Dominion®

Nuclear Media Guide

Information on Millstone Power Station
Waterford, Connecticut

How Nuclear Power Is Generated

In a hydroelectric station, the weight of falling water is used to turn a turbine-generator to produce electricity. In a fossil fuel power station, coal, oil or gas burned in a furnace provides heat to change water to high-temperature steam. This intensely hot (about 1,050 degrees Fahrenheit) "energy-filled" steam drives the blades of a turbine, which spins a generator, producing electricity.

In a nuclear power station, the furnace is replaced by a reactor containing a core of nuclear fuel, primarily uranium. Splitting uranium atoms in the reactor produces heat, which is used to make the steam

There are four essential parts of a commercial reactor:

1. The core contains the fissionable uranium fuel in assemblies. Each assembly consists of a number of metal tubes (**fuel rods**) in which there are cylindrical ceramic pellets containing uranium. The assemblies are held in carefully designed geometric arrays by grid spacers. A typical reactor fuel core is cylindrically shaped, about 12 feet in diameter and 12 feet high.

2. The **control system** serves to regulate the rate of fission and, thereby, the rate of heat generation.

3. The **primary cooling system** carries heat away from the fuel assemblies to boil water in the steam generators.

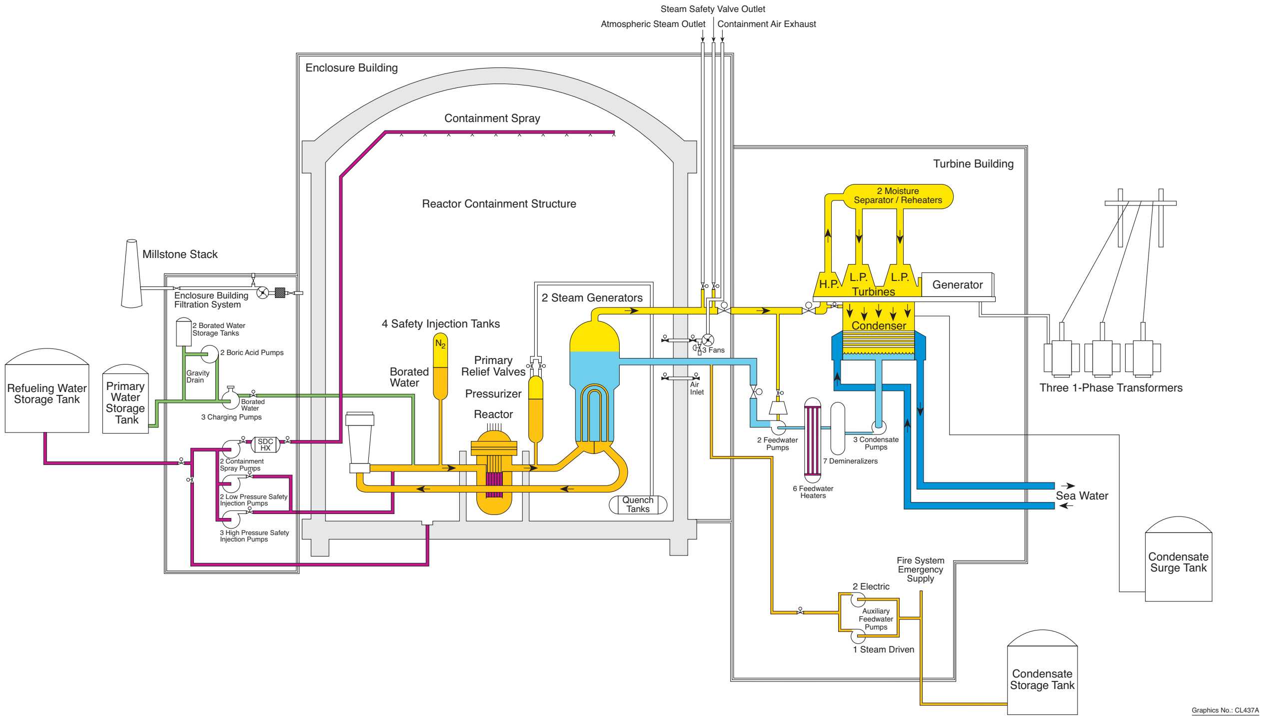
4. **Additional** cooling systems and protection barriers.

All operating commercial nuclear reactors in this country are of the water-cooled variety. Basically, they all work the same way. Water, in a closed cycle separate from the environment, flows through the reactor vessel and among the fuel rods and assemblies. This water carries away the heat that is a product of the fissioning of uranium atoms. The heat converts water to steam, which spins a turbine-generator, producing electricity.

Increasing or decreasing the rate of fission, and, thus, the amount of heat, is accomplished by two methods – inserting or removing control rods, and adjusting the amount of boron in the water. Both the control rods and boron act as fission moderators. A reactor operator can stop the fission process by fully inserting the control rods into the reactor.

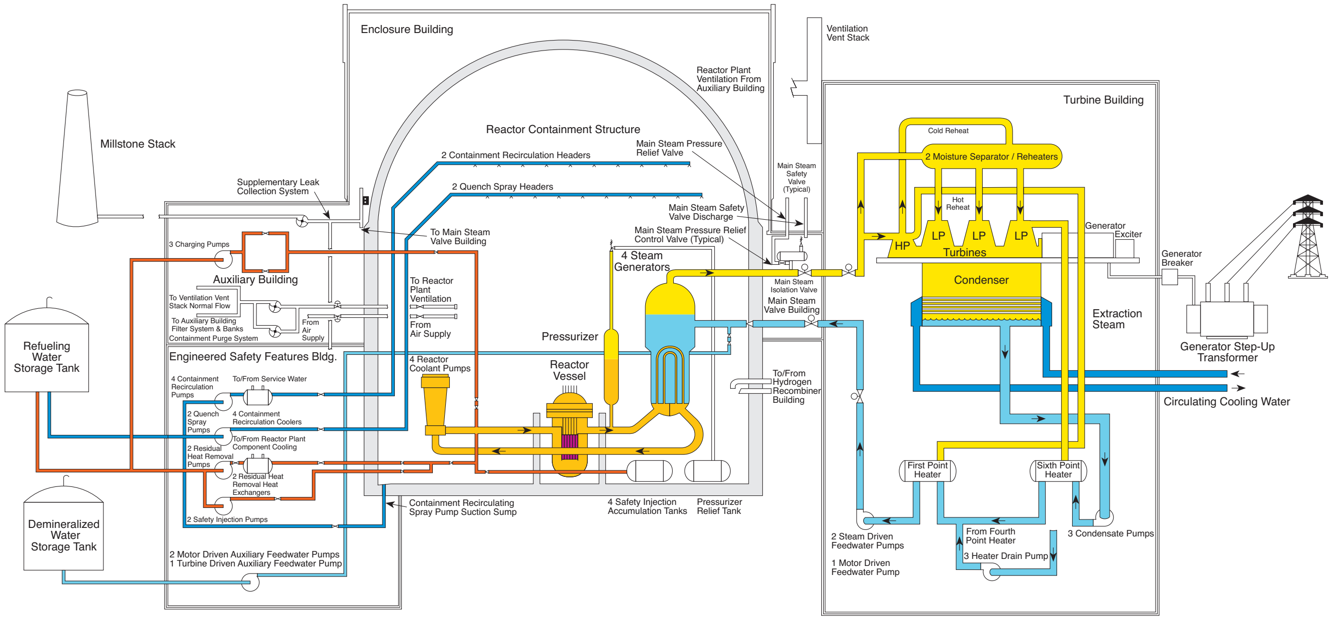
The fission process in a commercial nuclear reactor can never "run away" and cause a nuclear explosion. The fuel design precludes such an occurrence. If primary cooling water is lost from the reactor system, it is possible that the fuel may melt and destroy itself, but it cannot cause a nuclear explosion.

Millstone II



Net Generating Capacity:	884 mwe
Cost:	$424,400,000
Commercial Operation:	December, 1975
Station Employees (Both Units):	1090
Reactor Manufacturer:	Combustion Engineering Inc.
Turbine Generator Manufacturer:	General Electric Company
Engineer/Constructor:	Bechtel Corporation
Containment Walls (Thickness):	3.75 ft.
Steel Liner Thickness:	1/4 inch
Height from base:	176 ft.
Material:	Reinforced Concrete
Reactor Height:	42 ft.
Reactor Diameter:	14 ft.
Steel Wall Thickness:	4 3/8 – 8 5/8"
Number Fuel Assemblies in Reactor:	217
Operating Temperature:	572 degrees F
Operating Pressure:	2,235 psig
Uranium Fuel:	192,000 lbs.

Millstone III



Net Generating Capacity: 1,227 mwe

Cost: $3,770,000,000

Commercial Operation: April, 1986

Station Employees (Both Units): 1090

Reactor Manufacturer: Westinghouse Electric Corp.

Turbine Generator Manufacturer: General Electric Company

Engineer/Constructor: Stone & Webster Engineering Corp.

Containment Walls (Thickness): 4.5 ft.

Steel Liner Thickness: 3/8 – 1/2 ”

Height from base: 201 ft.

Material: Reinforced Concrete

Reactor Height: 44.8 ft.

Reactor Diameter: 14.4 ft.

Steel Wall Thickness: 5 3/8”

Number Fuel Assemblies in Reactor: 193

Operating Temperature: 587 degrees F

Operating Pressure: 2,235 psig

Uranium Fuel: 222,645 lbs

Plant Components and Systems

Primary System

There are two closed coolant systems: the primary and the secondary. The primary system (also called the *reactor coolant system*) consists of water flowing through the reactor vessel to steam generators where heat is transferred to a second coolant loop, the secondary system. This secondary system water boils into steam, which flows to the turbine generator, produces electricity, is condensed back into liquid, and is returned to the steam generators.

Reactor Vessel

The reactor vessel, which houses the core of nuclear fuel assemblies, is made of carbon steel and is lined with stainless steel. It is cylindrical in shape and three to nine inches thick. The fuel assemblies are placed in the vessel in a precise geometric configuration designed to allow the fission process to take place and to efficiently utilize the fissile materials within the fuel.

The vessel also contains control rod assemblies made of a special neutron-absorbing alloy and enclosed in stainless steel. Under a wide range of circumstances, varying from a minor deviation from normal operating conditions to an emergency situation, the reactor will receive a signal to immediately shut down, known as a *trip* or *scram*. If such a signal is received, all the control rods are automatically inserted into the core and the reaction ceases immediately.

Reactor Control

Control of the reactor is accomplished primarily by the introduction of neutron absorbing materials in the reactor system. Boric acid, a neutron-absorbing chemical, is added to the water flowing through the reactor. The control rods are used primarily for startup and shutdown purposes. The role of the water itself in the fission process can also contribute to reactor control. Water, as the moderator, is a necessary part of the fission reaction. If the water is lost, the reaction automatically ceases. Even an increase in temperature, which makes the water less dense, can slow down the fission reaction.

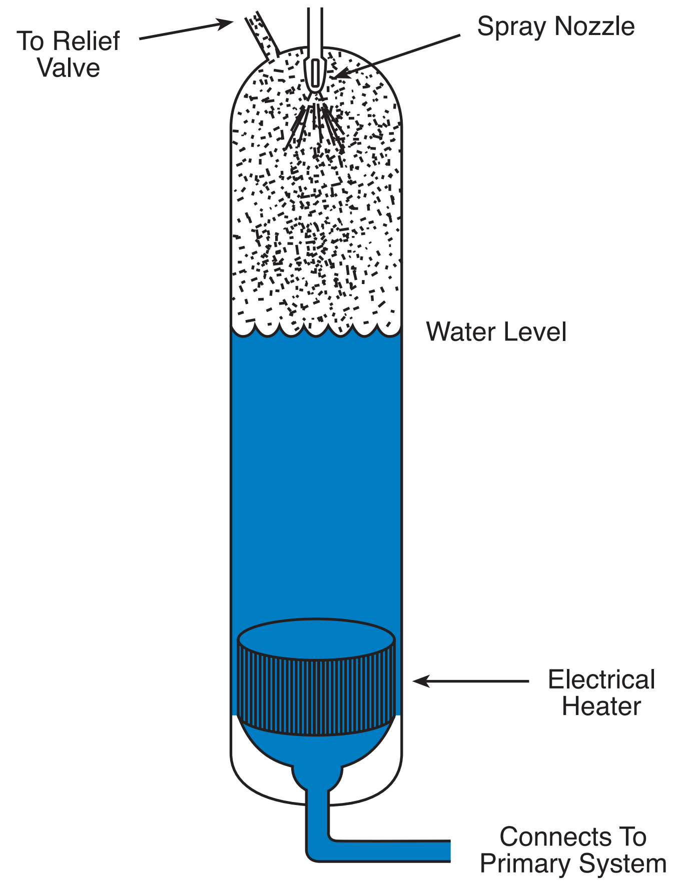
Reactor Protection

Nuclear plants are designed and operated for maximum efficiency; however, conditions, known as *transients*, such as equipment failures, operator error, or external factors (such as storms or loss of electrical power) may cause deviations from normal operating condition. To prevent these transients from affecting public safety, the plants are designed to automatically shut down whenever plant conditions exceed conservatively set operating boundaries. A deviation in power, pressure, temperature, water level, steam flow or coolant flow can cause an automatic shutdown, or trip. The reactor also can be tripped manually if an operator perceives a potentially unsafe condition or one that could damage plant equipment. A reactor trip is accomplished by rapidly inserting the control rods into the reactor core, which immediately stops the chain reaction.

Pressurizer

The primary (reactor) coolant system is kept under high pressure (approximately 2,235 pounds per square inch, or psi) to prevent boiling. This pressure is accomplished and controlled by a component called a pressurizer. Inside the pressurizer, electrical heaters heat the water to a higher temperature than the rest of the primary system, forming a large steam bubble in the top of the pressurizer. This is the only place that steam exists in the primary system, and it always remains in the pressurizer. System pressure can be reduced by sending water through spray nozzles in the top of the pressurizer, which cools the steam bubble and causes some of it to condense. The smaller steam bubble exerts less hydraulic force on the water, lowering system pressure.

Pressurizer



Steam Generator

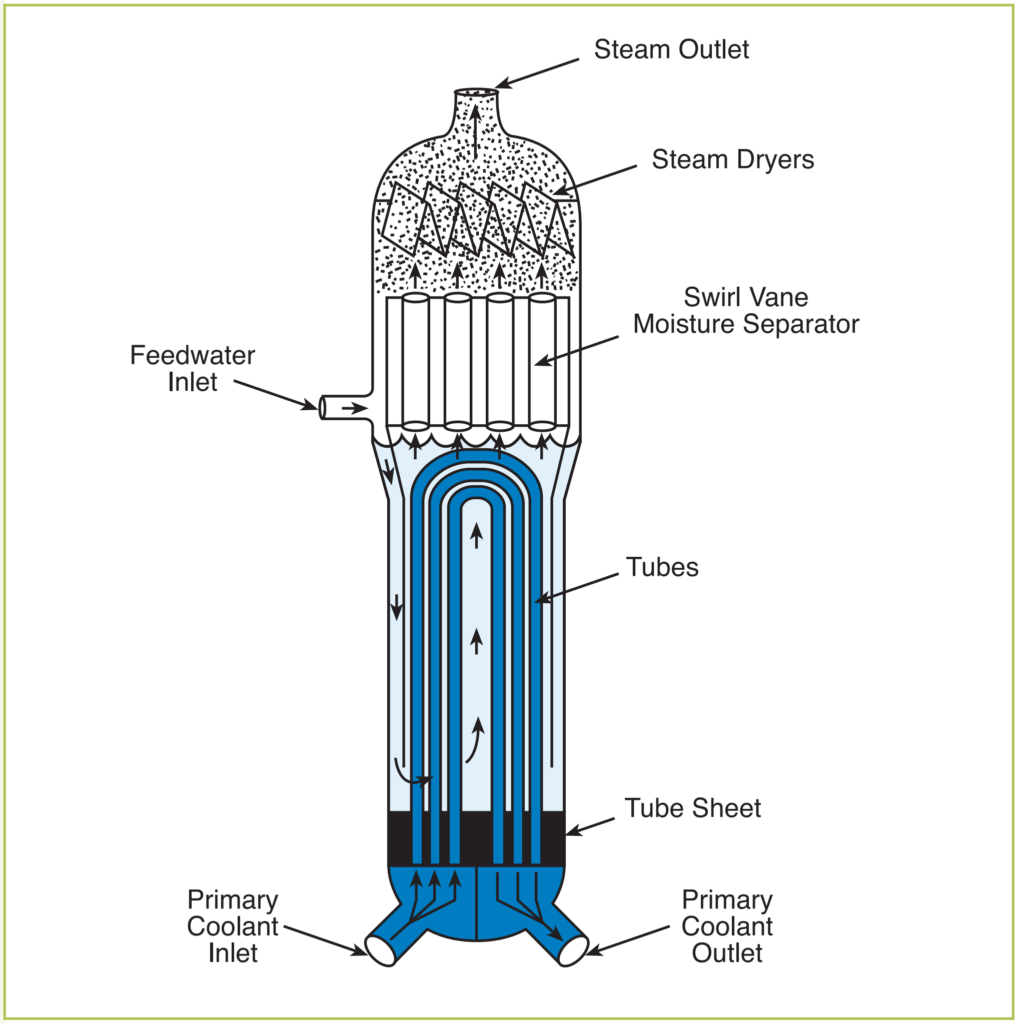
The primary system water is heated to approximately 550 to 600 degrees Fahrenheit (F) as it flows through the reactor core. It then flows to steam generators where it transfers its heat to the secondary system.

The steam generator is simply a heat exchanger between these two systems. Heated primary system water flows through thousands of U-shaped tubes in the steam generator, which serve as a boundary between the two systems. The heat is transferred through the tubes to the secondary system, which boils into steam.

The primary system water is then pumped back into the reactor vessel, approximately 50 to 60 degrees cooler than when it entered the steam generator.

The steam goes through moisture extraction devices, located in the upper area of the steam generator, which dry the steam. At this point, the steam – at approximately 500 to 550 degrees F – is sufficiently dry to go to the turbine generator.

Steam Generator



Reactor Coolant Pumps

Primary system water that has gone through the steam generator is pumped back into the reactor vessel by reactor coolant pumps. These pumps are designed to pump large volumes of water.

Secondary System

Main Steam Isolation Valves

There is one set of main steam isolation valves (MSIVs), located in the main steam lines that close in the event of a high steam flow signal. Because the steam is not a part of the primary system the MSIVs do not serve any containment function; they simply prevent excess steam production in the steam generators.

Turbine Stop And Control Valves

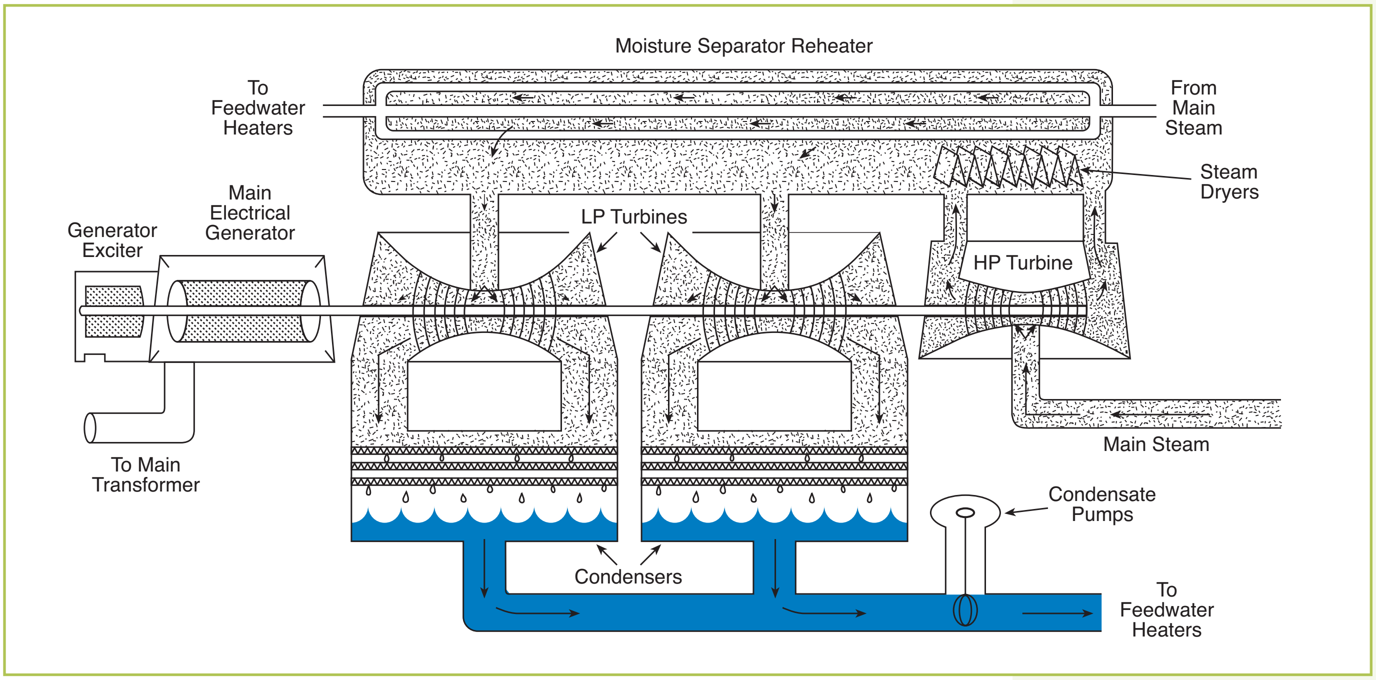
Steam entering the turbine building travels through two sets of valves prior to entering the turbine generator. The turbine stop valves are normally completely opened, but will close on a signal from a variety of systems. The purpose of these valves is to interrupt steam flow to the turbine to prevent it from over speeding when the generator stops generating electricity.

The turbine control valves are normally partially opened during operation. They throttle the steam flow to the turbine and control the steam flow to the turbine.

High-Pressure Turbine

Steam enters the high-pressure turbine casing and hits the blades of several successively larger sets of turbine blades, turning the shaft of the turbine-generator. During operation, the shaft spins at the rate of 1,800 revolutions per minute (RPM), in order to maintain the generator's electrical output at a constant frequency. By the time the steam hits the last stage of the high-pressure turbine, it has lost a great deal of its energy, and has begun to condense.

Turbine Generator



Moisture Separator-Reheater

Moist steam leaving the high-pressure turbine flows to the moisture separator reheater. The steam goes through moisture extraction devices that separate approximately 10 percent of the moisture from the steam. It is then reheated as it passes by hundreds of tubes carrying hot steam tapped off the main steam lines. At this point, the steam is sufficiently dry to go to the low-pressure turbines.

Low-Pressure Turbines

Steam leaving the moisture separator-reheater is sent to either two or three low-pressure turbines (Millstone 2 has two and Millstone 3 has three). It then passes through a series of turbine blades (usually seven or eight sets) attached to the turbine generator shaft, further contributing to the energy of the spinning turbine.

Combined intercept valves between the moisture separator reheater and the low-pressure turbines serve the same purpose as the turbine stop valves: on the proper signal, they close to prevent steam in the moisture separator-reheater from overspeeding the turbine on a loss of electrical generator load.

By the time the steam has passed through the last set of blades, its useful energy has been converted to rotation of the turbines, and it is at a very low temperature (approximately 100 degrees F) and pressure (very close to a vacuum). It is able to remain in steam form at this temperature because of the extremely low pressure. At this point, the remaining task is to condense it back into liquid for reuse in the plant.

Condensers

Below each low-pressure turbine is a condenser containing thousands of long tubes, approximately 40 to 50 feet long and one inch in diameter. Cool water from an outside source flows inside these tubes, while steam exhausting from the turbines condenses on the outside of the tubes and drops to the bottom of the condenser. From there it will be recycled back into the plant. Millstone's outside source of cooling water is Long Island Sound.

Electrical Generator

The electrical generator, attached to the same shaft as the turbines, converts the mechanical energy of the spinning shaft to electrical energy. Inside the generator a large electromagnet spins inside huge coils of wire. The magnetic field moving across the coils of wire produces electricity in the coils. This electricity, with a voltage of approximately 24,000 volts, travels to the main transformer where it is converted to approximately 345,000 volts, suitable for transmission across long distances.

The amount of electricity produced is controlled by the strength of the magnetic field: the stronger the magnetic field, the more electricity is produced. The magnetic field strength is controlled by an adjustable electrical device called the generator exciter. When electricity is produced in the coils surrounding the electromagnet, it produces a magnetic field of its own. The interaction of these two magnetic fields provides a very strong resistance to rotation of the turbine-generator shaft, which is why high-pressure steam is necessary. If the generator suddenly stops producing electricity, this resistance disappears and, if the flow of steam to the turbines continued, an acceleration of the turbine, or over speed, would result. This condition is prevented by an automatic closure of the turbine stop valves and the combined intercept valves.

Condensate And Feedwater

The overall function of the Condensate and Feedwater Systems is to return the condensed steam from the condensers back to the boiling device or steam generators. This water, known as feed and condensate, is purified and reheated prior to being recycled.

Condensate Pumps

The condensate pumps take water from the condensers and pump it into a series of feedwater heaters.

Feedwater Heaters

Condensate goes through a series of five or six feedwater heaters before being sent back to the steam generators to be reboiled. Each heater heats the water to a slightly higher temperature than the previous one. These heaters are similar in configuration to steam generators in that they have U-shaped tubes inside a shell. The condensate flows inside the tubes and is heated by steam outside the tubes, which has been tapped off various stages of the turbine.

By the time the water goes through the last feed water heater, it has been heated to more than 400 degrees F. The preheating of this water greatly increases the overall efficiency of the plant.

Feedwater Pumps

Feedwater pumps send the preheated water back for reboiling in the steam generators. These pumps operate at high pressure and enable the feedwater to overcome the steam pressure in the boiling device.

Feedwater Regulating Valves

The feedwater regulating valves control the flow of feedwater back to the boiling device, enabling operators to maintain a balance between feedwater flow and steam production.

Circulating Water System

The circulating water system pumps cool water from an outside source into the condensers to condense steam. Water is pumped from an intake structure located on the source of water, through tubes in the condensers, and back to the outside water source, somewhat warmer than when it entered the plant.

At Millstone, Long Island Sound is the outside source. After the water flows through the condenser tubes, it flows into what was once the Millstone granite quarry and then into the Sound.

Circulating Water Screens

Because sea water can carry debris that could clog the condenser tubes, the intakes are equipped with devices to clear debris from the water. Trash racks at the intake entrance prevent large debris, such as floating logs and large seaweed, from entering the plant. These racks are cleaned regularly.

Traveling screens filter smaller items, such as seaweed, fish and shellfish. The screens are made of wire mesh with 1/4 to 3/8 inch opening. When enough debris has accumulated on the screens, the screens are cleaned from behind by a pressure spray system.

Circulating Water Pumps

Large circulating water pumps, located in the intake structure, pump cooling water through the condensers in the plant. Millstone 2 has two condensers with four pumps. Millstone 3 has three condensers with six pumps.

Thermal Discharge

The circulating water discharged from the plant has been warmed by the process of condensing the steam. The temperature increase varies between the plants and is dependent upon power output, but is generally in the range of 20 to 40 degrees F. Because warm water has a potential for environmental impact, biological studies have been and continue to be conducted at the plants.

Studies at Millstone have demonstrated minimal environmental impact. Because of its location near the mouth of Long Island Sound, the tidal flow past Millstone is approximately thirty times greater than the flow through the two units. A measurable impact has been detected only in certain seaweed populations directly adjacent to the discharge.

Shutdown Cooling System

When a reactor shuts down, the fuel retains a significant amount of heat even though the fission reaction itself has been stopped. The fuel also generates additional heat through the decay of fission products. Although the heat output is a small percentage of that of normal operating conditions, it is sufficient to require a means of heat removal. During a non-emergency shutdown, the reactor will be placed in either hot-standby or cold-shutdown, depending on the expected duration and the work to be done during the outage.

In hot-standby, the fission reaction is stopped by the insertion of control rods, but the reactor system is maintained at close to normal operating temperature and pressure by removing decay heat at the rate at which it is produced. This allows the plant to resume operation by restarting the fission process without the need to go through a lengthy system heat-up.

When the plant is going to be out of service for several days, or when it is shutting down for refueling, it will be taken to cold shutdown. Heat is removed more quickly than it is being produced, and the temperature of the reactor system is reduced to less than 200 degrees F and 200 psi. This allows for inspection and maintenance of system components.

Shutdown Cooling

Steam bypasses the turbine generator and goes directly to the condensers. This water is returned to the steam generators by the feedwater pumps. Additional cooling, however, is provided by initiating the auxiliary feedwater system. This system takes cool water from a large storage tank and pumps it into the steam generators. The water boils in the steam generators and is then sent to the condenser or vented to the atmosphere. Because this water is coming from the secondary side of the steam generators, it is not radioactive.

If the plant is to taken to cold shutdown, the Residual Heat Removal (RHR) system is initiated when the primary system reaches 300 degrees F. Pumps in the RHR system take water from the primary system, cool it by sending through heat exchangers, and return the cooler water to the primary system. The pumps in this system are also used in the Low-Pressure Safety Injection (LPSI) systems, described later in this section.

Emergency Systems

Some safety systems are designed to provide additional water to the reactor in the event of a loss of its regular supply of coolant water. The objective of the Emergency Core Cooling System (ECCS) is to keep the core covered with water during the entire duration of the event. This prevents significant damage from overheating of the uranium pellets, as well as to the metal fuel cladding that contains them.

Some safety systems and components are designed to provide a physical barrier to the release of radioactivity to the public regardless of conditions inside the plant. These are: 1) the containment building; 2) the reactor coolant system boundary; and 3) the fuel rod cladding, collectively referred to as the three fission product barriers.

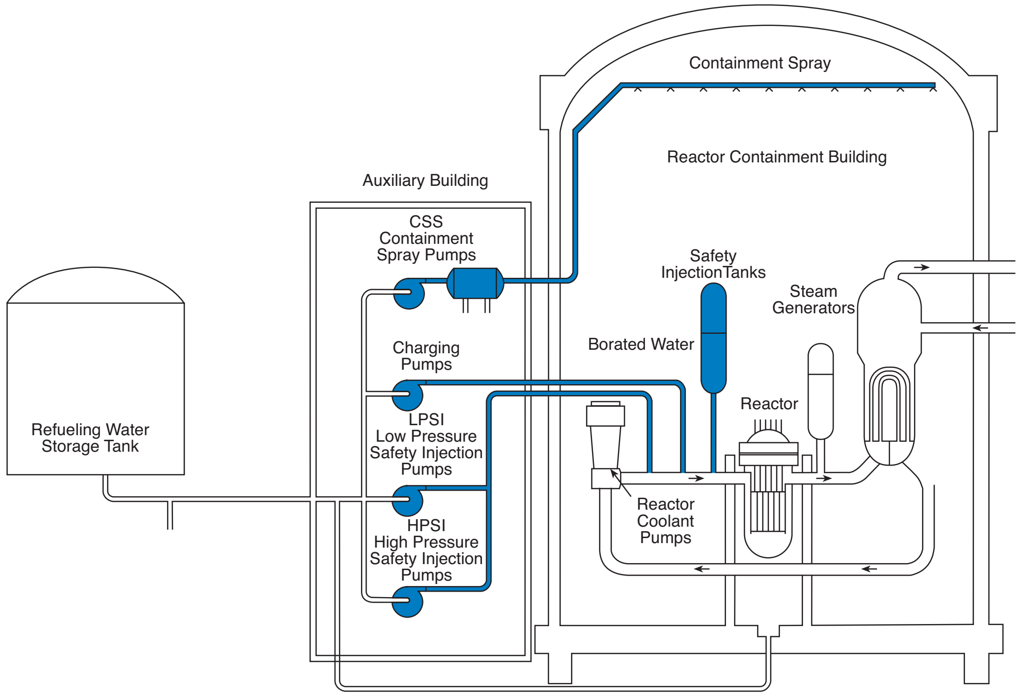
Still other safety systems are designed to reduce/clean up the level of radioactivity in the event it is released to the reactor containment building system or leaks from it. These are the containment sprays, containment air recirculation, standby gas treatment systems, and enclosure building filtration system.

Emergency Core Cooling System

The ECCS provides a backup water supply to the core in the event of a variety of Loss of Coolant Accidents (LOCAs) ranging from a small-break LOCA, in which a small pipe break exists but system pressure remains relatively high, to a large-break LOCA, in which a large pipe break causes a rapid loss of water and system pressure.

The components of the ECCS, like other safety systems, are redundant; that is, any component necessary to keep the core covered under any set of conditions has a backup. This is consistent with the “single failure criteria” design philosophy of the U.S. Nuclear Regulatory Commission (NRC) and the nuclear industry. This philosophy ensures that the public will not be endangered by the failure of a single piece of equipment necessary to mitigate the consequences of an accident.

Emergency Core Cooling System



The function of the ECCS in a PWR is to keep the core covered with water in the event of a LOCA. The reactor at a PWR would "trip" on a number of signals received as the result of a LOCA of any size, and various components of the ECCS would initiate. The systems of the ECCS all draw water with a high boron concentration designed to prevent the fission process from resuming.

Among the components of the ECCS are the charging pumps, high-pressure safety injection, low pressure safety injection, containment spray, water recirculation and accumulator tanks.

Charging Pumps

In the event of a very small leak in the primary system of a PWR, the charging pumps (part of the plant's Chemical and Volume Control System) would supply makeup water to the system. These pumps are capable of injecting water at normal operating pressure, and will supply sufficient water to compensate for any leak too small to depressurize the system to the operating pressure of the high pressure safety injection system (HPSI), described below.

High Pressure Safety Injection System (HPSI)

HPSI is designed to keep the core covered in the event of a small to intermediate break LOCA during which some primary system pressure is maintained and water loss is intermediate. HPSI consists of two pumps that pump borated water from a large refueling water storage tank (RWST), located outside the reactor building, into the reactor vessel. Its operating range varies from plant to plant, but is generally in the range of 600 to 1,700 psi.

Low pressure Safety Injection System (LPSI)

The LPSI system is designed to provide large volumes of water to the core during a large break LOCA in which the primary system is rapidly depressurized and more water is being lost than can be replaced by the HPSI system. It operates at approximately 600 psi or less, and pumps thousands of gallons of water per minute from the RWST into the reactor vessel.

Containment Spray System (CSS)

In the event of a LOCA, steam pressure in containment will increase, and the containment spray system may initiate. Pumps in this system will also take water from the RWST, and spray it into the containment atmosphere. The purpose of this system is to cool and condense steam in the containment, thus lowering pressure within the building. It also would remove some radioactive fission products from the containment atmosphere.

Water Recirculation

The HPSI, LPSI and containment spray systems described above all use the RWST as their primary source of water. Obviously, this tank could eventually be depleted. At that point, or at any point within the emergency operating procedures, these systems can be aligned to take water that has accumulated on the floor of the containment and recycle it though heat exchangers. Thus these systems have a virtually inexhaustible supply of water.

Safety Injection or Accumulator Tanks

PWRs are equipped with safety injection tanks designed to cover the core during the early stages of a large break LOCA. These tanks contain borated water under a pressure of 225 to 650 psi. If primary system pressure drops below that level, the tanks automatically flood the core with thousands of gallons of water without the need for any pumps or other equipment.

Physical Barriers

Fuel Cladding

The fuel rods that contain the uranium pellets provide a barrier to fission product release. These rods, made of either stainless steel or a high-quality zirconium alloy, are pressurized with helium and sealed prior to being placed in the reactor. The cladding, usually about 0.025 inches thick, retains fission products produced on the outside surface of the pellets.

Reactor Coolant System

The reactor coolant system acts as the second barrier to a fission product release. It consists of the reactor vessel itself and associated piping and equipment. The vessel is a high-quality carbon steel container, three to nine inches thick.

In a PWR, the entire primary coolant system is considered part of this barrier.

Containment

The containment building is the final barrier designed to prevent the release of radioactivity from the reactor coolant system to the environment under both normal and the most severe emergency conditions. Therefore, all systems and components that could potentially release large amounts of radioactivity are housed in the containment structure.

Some PWRs, including Millstone 2 and 3, also have an enclosure building around the primary containment to contain any leakage from the primary containment and treat it before release to the environment.

The containments are designed to withstand not only the internal forces generated by a severe accident, but also external forces, such as a tornado, hurricane, plane crash or earthquake.

Electrical Transmission

Electricity coming from the main electrical generator is at a relatively low voltage (approximately 24,000 volts), but with a high current. This current cannot be carried by normal transmission lines without damaging the lines. Thus, it must be transformed to a form more suitable for distribution before leaving the station. The power is carried from the generator to the main transformer through a large hollow conducting pipe rather than transmission lines. This pipe, called the isolated phase bus (or isophase bus, for short), is enclosed within another pipe, and is air-cooled both inside and out to prevent damage to the conductor.

In the transformer yard, electricity from the isophase bus enters the main transformer, where it is transformed from 24,000 volts up to 345,000 volts. At this voltage, the current is low enough to be transmitted via transmission lines, and transmission losses are minimized. The main transformer is cooled by oil, which is itself cooled by a massive array of air fans.

Station Power

Before the electricity enters the main transformer, a small percentage of it is "tapped off" by the normal station service transformer (NSST), where it is transformed from 24,000 volts to a lower voltage. This voltage varies from plant to plant, but is generally in the range of 4,000 to 7,000 volts.

The NSST is the source of electricity for plant equipment when the plant is in a normal operating mode (i.e., the generator is producing electricity). The plant uses approximately four to five percent of the electricity produced by the generator.

If the generator is not producing electricity, plant components get their power from the transmission grid, either through the main transformer and NSST or through the reserve station service transformer (RSST). This transformer takes electricity from the transmission grid and transforms it to 4,000 to 7,000 volts, suitable for "in-house" use.

Emergency Power

If both the NSST and the RSST are ever unavailable, each plant has two redundant onsite sources of backup power to provide all the AC power necessary to handle emergency conditions. Either of the two onsite sources is capable of independently operating the plant's emergency systems. Millstone 2 and 3 have two diesel generators each.

Loss of Normal Power

Loss of Normal Power is the unlikely condition during which all normal off-site and emergency on-site AC power sources are unavailable. Even under these conditions, the plant still has the capability of cooling down. Power to the controls necessary to operate equipment would be provided by the station's DC batteries.

Cooling is provided with the help of a phenomenon called "natural circulation." It makes use of the principle that warm water rises and cool water falls. Water heated in the reactor automatically flows upward to the steam generators. Heat is taken away by the secondary system water in the steam generator. The cooled water flows back downward to the reactor vessel.

In order to maintain the cooling process, however, the water on the secondary side of the steam generators, which boils as it draws heat away from the primary system, must be replenished. This is accomplished by using a steam-driven auxiliary feedwater pump, which takes water from the condensate storage tank and pumps it into the steam generators. Because this pump is driven by steam rather than electricity, it can operate as long as sufficient heat is being produced in the reactor to generate steam.

Control Room

All plant equipment is monitored and operated from the control room — the "nerve center" of the plant. Operators in the control room constantly monitor plant conditions, respond to changes in system parameters and, if necessary, will undertake actions to bring plant conditions under control.

The control building itself, because it is considered part of the emergency system, is capable of withstanding a severe earthquake.

The atmosphere of the control room is carefully controlled, and if a condition existed which made the air outside the control room unsafe, the control room would automatically be isolated. This would ensure that operators could remain in the room to bring any emergency situation under control.

Control Room Operators

Operators at commercial nuclear plants come from a variety of technical backgrounds. The majority have Navy nuclear submarine service and have already received intensive training in all areas of reactor operations, or a college background in engineering.

After joining Dominion, a candidate undergoes intensive training before becoming a licensed commercial nuclear plant operator. He or she begins as a Plant Equipment Operator (PEO), performing various hands on tasks around the plant under the direction of the control room. In addition to on-the-job training, the PEO receives classroom training in plant systems, theory of operation and other related subjects.

After one to two years, some PEOs are selected for the license training program to become a licensed reactor operator. This program includes more than 1,000 hours of instruction of plant systems design and operation. It typically involves 70 weeks of classroom instruction in topics such as reactor theory, thermal hydraulics and nuclear physics; training on a computer simulator, which provides an exact working replica of the control room, plus 13 weeks of on-the-job training under the direct supervision of a licensed reactor operator.

The National Nuclear Accrediting Board reviews and accredits operator training programs under the auspices of the Institute of Nuclear Power Operations (INPO) and its activities are monitored by the NRC. Applicants must undergo a physical examination and be certified physically and mentally fit to be an operator. If the NRC determines that the applicant’s qualifications and physical condition are acceptable, the applicant is scheduled to take the NRC licensing examination.

The examination process begins with a written exam covering reactor theory, thermodynamics, and mechanical components. The site-specific examination consists of a written examination covering the nuclear power plant system, procedures, and administrative requirements, and an operating test that includes a plant walk-through and a performance demonstration on the facility licensee’s power plant simulator.

The operator’s and senior operator’s licenses are only valid to operate the facility on which the applicant was trained and tested. All licensed operators are required to participate in their facility licensee’s drug and alcohol testing programs.

Operator licenses expire six years after the date of issuance or upon termination of employment with the facility licensee. The renewal process requires the applicant to provide written evidence of experience under the existing license. The NRC will renew the license if, on the basis of the application and certifications, it determines that the applicant continues to meet the regulatory requirements.