Workers selected for training as a fossil-fueled power plant operator or distributor undergo extensive on-the-job and classroom training. Several years of training and experience are required to become a fully qualified control room operator or power distributor. With further training and experience, workers may advance to shift supervisor. Utilities generally promote from within; therefore, opportunities to advance by moving to another employer are limited.

Extensive training and experience are necessary to pass the Nuclear Regulatory Commission (NRC) examinations for reactor operators and senior reactor operators. To maintain their license, licensed reactor operators must pass an annual practical plant operation exam and a biennial written exam administered by their employer. Training may include simulator and on-the-job training, classroom instruction, and individual study. Entrants to nuclear power plant operator trainee jobs must have strong math and science skills. Experience in other power plants or with Navy nuclear propulsion plants also is helpful. With further training and experience, reactor operators may advance to senior reactor operator positions.

In addition to preliminary training as a power plant operator, distributor, or dispatcher, most workers are given periodic refresher training. Nuclear power plant operators are given frequent refresher training. This training is usually taken on plant simulators designed specifically to replicate procedures and situations that might be encountered working at the trainee's plant.

Job Outlook

Little or no change in employment of power plant operators, distributors, and dispatchers is expected through the year 2010, as the industry continues to restructure in response to deregulation and increasing competition. The Energy Policy Act of 1992 has had a tremendous impact on the organization of the utilities industry. This legislation has increased competition in power generating utilities by allowing independent power producers to sell power directly to industrial and other wholesale customers. Utilities, which historically operated as regulated local monopolies, are restructuring operations to reduce costs and compete effectively and, as a result, the number of jobs is decreasing.

People who want to become power plant operators, distributors, and dispatchers are expected to encounter keen competition for these high-paying jobs. Little or no change in employment and low turnover in this occupation will result in few job opportunities. The slow pace of new plant construction also will limit opportunities for power plant operators, distributors, and dispatchers. Increasing use of automatic controls and more efficient equipment should increase productivity and decrease the demand for operators. Individuals with training in computers and automated equipment will have the best job prospects.

Earnings

Median annual earnings of power plant operators were $46,090 in 2000. The middle 50 percent earned between $37,320 and $54,200 a year. The lowest 10 percent earned less than $28,700, and the highest 10 percent earned more than $62,020 a year. Median annual earnings of power plant operators in 2000 were $48,350 in electric services and $40,160 in local government.

Median annual earnings of nuclear power reactor operators were $57,220 in 2000. The middle 50 percent earned between $50,720 and $67,320 a year. The lowest 10 percent earned less than $46,890, and the highest 10 percent earned more than $74,370 a year.

Median annual earnings of power distributors and dispatchers were $48,570 in 2000. The middle 50 percent earned between $39,880 and $58,290 a year. The lowest 10 percent earned less than $31,760, and the highest 10 percent earned more than $69,260 a year. Median annual earnings in electric services, the industry employing the largest numbers of power distributors and dispatchers, were $49,070.

Related Occupations

Other workers who monitor and operate plant and systems equipment include chemical plant and system operators; petroleum pump system operators, refinery operators, and gaugers; stationary engineers and boiler operators; and water and wastewater treatment plant and system operators.

Sources of Additional Information

For information about employment opportunities, contact local electric utility companies, locals of unions mentioned below, and State employment service offices.

For general information about power plant operators, nuclear power reactor operators, and power distributors and dispatchers, contact:

➤ International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, DC 20005.

➤ Utility Workers Union of America, 815 16th St. NW., Suite 605, Washington, DC 20006.

Stationary Engineers and Boiler Operators

(O*NET 51-8021.01, 51-8021.02)

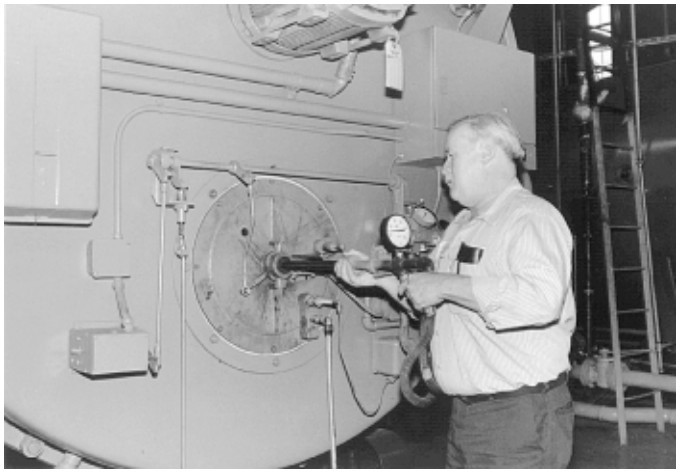
Significant Points

- Job opportunities will be best for workers with computer skills.
- Stationary engineers and boiler operators usually acquire their skills through a formal apprenticeship program or informal on-the-job training supplemented by courses at a trade or technical school.
- A license to operate boilers, ventilation, air conditioning, and other equipment is required in most States and cities.

Nature of the Work

Heating, air-conditioning, and ventilation systems keep large buildings comfortable all year long. Industrial plants often have facilities to provide electrical power, steam, or other services. Stationary engineers and boiler operators control and maintain these systems, which include boilers, air-conditioning and refrigeration equipment, diesel engines, turbines, generators, pumps, condensers, and compressors. The equipment that stationary engineers and boiler operators control is similar to equipment operated by locomotive or marine engineers, except that it is not on a moving vehicle.

Stationary engineers and boiler operators start up, regulate, and shut down equipment. They ensure that it operates safely, economically, and within established limits by monitoring meters, gauges, and computerized controls. They manually control equipment and, if necessary, make adjustments. They use hand and power tools to perform repairs and maintenance ranging from a complete overhaul to replacing defective valves, gaskets, or bearings. They also record relevant events and facts concerning operation and maintenance in an equipment log. On steam boilers, for example, they observe, control, and record steam pressure, temperature, water level and chemistry, power output, fuel consumption, and emissions. They watch and listen to machinery and routinely check safety devices, identifying and correcting any trouble that develops.



Routine maintenance is a regular part of the work of stationary engineers and boiler operators.

Stationary engineers and boiler operators may use computers to operate the mechanical systems of new buildings and plants. Engineers and operators monitor, adjust, and diagnose these systems from a central location using a computer linked into the buildings' communications network.

Routine maintenance, such as lubricating moving parts, replacing filters, and removing soot and corrosion that can reduce operating efficiency, is a regular part of the work of stationary engineers and boiler operators. They test boiler water and add chemicals to prevent corrosion and harmful deposits. They also may check the air quality of the ventilation system and make adjustments to keep within mandated guidelines.

In a large building or industrial plant, a stationary engineer may be in charge of all mechanical systems in the building. Engineers may supervise the work of assistant stationary engineers, turbine operators, boiler tenders, and air-conditioning and refrigeration operators and mechanics. Some perform other maintenance duties, such as carpentry, plumbing, and electrical repairs. In a small building or industrial plant, there may be only one stationary engineer.

Working Conditions

Stationary engineers and boiler operators generally have steady, year-round employment. The average workweek is 40 hours. In facilities that operate around the clock, engineers and operators usually work one of three daily 8-hour shifts on a rotating basis. Weekend and holiday work often is required.

Engine rooms, power plants, and boiler rooms usually are clean and well lighted. Even under the most favorable conditions, however, some stationary engineers and boiler operators are exposed to high temperatures, dust, dirt, and high noise levels from the equipment. General maintenance duties also may require contact with oil, grease, or smoke. Workers spend much of the time on their feet. They may also have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean, or repair equipment.

Stationary engineers and boiler operators work around potentially hazardous machinery such as boilers and electrical equipment. They must follow procedures to guard against burns, electric shock, and exposure to hazardous materials such as asbestos or certain chemicals.

Employment

Stationary engineers and boiler operators held about 57,000 jobs in 2000. They worked in a variety of places, including factories, hospitals, hotels, office and apartment buildings, schools, and shopping malls. Some are employed as contractors to a building or plant.

Stationary engineers and boiler operators work throughout the country, generally in the more heavily populated areas in which large industrial and commercial establishments are located.

Training, Other Qualifications, and Advancement

Stationary engineers and boiler operators usually acquire their skills through a formal apprenticeship program or informal on-the-job training supplemented by courses at a trade or technical school. In addition, valuable experience can be obtained in the Navy or the Merchant Marine because marine-engineering plants are similar to many stationary power and heating plants. Most employers prefer to hire persons with at least a high school diploma, or equivalent, due to the increasing complexity of the equipment with which engineers and operators work. Many stationary engineers and boiler operators have some college education. Mechanical aptitude, manual dexterity, and good physical condition also are important.

The International Union of Operating Engineers sponsors apprenticeship programs and is the principal union for stationary engineers and boiler operators. In selecting apprentices, most local labor-management apprenticeship committees prefer applicants with education or training in mathematics, computers, mechanical drawing, machine-shop practice, physics, and chemistry. An apprenticeship usually lasts 4 years and includes 8,000 hours of on-the-job training. In addition, apprentices receive 600 hours of classroom instruction in subjects such as boiler design and operation, elementary physics, pneumatics, refrigeration, air conditioning, electricity, and electronics.

Those who acquire their skills on the job usually start as boiler tenders or helpers to experienced stationary engineers and boiler operators. This practical experience may be supplemented by postsecondary vocational training in computerized controls and instrumentation. However, becoming an engineer or operator without completing a formal apprenticeship program usually requires many years of work experience.

Most large and some small employers encourage and pay for skill-improvement training for their employees. Training almost always is provided when new equipment is introduced or when regulations concerning some aspect of the workers' duties change.

Most States and cities have licensing requirements for stationary engineers and boiler operators. Applicants usually must be at least 18 years of age, reside for a specified period in the State or locality, meet experience requirements, and pass a written examination. A stationary engineer or boiler operator who moves from one State or city to another may have to pass an examination for a new license due to regional differences in licensing requirements.

There are several classes of stationary engineer licenses. Each class specifies the type and size of equipment the engineer can operate without supervision. A licensed first-class stationary engineer is qualified to run a large facility, supervise others, and operate equipment of all types and capacities. An applicant for this license may be required to have a high school education, apprenticeship or on-the-job training, and several years of experience. Licenses below first class limit the types or capacities of equipment the engineer may operate without supervision.

Stationary engineers and boiler operators advance by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher class licenses. Some stationary engineers and boiler operators advance to boiler inspectors, chief plant engineers, building and plant superintendents, or building managers. A few obtain jobs as examining engineers or technical instructors.

Job Outlook

Persons wishing to become stationary engineers and boiler operators may face competition for job openings. Employment opportunities

will be best for those with apprenticeship training or vocational school courses covering systems operation using computerized controls and instrumentation.

Employment of stationary engineers and boiler operators is expected to decline through the year 2010. Continuing commercial and industrial development will increase the amount of equipment to be operated and maintained. However, automated systems and computerized controls are making newly installed equipment more efficient, thus reducing the number of jobs needed for its operation. Some job openings will arise from the need to replace experienced workers who transfer to other occupations or leave the labor force. However, turnover in this occupation is low, partly due to its high wages. Consequently, relatively few replacement openings are expected.

Earnings

Median annual earnings of stationary engineers and boiler operators were $40,420 in 2000. The middle 50 percent earned between $31,490 and $51,090 a year. The lowest 10 percent earned less than $24,470, and the highest 10 percent earned more than $61,530 a year. Median annual earnings of stationary engineers and boiler operators in 2000 were $46,600 in local government and $37,680 in hospitals.

Related Occupations

Other workers who monitor and operate stationary machinery include chemical plant and system operators; gas plant operators; petroleum pump system operators, refinery operators, and gaugers; power plant operators, distributors, and dispatchers; and water and wastewater treatment plant and system operators. Other workers who maintain the equipment and machinery in a building or plant are industrial machinery repairers and millwrights.

Sources of Additional Information

Information about apprenticeships, vocational training, and work opportunities is available from State employment service offices, locals of the International Union of Operating Engineers, vocational schools, and State and local licensing agencies.

Specific questions about this occupation should be addressed to:

➤ International Union of Operating Engineers, 1125 17th St. NW., Washington, DC 20036. Internet: **http://www.iuoe.org**

➤ National Association of Power Engineers, Inc., 1 Springfield St., Chicopee, MA 01013. Internet: **http://www.powerengineers.com**

➤ Building Owners and Managers Institute International, 1521 Ritchie Hwy., Arnold, MD 21012. Internet: **http://www.bomi-edu.org**

Water and Liquid Waste Treatment Plant and System Operators

(O*NET 51-8031.00)

Significant Points

- Employment is concentrated in local government and private water supply and sanitary services companies.
- Postsecondary training is increasingly an asset as the number of regulated contaminants grows and treatment plants become more complex.
- Operators must pass exams certifying that they are capable of overseeing various treatment processes.

Nature of the Work

Clean water is essential for everyday life. *Water treatment plant and system operators* treat water so that it is safe to drink. *Liquid waste treatment plant and system operators*, also known as wastewater treatment plant and system operators, remove harmful pollutants from domestic and industrial liquid waste so that it is safe to return to the environment.

Water is pumped from wells, rivers, and streams to water treatment plants, where it is treated and distributed to customers. Liquid waste travels through customers' sewer pipes to liquid waste treatment plants, where it is treated and returned to streams, rivers, and oceans, or reused for irrigation and landscaping. Operators in both types of plants control processes and equipment to remove or destroy harmful materials, chemical compounds, and microorganisms from the water. They also control pumps, valves, and other processing equipment to move the water or liquid waste through the various treatment processes, and dispose of the removed waste materials.

Operators read, interpret, and adjust meters and gauges to make sure plant equipment and processes are working properly. They operate chemical-feeding devices, take samples of the water or liquid waste, perform chemical and biological laboratory analyses, and adjust the amount of chemicals, such as chlorine, in the water. They use a variety of instruments to sample and measure water quality, and common hand and power tools to make repairs. Operators also make minor repairs to valves, pumps, and other equipment.

Water and liquid waste treatment plant and system operators increasingly rely on computers to help monitor equipment, store sampling results, make process-control decisions, schedule and record maintenance activities, and produce reports. When problems occur, operators may use their computers to determine the cause of the malfunction and its solution.

Occasionally operators must work under emergency conditions. A heavy rainstorm, for example, may cause large amounts of liquid waste to flow into sewers, exceeding a plant's treatment capacity. Emergencies also can be caused by conditions inside a plant, such as chlorine gas leaks or oxygen deficiencies. To handle these conditions, operators are trained to make an emergency management response and use special safety equipment and procedures to protect public health and the facility. During these periods, operators may work under extreme pressure to correct problems as quickly as possible. These periods may create dangerous working conditions, and operators must be extremely cautious.

The specific duties of plant operators depend on the type and size of plant. In smaller plants, one operator may control all machinery, perform tests, keep records, handle complaints, and do repairs and maintenance. A few operators may handle both a water treatment and a liquid waste treatment plant. In larger plants with many employees, operators may be more specialized and only monitor one process. The staff also may include chemists, engineers, laboratory technicians, mechanics, helpers, supervisors, and a superintendent.

Water pollution standards have become increasingly stringent since adoption of two major Federal environmental statutes: the Clean Water Act of 1972, which implemented a national system of regulation on the discharge of pollutants; and the Safe Drinking Water Act of 1974, which established standards for drinking water. Industrial facilities sending their wastes to municipal treatment plants must meet certain minimum standards to ensure that the wastes have been adequately pretreated and will not damage municipal treatment facilities. Municipal water treatment plants also must meet stringent drinking water standards. The list of contaminants regulated by these statutes has grown over time. For example, the 1996 Safe Drinking Water Act Amendments include standards for the monitoring of cryptosporidium and giardia, two biological organisms that cause health problems. Operators must be familiar with