment, we identify that there are two potential strategies for communities to pursue should there be a plant closure. On the one hand, a community can support industries that they currently have to grow them with transition and workforce strategies. On the other hand, a community can attract and build industries that have a much broader national-level appeal. These strategies are not mutually exclusive and communities are likely to employ some match of both.

For local matches, examples can include supporting industries like “eds and meds,” currently existing engineering and scientific fields. Further, the CHIPS Act affords federal subsidies for computer hardware and semiconductor manufacturing that can build those industries for better matches of technical staff. In terms of support staff, security industries, professional services, and trades and mechanical industries will remain vital for cross-industry employment of people like technicians and tradespeople. From a national perspective, many nuclear facility employees can find suitable matches in major national industries like engineering services outside of nuclear power, in other energy industries, in R&D, waste treatment, and high-tech manufacturing. Again, subsidies like the CHIPS Act provide opportunities to build nationally competitive industries. The support staff will continue to find employment opportunities in places like hospitals, service industries, and the local trades.

Overall, we identify that nuclear facilities have large employment multiplier effects (of 9.3) and that a negative shock can be significant for local communities. This is because nuclear communities tend to be in smaller regions with smaller economies that may not currently have large-scale industries suitable for efficient employment matches. The major skills at these facilities are highly specific, but are still transferable to other occupations and across other industries. Finally, support services at nuclear facilities are significant in number. These employees, who tend to make lower wages, are more vulnerable to economic shocks but may find suitable matches across the economy in places like healthcare, real estate, and local trades.



## APPENDIX A

### Absorption Index for Top Nuclear Occupations: U.S.

Nuclear Occupation	Absorption Occupation	Absorption Index
Nuclear Engineers	Managers, All Other-Offices of Physicians	0.61
Nuclear Engineers	Managers, All Other-General Medical and Surgical Hospitals	0.61
Nuclear Engineers	General and Operations Managers-Offices of Physicians	0.60
Security Guards	Security Guards-General Medical and Surgical Hospitals	0.81
Security Guards	Security Guards-Colleges, Universities, and Professional Schools	0.80
Security Guards	Security Guards-Elementary and Secondary Schools	0.69
Security Guards	Security and Fire Alarm Systems Installers-Investigation and Security Services	0.63
Security Guards	Security Guards-Other Residential Care Facilities	0.60
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Machinery, Equipment, and Supplies Merchant Who	0.81
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Cement and Concrete Product Manufacturing	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Other Miscellaneous Manufacturing	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Plastics Product Manufacturing	0.79
First-Line Supervisors of Production and Operating Workers	Managers, All Other-Offices of Physicians	0.79
First-Line Supervisors of Production and Operating Workers	Managers, All Other-Architectural and Structural Metals Manufacturing	0.79
Training and Development Specialists	Training and Development Specialists-Restaurants and Other Eating Places	0.80
Training and Development Specialists	Instructional Coordinators-Colleges, Universities, and Professional Schools	0.69
Training and Development Specialists	Educational, Guidance, and Career Counselors and Advisors-Colleges, Universities, and Professional Schools	0.68
Training and Development Specialists	Education Administrators, Postsecondary-Colleges, Universities, and Professional Schools	0.68
Training and Development Specialists	Managers, All Other-Offices of Physicians	0.68

Source: Lightcast; Smart Growth America

## APPENDIX B

### Absorption Index for Top Nuclear Occupations: U.S. South

Nuclear Occupation	Absorption Occupation	Absorption Index
Nuclear Engineers	Managers, All Other-Offices of Physicians	0.61
Nuclear Engineers	Managers, All Other-General Medical and Surgical Hospitals	0.61
Nuclear Engineers	General and Operations Managers-Offices of Physicians	0.60
Security Guards	Security Guards-General Medical and Surgical Hospitals	0.81
Security Guards	Security Guards-Colleges, Universities, and Professional Schools	0.80
Security Guards	Security Guards-Elementary and Secondary Schools	0.69
Security Guards	Security and Fire Alarm Systems Installers-Investigation and Security Services	0.63
Security Guards	Security Guards-Other Residential Care Facilities	0.60
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Machinery, Equipment, and Supplies Merchant Who	0.81
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Cement and Concrete Product Manufacturing	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Other Miscellaneous Manufacturing	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Plastics Product Manufacturing	0.79
First-Line Supervisors of Production and Operating Workers	Managers, All Other-Offices of Physicians	0.79
First-Line Supervisors of Production and Operating Workers	Managers, All Other-Architectural and Structural Metals Manufacturing	0.79
Training and Development Specialists	Training and Development Specialists-Restaurants and Other Eating Places	0.80
Training and Development Specialists	Instructional Coordinators-Colleges, Universities, and Professional Schools	0.69
Training and Development Specialists	Educational, Guidance, and Career Counselors and Advisors-Colleges, Universities, and Professional Schools	0.68
Training and Development Specialists	Education Administrators, Postsecondary-Colleges, Universities, and Professional Schools	0.68
Training and Development Specialists	Managers, All Other-Offices of Physicians	0.68

Source: Lightcast; Smart Growth America

## APPENDIX C

### Absorption Index for Top Nuclear Occupations: U.S. Northwest

Nuclear Occupation	Absorption Occupation	Absorption Index
Nuclear Engineers	Nuclear Engineers-Architectural, Engineering, and Related Services	0.73
Nuclear Engineers	Engineers, All Other-Architectural, Engineering, and Related Services	0.66
Nuclear Engineers	Nuclear Engineers-Scientific Research and Development Services	0.64
Nuclear Engineers	Computer Systems Analysts-Scientific Research and Development Services	0.63
Nuclear Engineers	General and Operations Managers-Scientific Research and Development Services	0.63
Security Guards	Security Guards-General Medical and Surgical Hospitals	0.81
Security Guards	Security and Fire Alarm Systems Installers-Investigation and Security Services	0.63
Security Guards	Security Guards-Gambling Industries	0.63
Security Guards	Security Guards-Traveler Accommodation	0.59
Security Guards	Security and Fire Alarm Systems Installers-Building Equipment Contractors	0.55
Nuclear Power Reactor Operators	Managers, All Other-Waste Treatment and Disposal	0.52
Nuclear Technicians	Environmental Science and Protection Technicians, Including Health-Management, Scientific, and Technical Consu	0.84
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Waste Treatment and Disposal	0.82
Nuclear Technicians	Mechanical Engineering Technologists and Technicians-Architectural, Engineering, and Related Services	0.81
Nuclear Technicians	Engineering Technologists and Technicians, Except Drafters, All Other-Scientific Research and Development Servic	0.81
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Machinery, Equipment, and Supplies Merchant Who	0.81
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Basic Chemical Manufacturing	0.83
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Cement and Concrete Product Manufacturing	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Office and Administrative Support Workers-General Medical and Surgical Hospitals	0.79
First-Line Supervisors of Production and Operating Workers	General and Operations Managers-Individual and Family Services	0.78
First-Line Supervisors of Production and Operating Workers	General and Operations Managers-Architectural, Engineering, and Related Services	0.78

Source: Lightcast; Smart Growth America

## APPENDIX D

### Absorption Index for Top Nuclear Occupations: U.S. Midwest

Nuclear Occupation	Absorption Occupation	Absorption Index
Nuclear Engineers	General and Operations Managers-Scientific Research and Development Services	0.63
Nuclear Engineers	General and Operations Managers-Architectural, Engineering, and Related Services	0.62
Nuclear Engineers	Industrial Engineers-Architectural, Engineering, and Related Services	0.62
Nuclear Engineers	Administrative Services Managers-General Medical and Surgical Hospitals	0.62
Nuclear Engineers	Managers, All Other-General Medical and Surgical Hospitals	0.61
Security Guards	Security Guards-General Medical and Surgical Hospitals	0.81
Security Guards	Security Guards-Religious Organizations	0.63
Security Guards	Security and Fire Alarm Systems Installers-Investigation and Security Services	0.63
Security Guards	Security Guards-Gambling Industries	0.63
Security Guards	Security and Fire Alarm Systems Installers-Building Equipment Contractors	0.55
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Machinery, Equipment, and Vehicles	0.81
Nuclear Technicians	First-Line Supervisors of Mechanics, Installers, and Repairers-Support Activities for Air and Space Transportation	0.81
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Cement and Concrete Products	0.80
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Plastics Product Manufacturing	0.79
First-Line Supervisors of Production and Operating Workers	Administrative Services Managers-General Medical and Surgical Hospitals	0.79
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Motor Vehicle Parts Manufacturing	0.79
First-Line Supervisors of Production and Operating Workers	First-Line Supervisors of Production and Operating Workers-Other Fabricated Metal Products	0.79
Electrical Engineers	Electrical Engineers-Architectural, Engineering, and Related Services	0.82
Electrical Engineers	Electrical Engineers-Electrical Equipment Manufacturing	0.74
Electrical Engineers	Architectural and Engineering Managers-Architectural, Engineering, and Related Services	0.65
Electrical Engineers	Industrial Engineers-Architectural, Engineering, and Related Services	0.65
Electrical Engineers	Electrical Engineers-Other General Purpose Machinery Manufacturing	0.65

Source: Lightcast; Smart Growth America