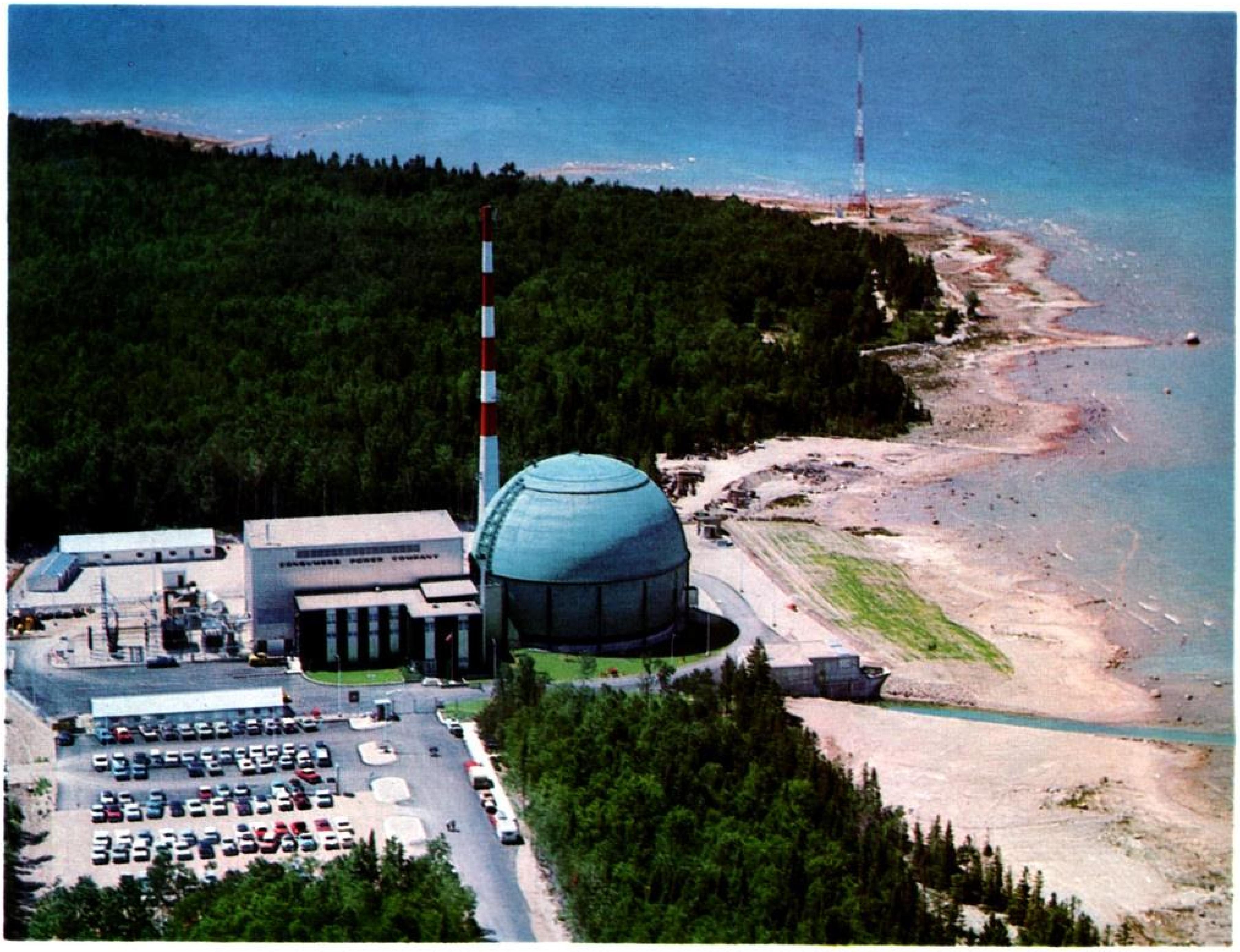


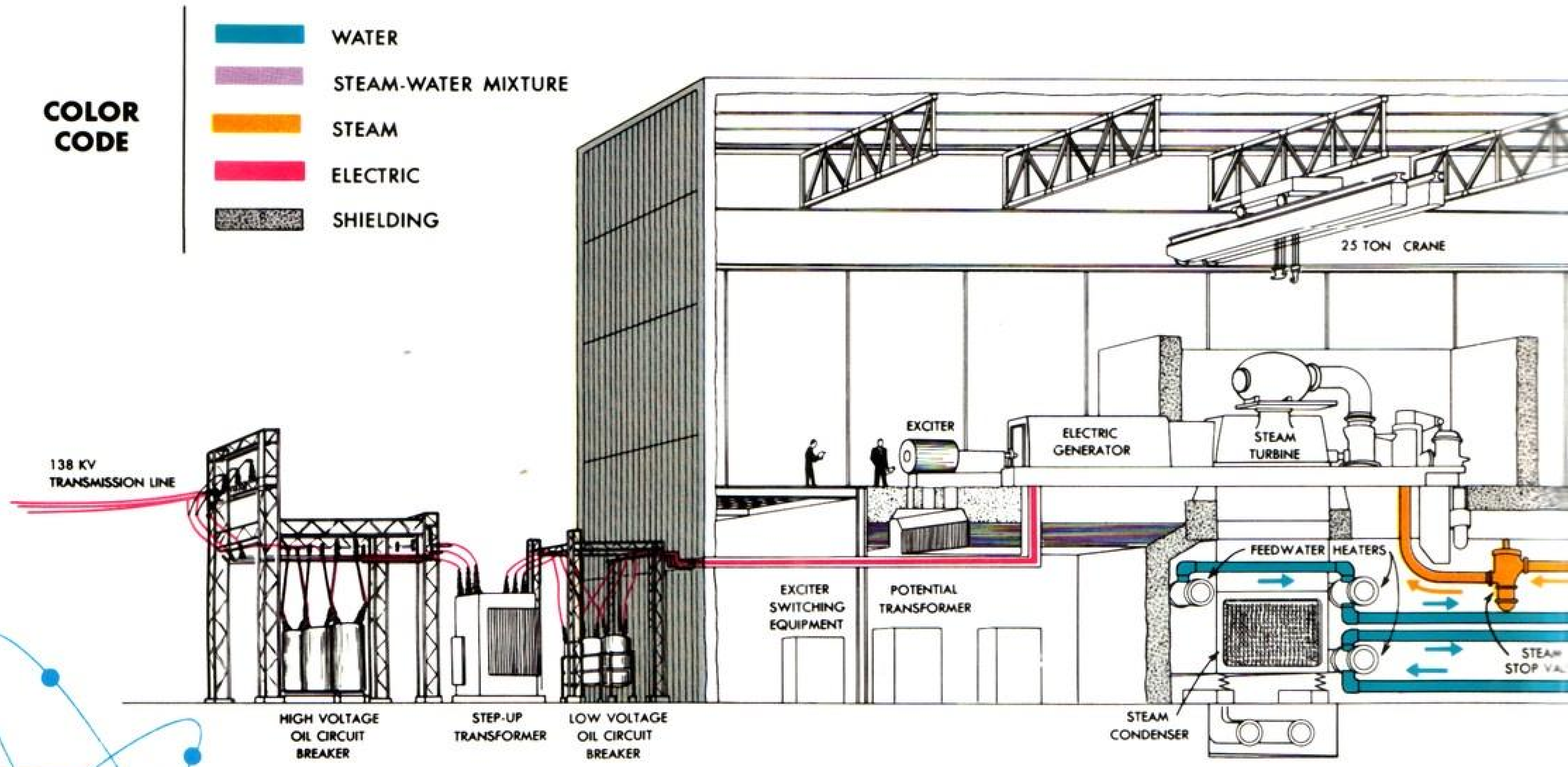
CONSUMERS POWER COMPANY'S

Big Rock Point Nuclear Plant

Five Miles North of Charlevoix, Michigan on U.S. 31

This 'X-Ray View'

SHOWS HOW THE BIG ROCK POINT NUCLEAR PLANT OF



Uranium is the heat source for producing steam to generate

The Big Rock Point Nuclear Power Plant is Michigan's first nuclear electric power plant to go into operation. It was preceded by only four other large-scale nuclear electric power plants in the United States.

This is one of the projects through which the electric industry is learning how to use the energy of the atom most effectively in electric power production. The Big Rock Point Plant utilizes a boiling water, direct cycle, forced circulation, high power density nuclear reactor.

Consumers Power Company, sole owner, has made the plant available for a research and development program to be conducted for the United States Atomic Energy Commission by the General Electric Company with Consumers cooperating. This program will continue until early 1966.

Researchers are trying to extend the life of nuclear fuel. They are seeking to cut the cost of fuel fabrication. They are endeavoring to step up the initial generating capacity of the plant 50 per cent, thus improving the ratio between generating capacity and dollars invested.

These are essential objectives in the effort to make nuclear energy fully practicable as a heat source for the generating of electric power.

Construction at Big Rock Point began in the spring of 1960. A controlled chain reaction was achieved September 27, 1962, and first production of electricity occurred a few weeks later.

Electricity is generated in much the same manner as in a coal-burning or oil-burning electric station. The difference is that uranium, rather than coal or oil or gas, is the source of heat for the production of steam to turn the turbine-generator.

The plant includes a single-cycle forced circulation boiling water reactor instead of a conventional boiler.

While initial capacity was 50,000 electrical kilowatts, the plant is designed for a maximum expected gross capacity of 75,000 kilowatts. Big Rock Point is the largest electric generating station in Michigan north of the Bay City and Muskegon areas.

At the end of the initial research and development period the plant will be available for full-time service as a commercial generating unit, adding important strength to the power supply in the northern part of the Consumers Power Company service area.

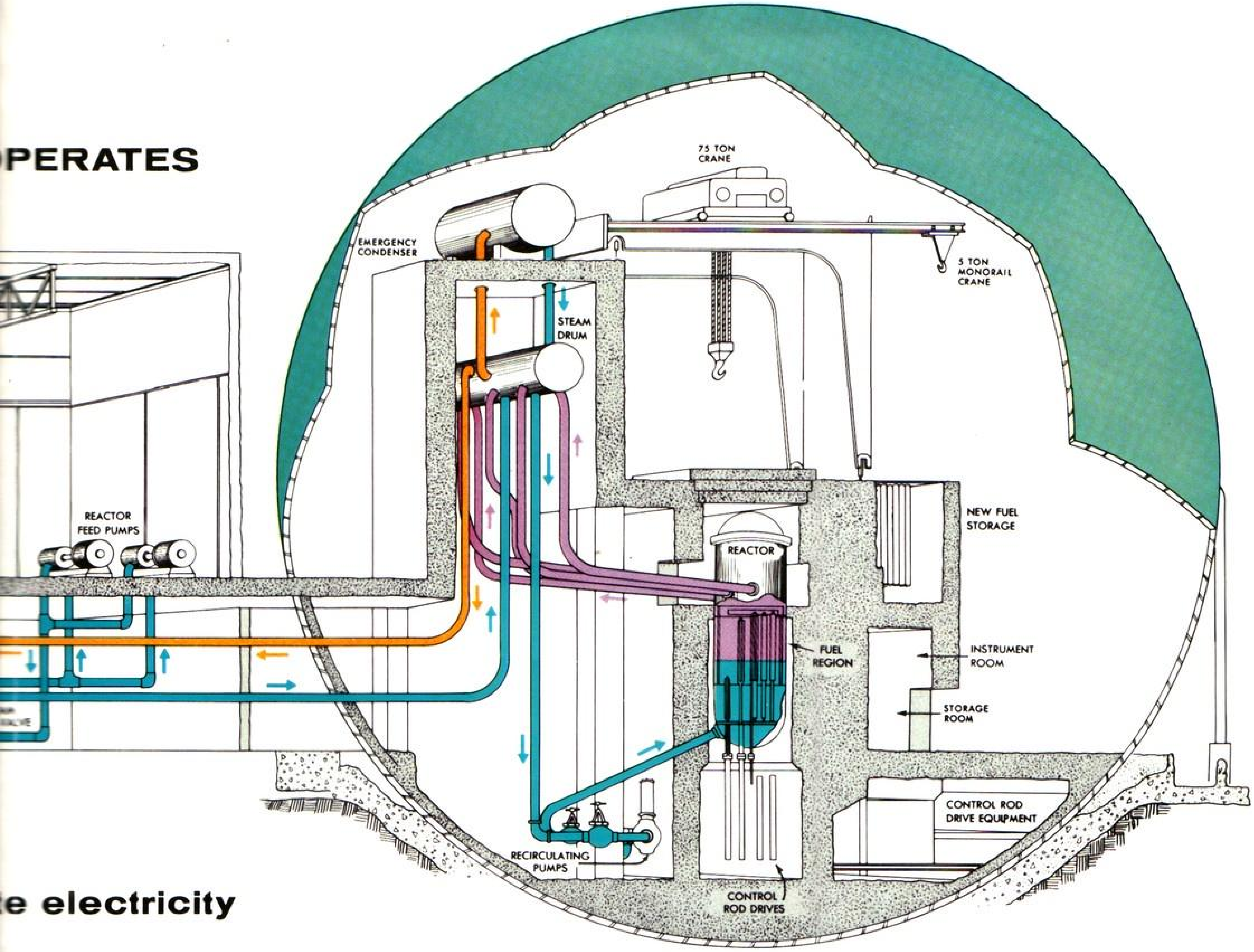
Total cost, including conventional turbine-generator and related facilities, was approximately $27,000,000.

Engineer-constructor was the Bechtel Corporation.

IT IS A SAFE PLANT

Boiling water reactors are inherently safe because they tend to shut themselves down if trouble develops. Safety systems of several types, operating independently of each other, also assure fullest protection to plant personnel, visitors and neighboring residents. These systems were developed and proved through

PERATES



e electricity

construction and operation of boiling water reactors elsewhere in the United States and in Europe.

An additional safety feature is the steel containment sphere enclosing the nuclear reactor. The sphere is 130 feet in diameter, about the height of an 11-story building.

URANIUM OXIDE IN CORE

The power-producing unit is the core. The first core, consisting of 56 fuel bundles, contains approximately 9.5 tons of slightly enriched uranium (about 3.2% U-235) in the form of uranium oxide (UO_2) pellets. A six-foot stack of pellets in a stainless steel tube sealed at each end by welded end-plugs makes up a fuel rod. There are 144 fuel rods per fuel bundle, or 8,064 fuel rods. The power from a single load of fuel will be roughly equal to that which could be generated by burning 260,000 tons of coal.

When the uranium within the core is fissioned it releases heat, causing the surrounding water to boil and form steam.

Fission is achieved and regulated by the movement of control rods out of or into the core, producing an increase or a decrease in power production.

A steam-water mixture leaves the reactor through piping and goes to the steam drum, where water is separated from the steam.

From the drum the steam goes to the turbine which drives the generator. The generator produces electricity at 13,800 volts. This voltage is increased to 138,000 volts in the outdoor substation before the electricity enters the Consumers transmission system.

The steam is condensed back to water by causing it to pass over condenser tubes through which cold water from Lake Michigan is flowing. The Lake Michigan water goes back unchanged to the lake. It never comes in contact with the water in the steam system.

The water that has been condensed from steam is pumped through intermediate heaters back to the steam drum and mixed with the water which was separated from the steam.

The water is taken from the drum and pumped into the bottom of the reactor vessel, closing the cycle.

The reactor system has an initial rating of 607,000 pounds of saturated steam per hour at a pressure of 1050 pounds per square inch. It is capable of supplying 964,000 pounds of saturated steam per hour at a pressure of 1450 pounds per square inch.

The turbine is a General Electric 3600 rpm tandem-compound double-flow condensing unit directly connected with a hydrogen-cooled generator.

At initial capacity, the Big Rock Point Nuclear Plant is capable of supplying enough electricity to meet all the needs—residential, commercial and industrial—of an average city of 65,000 persons.

The Information Center at Big Rock Point

The Information Center at Big Rock Point attracts as many as 10,000 visitors a week during the tourist season.

It includes a small auditorium for explanatory talks and motion pictures.

Closed circuit television enables visitors to observe activity within the plant as it occurs.

While looking at a cutaway scale model, visitors listen by "telephone" to a brief recorded explanation of how the plant operates.

Automatic exhibits, at the press of a button, illustrate the fissioning of the atom, the action of control rods, the generating of electricity.

There is a small gallery of construction pictures.

An observation lobby provides a close-up view of the plant itself, and there is also an outdoor viewing platform with a telescope for looking out over Lake Michigan.

The Information Center is open to the public seven days a week in spring, summer and autumn.

3925 LITHO IN U.S.A.

Big Rock Point Nuclear Plant

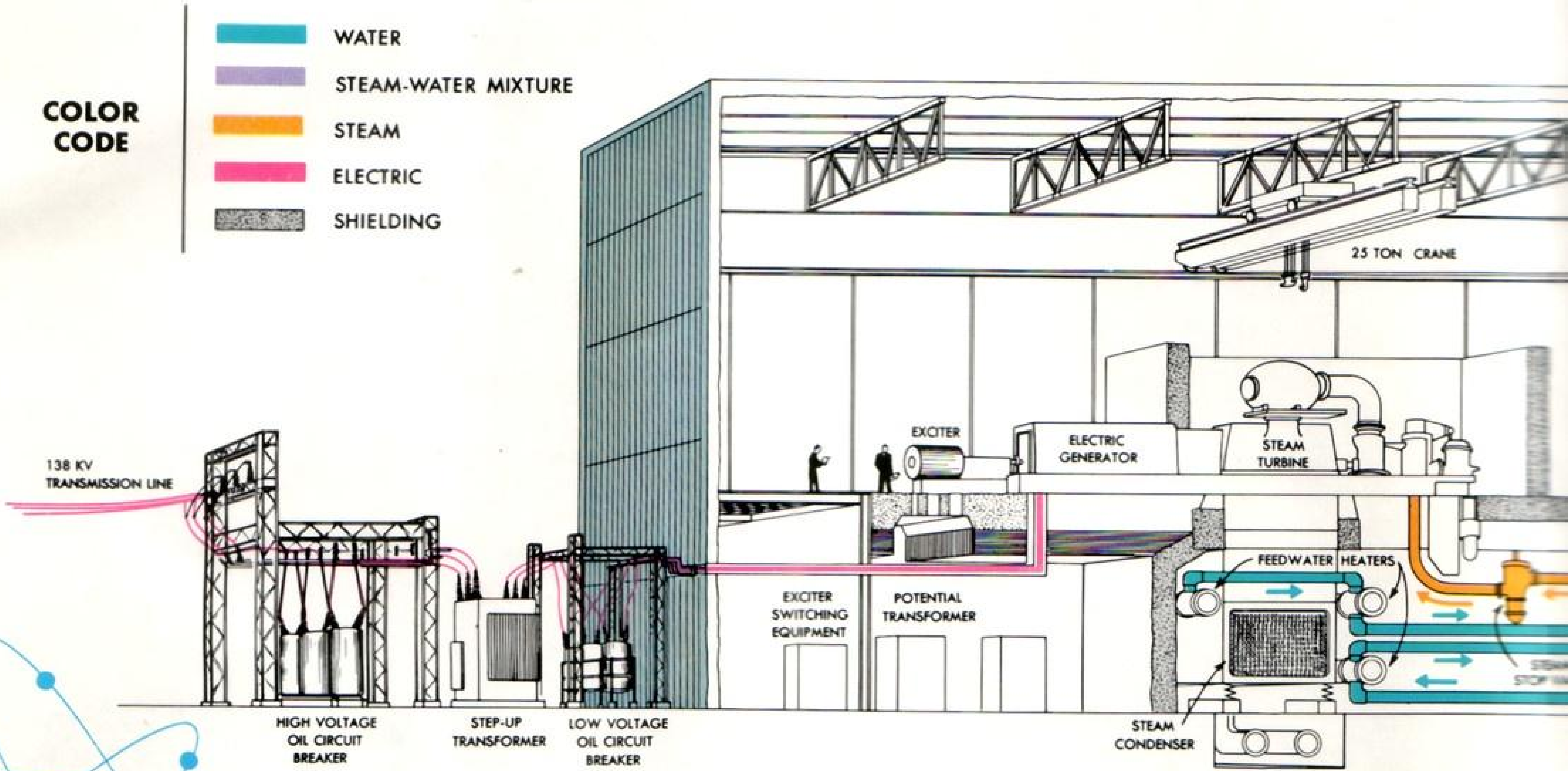
ON LAKE MICHIGAN NEAR CHARLEVOIX, MICHIGAN

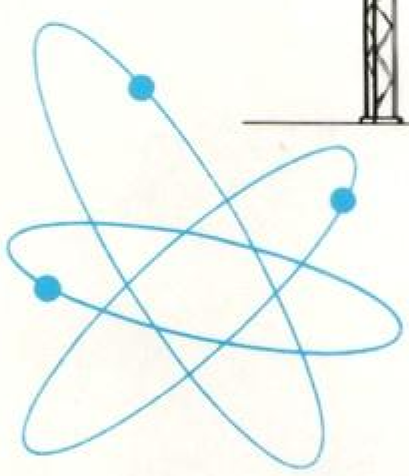
Owned and operated by

Consumers Power

An investor-owned electric and natural gas utility serving 4.2 million Michigan people

HOW THE BIG ROCK POINT NUCLEAR PLANT (





Uranium is the heat source for producing steam t

Electricity is generated in Big Rock Point Nuclear Plant in much the same manner as in a coal-burning or oil-burning electric station. The difference is that uranium, rather than coal or oil or gas, is the source of heat for the production of steam to turn the turbine-generator.

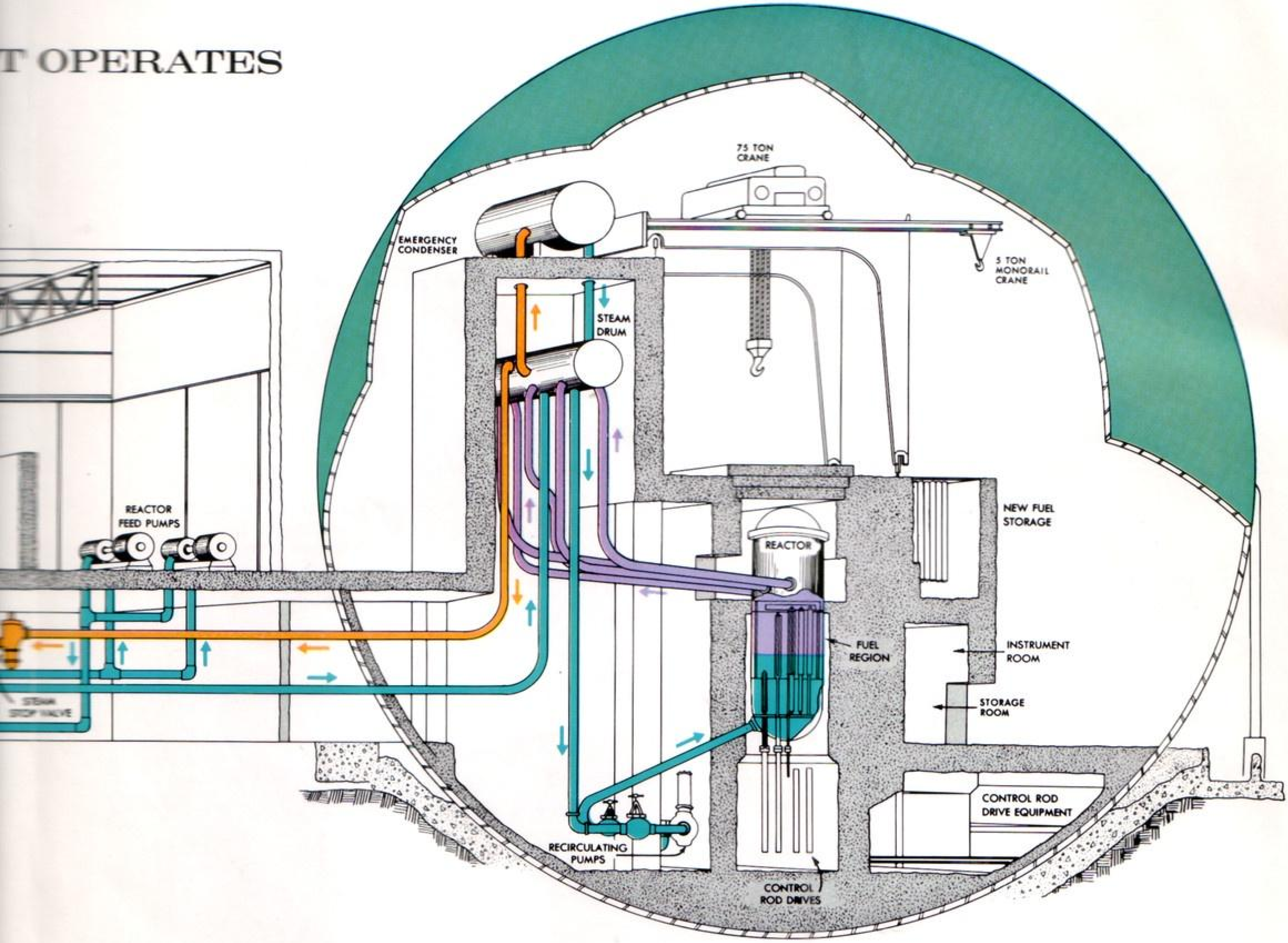
The plant includes a single-cycle forced circulation boiling water reactor instead of a conventional boiler.

The heart of the plant is the core of the reactor, indicated in the diagram by the words "fuel region." It is here that nuclear fission occurs. The core consists of 84 fuel bundles containing approximately 12 tons of slightly enriched uranium (about 3.2% U-235) in the form of uranium oxide (UO_2) pellets. A six-foot stack of pellets in a stainless steel tube sealed at each end by welded end-plugs makes up a fuel rod. There are 144 fuel rods per fuel bundle, or 12,096 fuel rods. The power available from a single load of fuel is roughly equal to that which could be generated by burning 580,000 tons of coal.

When the uranium within the core is fissioned it releases heat, causing the surrounding water to boil and form steam.

Fission is achieved and regulated by the movement of control rods out of or into the core, producing an increase or a decrease in power production.

T OPERATES



n to generate electricity

A steam-water mixture leaves the reactor through piping and goes to the steam drum, where water is separated from the steam.

From the drum the steam goes to the turbine which drives the generator. The generator produces electricity at 13,800 volts. This voltage is increased to 138,000 volts in the outdoor substation before the electricity enters the Consumers transmission system.

The steam is condensed back to water by causing it to pass over condenser tubes through which cold water from Lake Michigan is flowing. The lake water goes back unchanged to the lake. It never comes in contact with the water in the steam system.

The water that has been condensed from the steam is pumped through intermediate heaters back to the steam drum and mixed with the water which was separated from the steam.

The water is taken from the drum and pumped into the bottom of the reactor vessel, closing the cycle.

The reactor system can produce nearly a million pounds of saturated steam per hour at a pressure of 1450 pounds per square inch.

The turbine is a General Electric 3600 rpm tandem-compound double-flow condensing unit.

Engineer-constructor of the Big Rock Point Nuclear Plant was the Bechtel Corporation.

Research and Development Progress

In 1964 the United States Atomic Energy Commission issued a full-term license for the plant, first operation at maximum capacity (75,000 kilowatts) was achieved, and a number of performance tests were successfully completed.

Following the tests, the plant entered the last leg of a 4½-year research and development program preceding full-time commercial operation. Consumers Power Company, the United States Atomic Energy Commission and General Electric Company are cooperating in the research and development program.

The program already has achieved its basic purpose of demonstrating that required amounts of heat for electric power generation can be obtained with less nuclear fuel. Further progress in this direction is expected.

The program also seeks to determine the best over-all operating conditions for the plant. Information is being obtained that will aid in the further development of boiling water reactors and in the general advancement of nuclear power generation as a competitive reality.

Big Rock Point Highlights

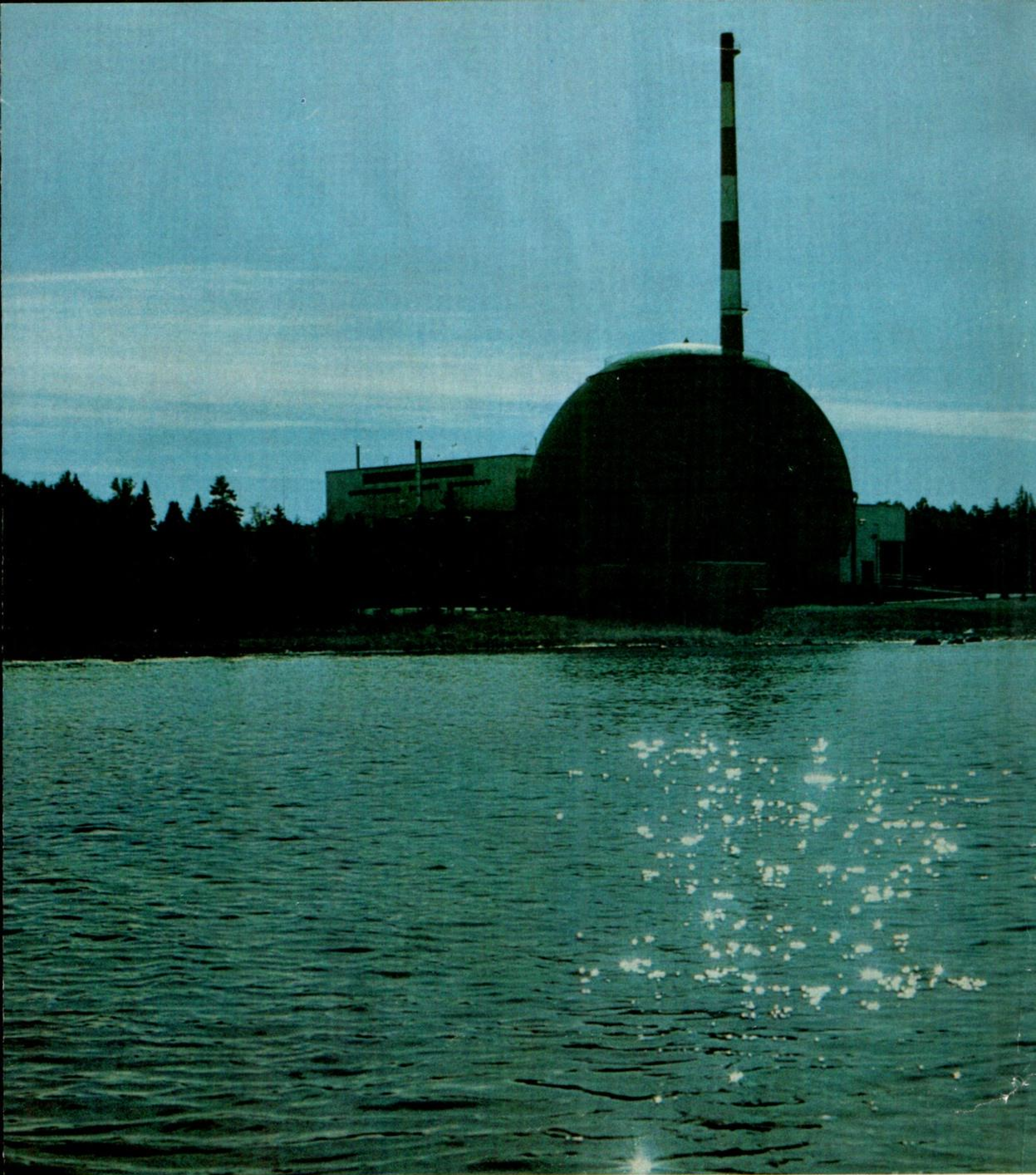
Big Rock Point Nuclear Plant was built by Consumers Power Company on its own initiative and entirely at its own expense. Total cost, including conventional turbine-generator and related facilities, was approximately $27,000,000.

Construction was begun in the spring of 1960 and completed ahead of schedule 29 months later. A controlled chain reaction was achieved September 27, 1962, first production of electricity occurred December 8, 1962, and full initial production was attained March 21, 1963.

Big Rock Point was Michigan's first nuclear electric plant to go into operation. It was preceded by only four other large-scale nuclear electric plants in the United States.

Construction of Big Rock Point and other pioneering nuclear electric plants by investor-owned electric companies has been a factor in bringing nuclear energy to its present state of competitiveness with coal as a heat source for the generation of electric power.

Big Rock Point is the largest electric generating station in Michigan north of the Bay City and Muskegon areas. At maximum expected gross capacity it will be capable of supplying enough electricity to meet all the needs — residential, commercial and industrial — of an average city of 100,000 persons.



Big Rock Point Nuclear Plant

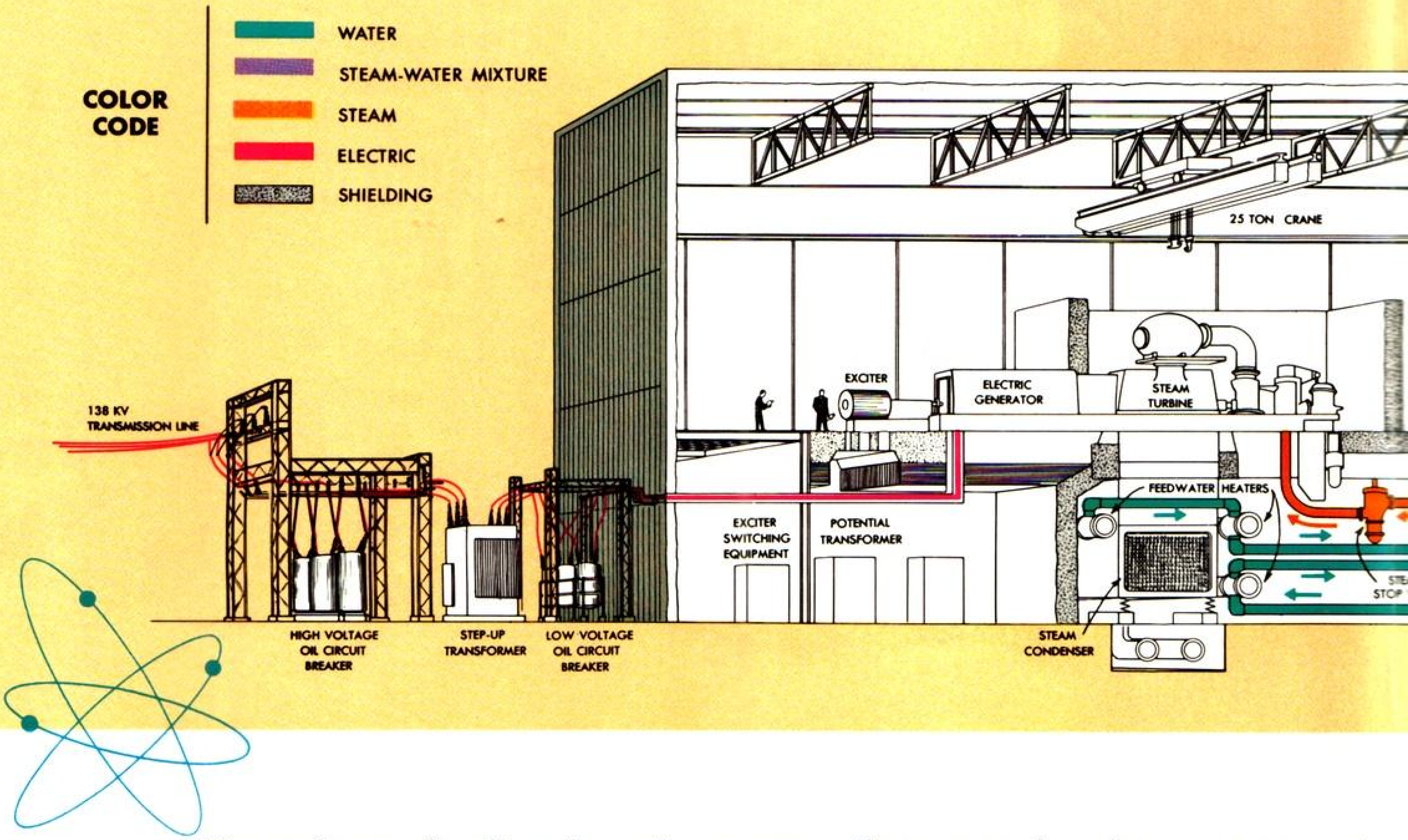
ON LAKE MICHIGAN NEAR CHARLEVOIX, MICHIGAN

Owned and Operated by

Consumers Power Company

An investor-owned electric and natural gas utility serving 4.5 million Michigan people

HOW THE BIG ROCK POINT NUCLEAR PLANT MAK



Uranium is the heat source for producing steam to

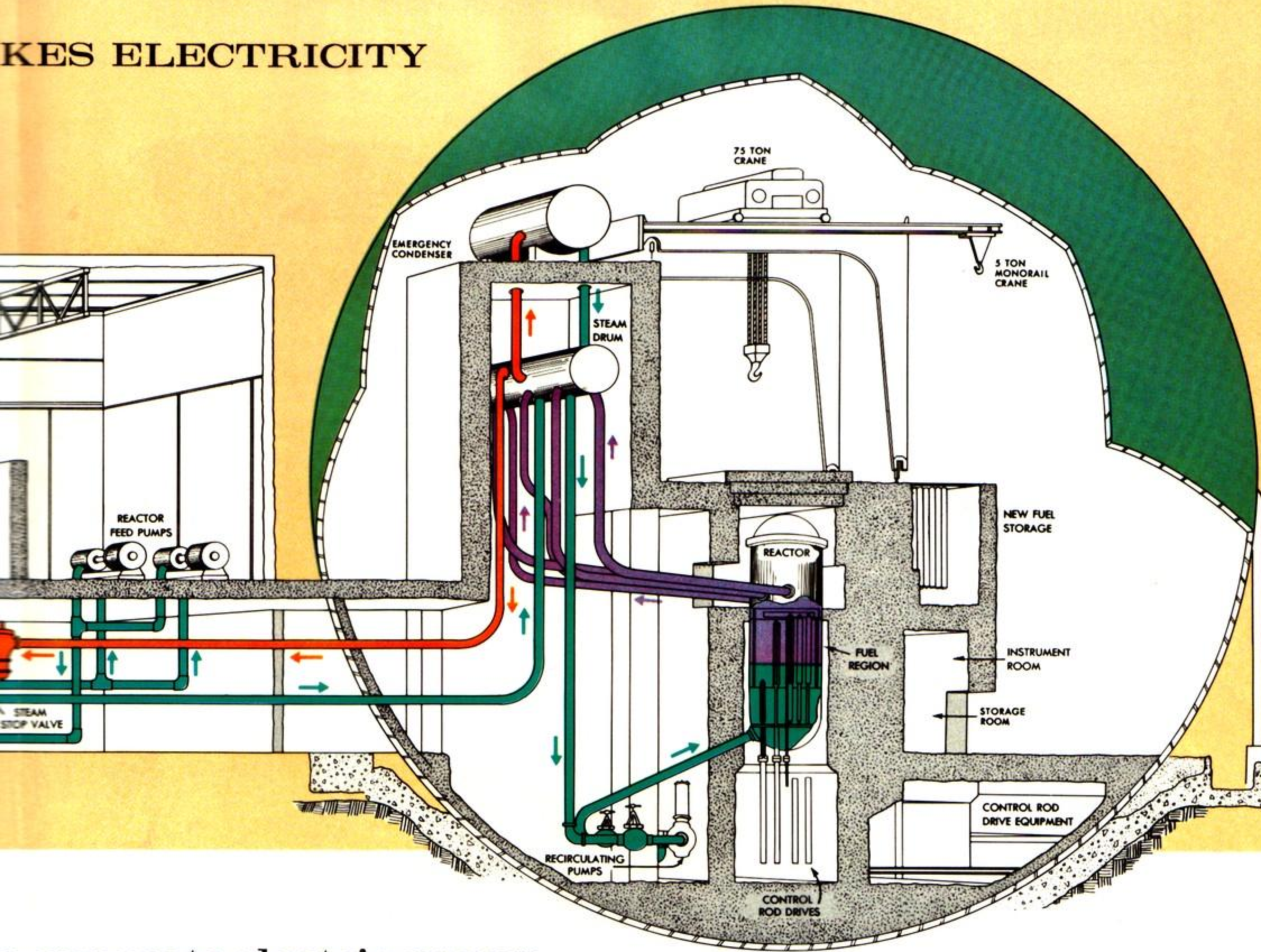
The cut-away diagram is intended to show, in simplified form, how a nuclear power plant makes electricity.

A nuclear plant is very similar to any other steam-powered generating plant. Each must use fuel to make steam. A majority of these plants use coal, oil, or gas (often referred to as "fossil fuels") as a source of heat. The heat brings water to a boil, and the boiling water turns into steam. The steam, in turn, drives a turbine generator, making electricity.

Thus, the only substantial difference between a nuclear plant and any other steam-powered generator is the *source of heat.* This nuclear plant and others that are commercially attractive in competition with steam plants fired with coal, oil, or gas, uses slightly enriched uranium oxide as fuel. This fissionable rather than combustible heat source is particularly unique as it is the cleanest and most concentrated fuel used today by man.

In the diagram, the reactor (which might be called a boiler) can be seen in the center of the containment sphere, at the right of the illustration. It is shaped like an oversize, wide-mouthed jar, or bottle, and is made of steel. Inside the reactor (where water changes to steam-water mixture in the diagram) is the "fuel region" or core. The Big Rock Point core includes 84 bundles of nuclear fuel, each containing 144 stainless steel tubes filled with pellets of uranium oxide (UO_2). These tubes, slightly larger than a man's finger in diameter and six feet long, after loaded with pellets are sealed at each end with welded plugs,

KES ELECTRICITY



o generate electric power.

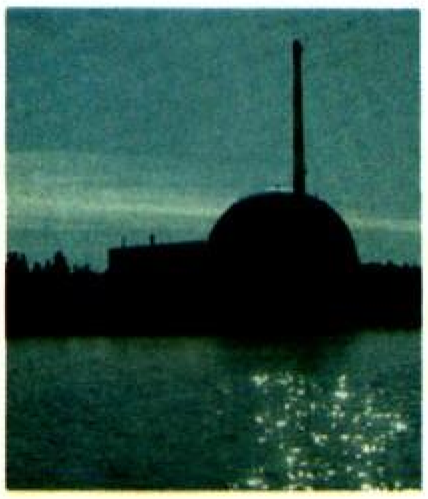
so the nuclear fuel is tightly contained.

These individual fuel bundles, by themselves, produce no heat at all. However, if the bundles are placed in the reactor in a geometric pattern, at exactly the right distance from each other, atomic particles of uranium from one bundle fly out and strike uranium atoms in nearby bundles. The atoms which are struck by these uranimum particles are caused to split, or "fission." The fissioned particles, in turn, fly off and strike other nearby atoms, creating what is known as a "controlled chain reaction."

This atom-splitting, or fissioning, is what causes the water in the reactor to become hot. Water, circulating in the reactor, is turned to steam, and the steam is then conveyed via a steam drum, which removes moisture, to the turbine and thence to the generator, where electricity is made. After turning the generator, the steam is condensed back into water by passing it over condenser tubes through which cold water from Lake Michigan is flowing. The water that has been condensed from the steam is pumped back through the steam drum and eventually goes back into the bottom of the reactor. The lake water meanwhile is returned, unchanged, to Lake Michigan. It never comes in contact with the water in the steam system.

The turbine generator produces electricity at 13,800 volts. This is stepped up ten-fold to 138,000 volts in the outdoor substation before being fed into the Consumers Power 138 kv transmission system.

Big Rock Point Highlights



Big Rock Point Nuclear Plant was built by Consumers Power Company on its own initiative and entirely at its own expense. Total cost, including conventional turbine-generator and related facilities, was approximately $27,000,000.

Construction was begun in the spring of 1960 and completed ahead of schedule 29 months later. A controlled chain reaction was first achieved September 27, 1962. First production of electricity occurred December 8, 1962, and full initial production of electricity was attained March 21, 1963.

In 1964 the United States Atomic Energy Commission issued a full-term operating license for the plant. First operation at maximum capacity (75,000 kilowatts) was achieved in June. Following successful completion of a series of performance tests, the final phase of the initial research and development program at the plant was begun.

In late 1965, the Big Rock Point Nuclear Plant was placed in regular operation as part of Consumers Power Company's electric system.

An extensive research and development program has been carried out at Big Rock, and some projects still continue. In this R&D effort, Consumers Power Company, the United States Atomic Energy Commission and General Electric Company cooperated.

One of the major objectives of the research and development program was to test various types of nuclear fuel and determine how a given quantity of fuel could be made to yield the greatest possible amount of heat. The application of these demonstrations to the design of other plants has helped to improve the performance of other nuclear power plants, and helped to prove the economic feasibility of large nuclear generating stations.

Largely as a result of our experience with Big Rock Point, and the advent of economic nuclear power, Consumers Power Company decided in 1966 to proceed with construction of a major nuclear power plant on the shore of Lake Michigan, about 35 miles west of Kalamazoo. This generating station, to be known as the Palisades Plant, will have ten times the electric output of Big Rock Point. Its initial generating capacity will be 710,000 kilowatts. When it goes into commercial operation in 1970, it will increase the total capacity of Consumers Power Company's electric system by 20 percent.

Big Rock Point, now regarded as a relatively small nuclear plant, nevertheless is the largest electric generating station north of the Bay City and Muskegon areas. At maximum capacity, it is capable of supplying enough electricity to meet the non-industrial needs of an average city of 100,000 persons.

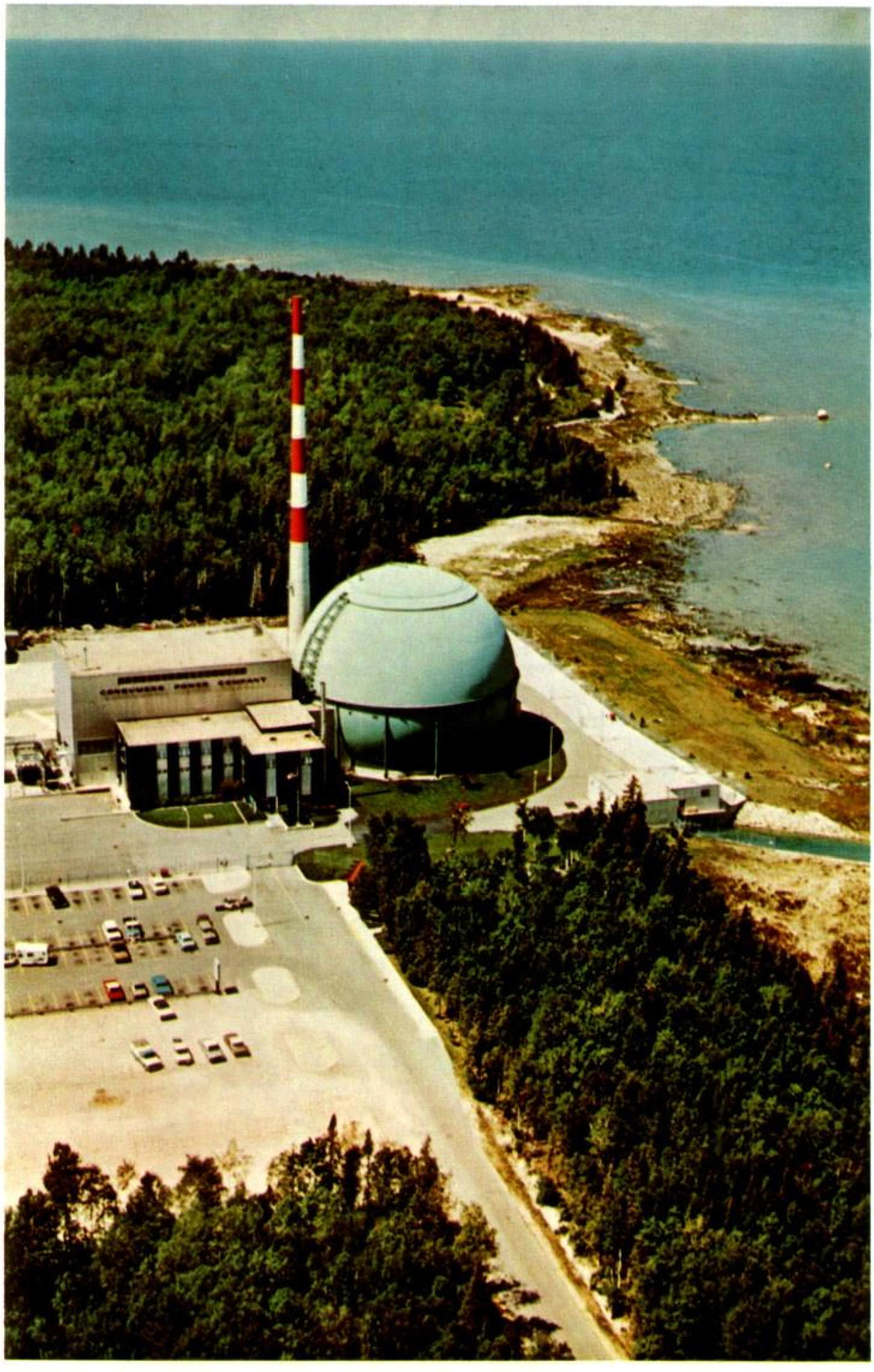
At the time it began operation in 1963, it was the first nuclear plant to produce electricity in Michigan. It was preceded by only four other nuclear electric plants in the entire United States.

On March 30, 1967, a significant milestone was passed when Big Rock Point generated its 1-billionth kilowatt hour of electricity.

Consumers Power Company

Where "CP" stands for Continuing Progress in Nuclear Energy

GENERAL OFFICES: JACKSON, MICHIGAN

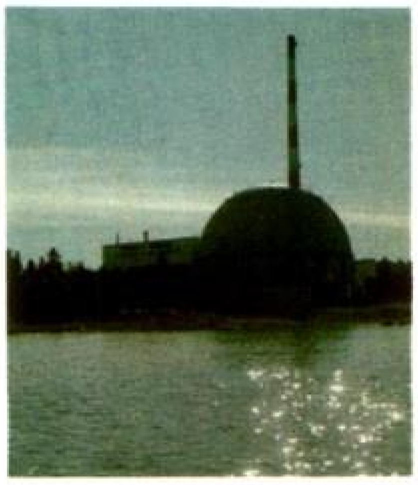


BIG ROCK POINT NUCLEAR POWER PLANT

ON LAKE MICHIGAN NEAR CHARLEVOIX, MICHIGAN

Consumers Power Company

HOW THE BIG ROCK POINT NUCLEAR PLANT MAKES ELECTRICITY



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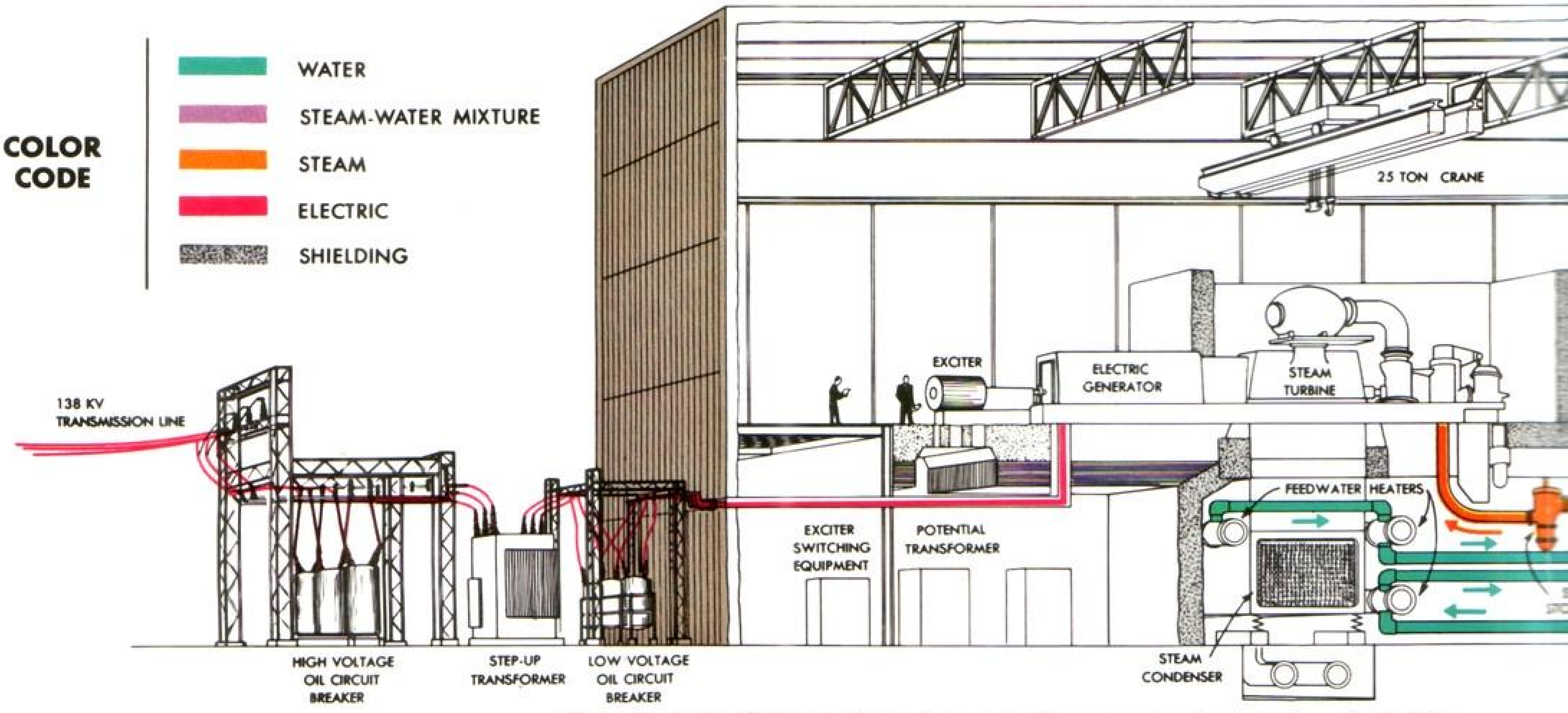
In the diagram, the reactor (which might be called a boiler) can be seen in the center of the containment sphere, at the right of the illustration. It is shaped like an oversize, wide-mouthed jar, or bottle, and is made of steel. Inside the reactor (where water



The cut-away diagram shows how a nuclear power plant makes electricity.

changes to steam-water mixture in the diagram) is the "fuel region" or core. The Big Rock Point core includes 84 bundles of nuclear fuel, each containing 81 zirconium alloy tubes filled with pellets of uranium oxide (UO_2). These tubes, slightly larger than a man's finger in diameter and six feet long after loaded with pellets, are sealed at each end with welded plugs, so the nuclear fuel is tightly contained.

These individual fuel bundles, by themselves, produce no heat at all. However, if the bundles are placed in the reactor in a geometric pattern, at exactly the right distance from each other, atomic particles of uranium from one bundle fly out and strike uranium atoms in nearby bundles. The atoms which are struck by these uranium particles are caused to split, or "fission." The fissioned particles, in turn, fly off and strike other nearby atoms, creating what is known as a "controlled chain reaction."

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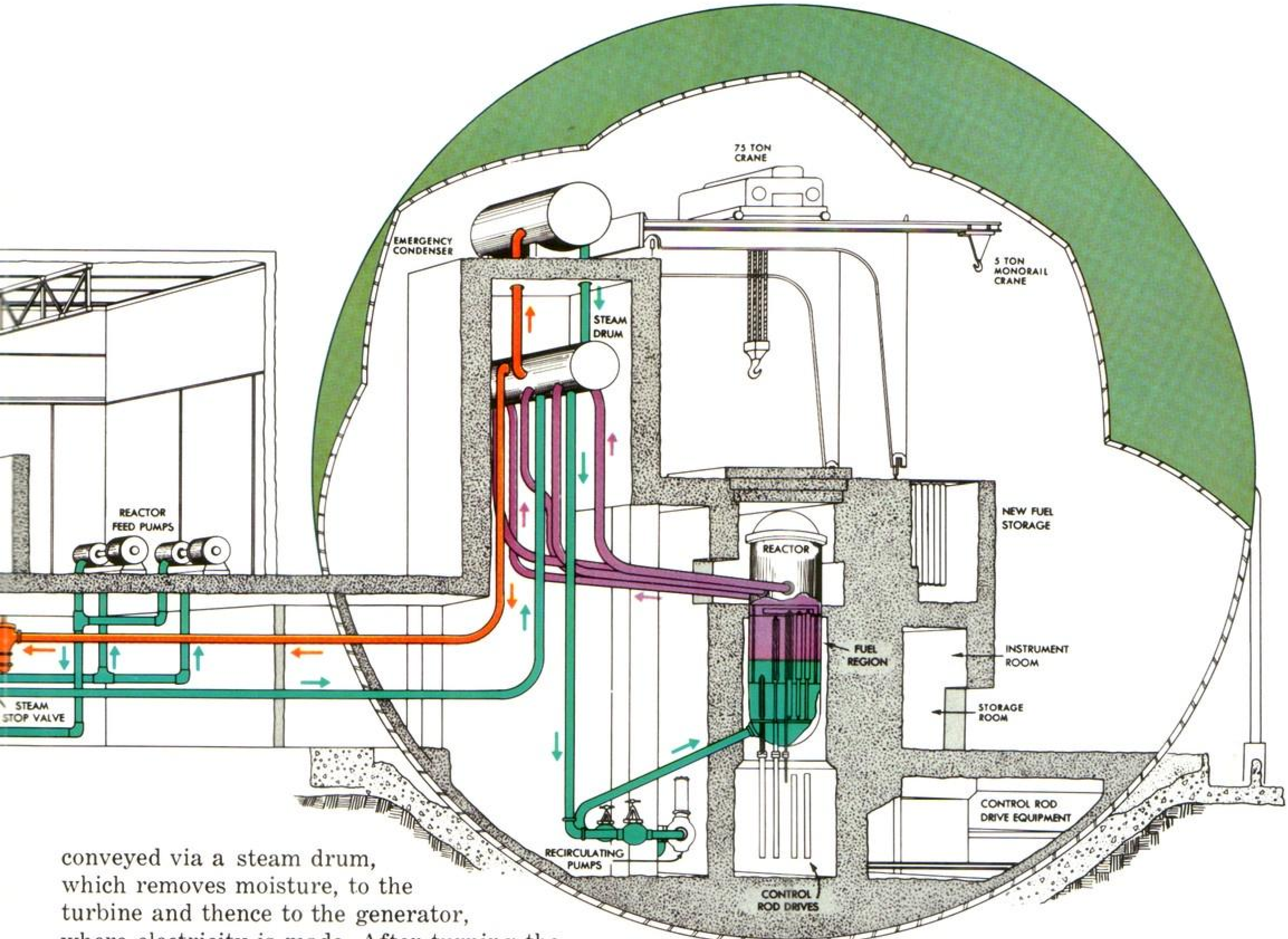

conveyed via a steam drum, which removes moisture, to the turbine and thence to the generator, where electricity is made. After turning the generator, the steam is condensed back into water by passing it over condenser tubes through which cold water from Lake Michigan is flowing. The water that has been condensed from the steam is pumped back through the steam drum and eventually goes back into the bottom of the reactor. The lake water meanwhile is returned to Lake Michigan, slightly warmer, but otherwise unchanged. It never comes in contact with the water in the steam system.

The turbine generator produces electricity at 13,800 volts. This is stepped up ten-fold to 138,000 volts in the outdoor substation before being fed into the Consumers Power 138 kv transmission system.

An artists's rendition of Consumers Power Company's Midland Nuclear Power Plant, to be built near Midland, Michigan.

A three dimensional model of Consumers Power Company's Palisades Nuclear Power Plant, as it will look when completed. It is located on Lake Michigan, about five miles south of South Haven, and 35 miles west of Kalamazoo, Michigan.

BIG ROCK POINT HIGHLIGHTS

Big Rock Point, the first nuclear power plant built by Consumers Power, and the fifth investor-owned nuclear power plant in the nation, achieved its first controlled nuclear reaction September 27, 1962.

ELECTRIC POWER PLUS NUCLEAR RESEARCH AND DEVELOPMENT

On December 8, 1962, the plant began producing electricity. By June, 1964, Big Rock Point reached its maximum capacity — 75,000 kilowatts — and began undergoing performance tests to launch an important research and development program.

This program has been carried forward under sponsorship of the Atomic Energy Commission, with engineers and scientists of the General Electric Company and nuclear engineers of Consumers Power Company cooperating in developing and testing new and more efficient fuel elements. The research and development has yielded valuable experience, and has added appreciably to the technology of nuclear power generation.

While Big Rock Point plant is in regular operation, producing up to 71,000 kilowatts for Consumers Power's electric system, it will continue its research and development mission for years to come.

THOUSANDS VISIT INFORMATION CENTER EVERY YEAR

An attractive Information Center at Big Rock Point has received approximately 600,000 visitors since it first opened in 1962. Descriptive literature and exhibits are displayed in the Information Center, and experienced guides give illustrated lectures explaining how electricity is generated with heat from a nuclear reactor.

NUCLEAR FACILITIES ARE EXPANDING

A second Consumers Power nuclear plant is under construction on the shore of Lake Michigan, 35 miles west of Kalamazoo. This is the Palisades plant, scheduled to begin generating electricity in 1970, with initial capacity of 710,000 kilowatts.

A third nuclear power plant is planned near Midland, Michigan. This will be a dual-purpose plant, capable of generating 1,300,000 kilowatts of electricity and providing large quantities of process steam for industrial use by The Dow Chemical Company.
The Midland plant will have two reactors, each the size of the reactor at Palisades. The first unit is scheduled for operation in 1974, the second in 1975.

Consumers Power Company

Where "CP" stands for Continuing Progress in Nuclear Power

General Offices:
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Jackson, Michigan 49201

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