UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In re: License Renewal Application

Submitted by

Nuclear Management Company, LLC

PINGP, Units 1 and 2

Docket Nos. 50-282 and 50-306

DECLARATION OF PHILIP R. MAHOWALD

1. My name is Philip R. Mahowald. I am General Counsel for the Prairie Island Indian Community in the State of Minnesota.

2. Attached to this Declaration as Exhibit A is a map which shows the lands held in trust by the United States for the benefit of the Prairie Island Indian Community

3. Attached to this Declaration as Exhibit B is a true and correct copy of *Digging in at Prairie Island*, which upon my information and belief, was published in the NSP News on or about September 1967.

4. Attached to this Declaration as Exhibit C is a true and correct copy of *Prairie Island: From antiquity to atoms*, a publication produced by Northern States Power Company.

5. Attached to this Declaration as Exhibit D is a true and correct copy of a July 4, 2008 letter from Ronald C. Schirmer, Ph.D. to Ron Johnson and Mike Wadley.

6. Attached to this Declaration as Exhibit E is a true and correct copy of *Childhood Cancer in the Vicinity of Nuclear Power Plants: The 2007 "KiKK" Study – IPPNW Physicians Issue Warning: "Young children develop cancer more frequently when they live near nuclear power plants (NPP). It has to be assumed that radioactive emissions from NPP stacks are indeed not as harmless as previously believed. Now it is time to act,"* information published by IPPNW/Ulm Physician's Initiative – January 2008.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 18th day of August, 2008, at Welch, Minnesota.

Signed (electronically) by Philip R. Mahowald

____
Philip R. Mahowald

Prairie Island Indian Community
State of Minnesota
County of Goodhue

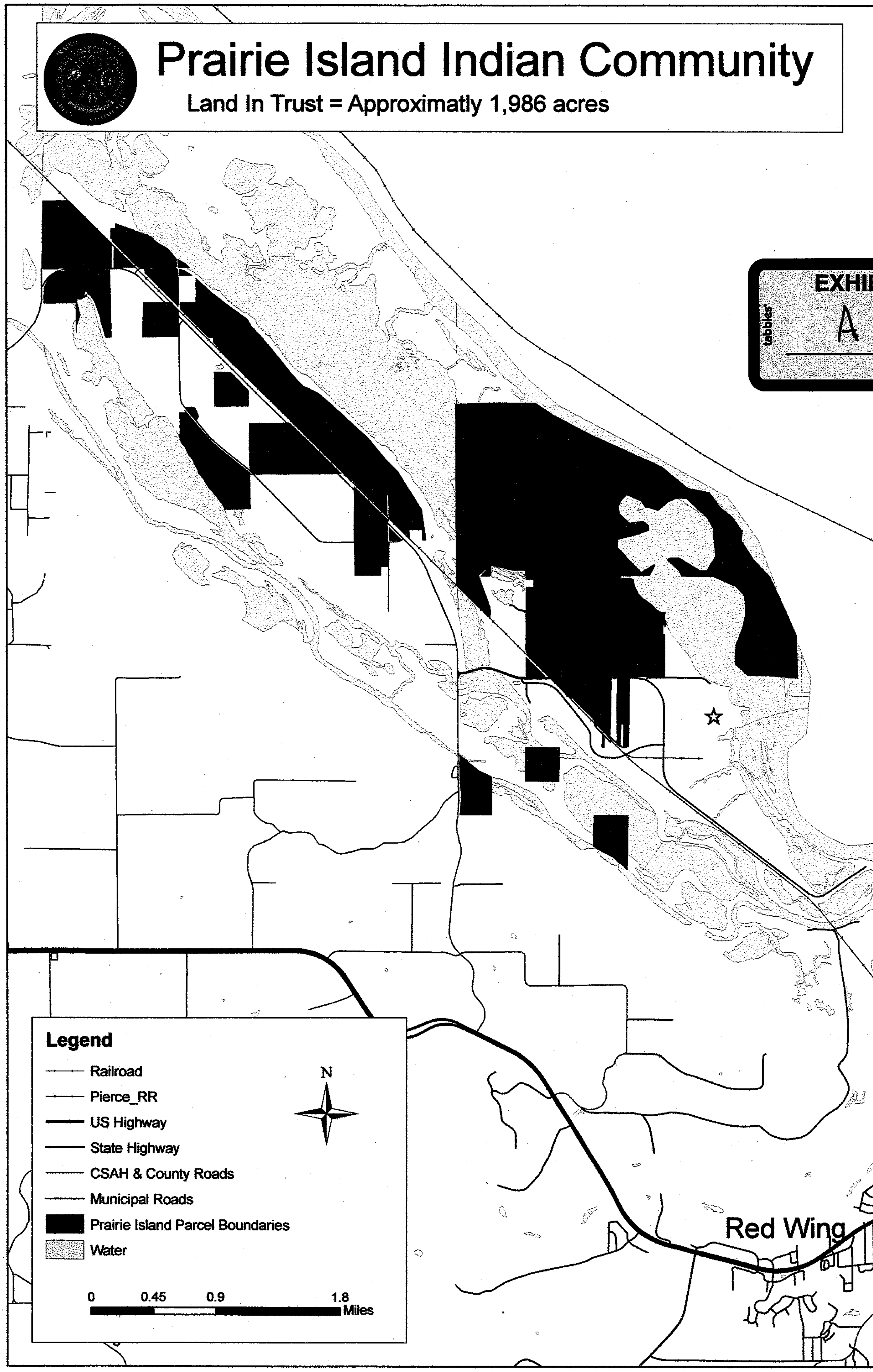

Prairie Island Indian Community
Land In Trust = Approximatly 1,986 acres
Legend
Railroad
Pierce_RR
US Highway
State Highway
CSAH & County Roads
Municipal Roads
Prairie Island Parcel Boundaries
Water
N
0
0.45
0.9
1.8
Miles
Red Wing

EXHIBIT
A

Dr. Johnson looks at a map of Prairie Island while the students screen soil in search of small artifacts.

EXHIBIT
tabbies
B

University of Minnesota archaeology students uncover an ancient firepit, around which an American Indian family once sat to cook its meals.

DIGGING I

NSP is helping to uncover the past before buil[...] for the future at the site of the Compan[...] largest generating plant. The 1.1 million-kilowatt nu[...] clear generating station to be built on Prairie Isl[...] near Red Wing is in an area rich in archaeolog[...] treasures. NSP is underwriting a salvage prog[...] sponsored by the Minnesota Historical Society in [...] effort to find any valuable artifacts before beginni[...] construction of the power plant.

Farming Indians who lived on Prairie Island ab[...] 2,000 years ago left behind a wealth of informa[...] about their culture, according to Dr. Elden Johns[...] Minnesota state archaeologist and assistant prof[...] of anthropology at the University of Minnesota, [...] is directing the Prairie Island project.

The recent archaeological salvage work at the [...] site has produced evidence of two major prehis[...] Indian sites, according to Dr. Johnson. The ea[...] site so far consists of a series of earth burial mou[...]

NSP News 9/1967

...lden Johnson, right, and ... Wystuen, University of Minnesota ... examine a jar handle left ... by Indians who farmed Prairie ... thousand years ago.

Dave Wystuen charts a find while Dr. Johnson supervises the work of other students.

AT PRAIRIE ISLAND

...Dr. Johnson says were probably constructed dur- ...the Middle Woodland period, between 500 B.C. ...300 A.D. The second major site is that of a large ...ge probably occupied between 1200 and 1500 ...by farming Indians.

...e burial mounds are located on and adjacent to ...proposed location of the cooling towers to be built ...e plant. Excavation of these mounds will be done ...e early fall of this year or in the spring of 1968. ...excavations of the village site produced a large ...tity of stone tools and pottery fragments as well ...e remains of large food storage pits. The site dates ...the cultural tradition called Mississippian by ...eologists and is one of the few such sites in Min- ...which remain in an undisturbed condition, ...never been cultivated. Excavation of the ...ssippian village site is planned for later in 1968 ...as it is not in the area of initial construction ...e nuclear generating plant planned by NSP.

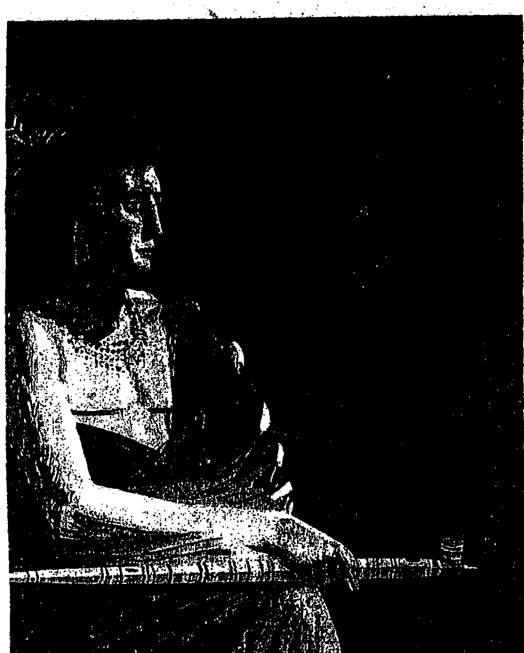
Dr. Johnson is hopeful that in his studies of Prairie Island he will someday find the remains of a trading post built on the island in 1696 by Pierre Le Sueur, the French explorer. The area is rich in general archaeological value, with more than 2,000 prehistoric burial mounds recorded within a five mile radius of the junction of the Cannon and Mississippi rivers. Historic contacts between Europeans and American Indians took place near Prairie Island, and it was near there that Father Hennepin first met the Mdewakanton Sioux.

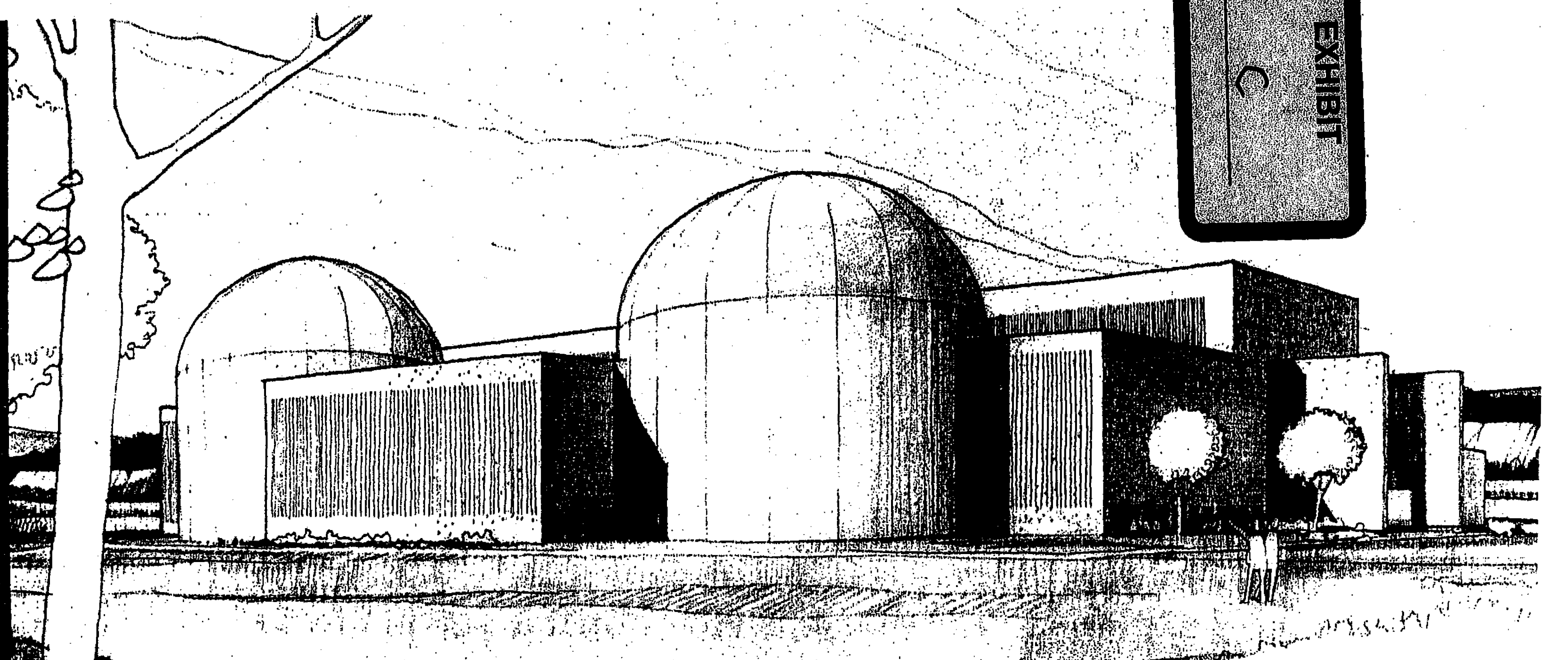
Dr. Johnson has speeded parts of the study by borrowing a trenching machine and operator from NSP. The machine is used to locate large concentrations of artifacts, at which time the careful job of uncovering treasures is taken over by the University of Minnesota archaeology students working with Dr. Johnson. The trencher is "a bit rough," but it saves time in locating a worthwhile digging site.

Prairie Island

From antiquity to atoms

hern States Power Company builds a nuclear electric-generating plant containing two reactors





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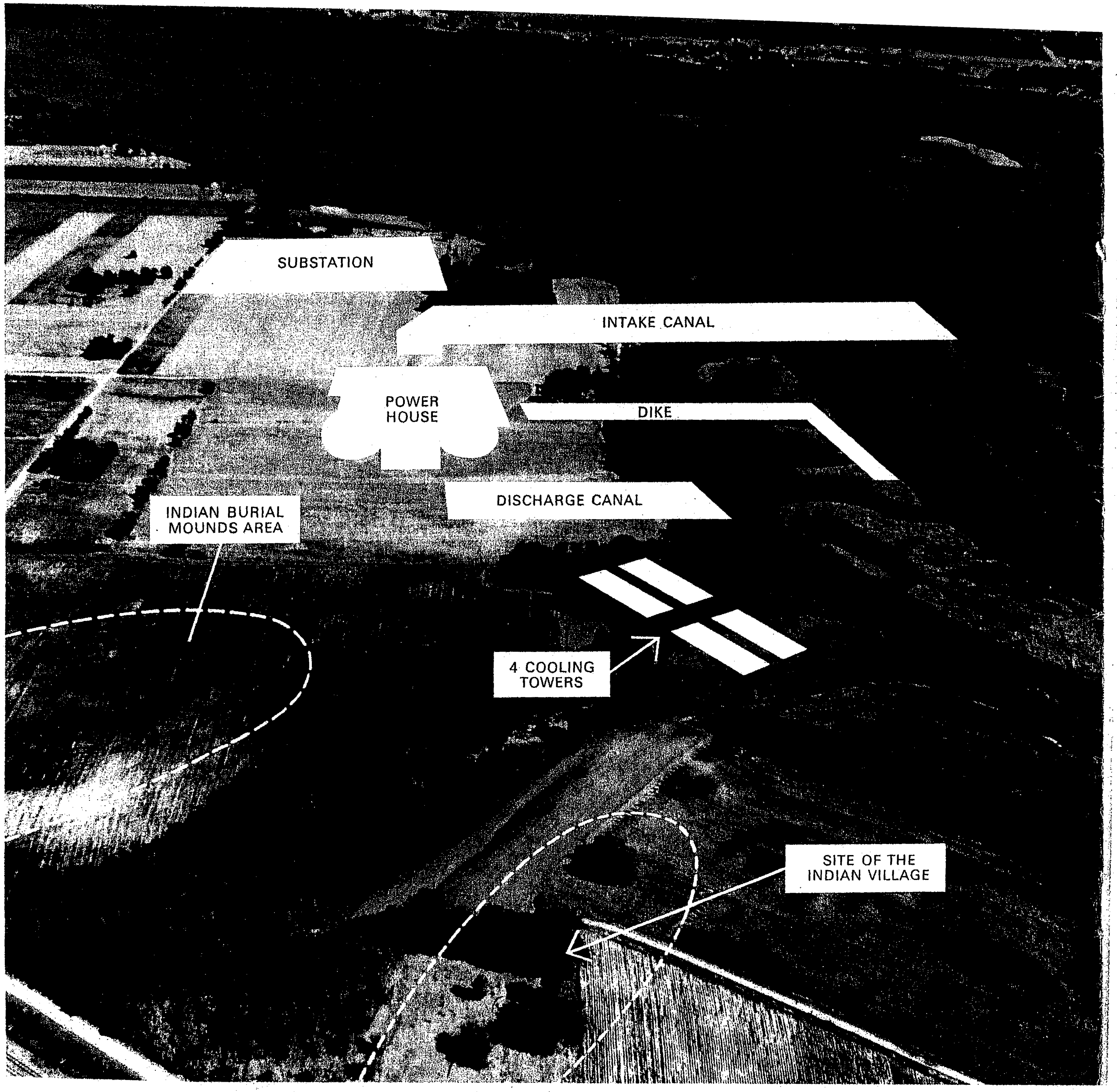


Past, present, and future are represented in this north-looking aerial photo of NSP's grounds at Prairie Island. The company is sponsoring excavation of ancient Indian sites, in foreground, while not far away NSP is building a modern atomic power plant. Location of the plant's main features are outlined in white.

From antiquity to atoms

SINCE EARTH BEGAN, powerful forces have roamed the site where Northern States Power Company is building another nuclear electric-generating plant.

The location is Prairie Island, now an eight-by-two mile peninsula on the Mississippi River 28 miles southeast of the Twin Cities and six miles northwest of Red Wing, Minn.

NSP will begin operating a 545,000-kilowatt plant at Monticello, Minn., in 1970. Construction on the nuclear plant at Prairie Island began in 1968, with one nuclear reactor of 550,000 kilowatts scheduled to start operation in 1972 and the second of 550,000 kilowatts in 1974.

It's part of a world-wide trend toward peaceful harnessing of the atom. In the U.S. alone, 17 atomic power plants were operating, with 16 under construction, and some 50 more plants being designed as of mid-1968.

The story of power at Prairie Island ranges from glowing lava five billion years ago to present-day sandy soil. Wandering Indian-hunters came to the scenic wooded bluffs and flat islands of the upper Mississippi River valley after the last glaciers withdrew, some 11,000 years ago. By about 800 A.D. a group lived part of each year in a small hunting and fishing settlement on Prairie Island.

From 1400-1500 A.D. a different group of Indians lived year around on Prairie Island in a small farming village.

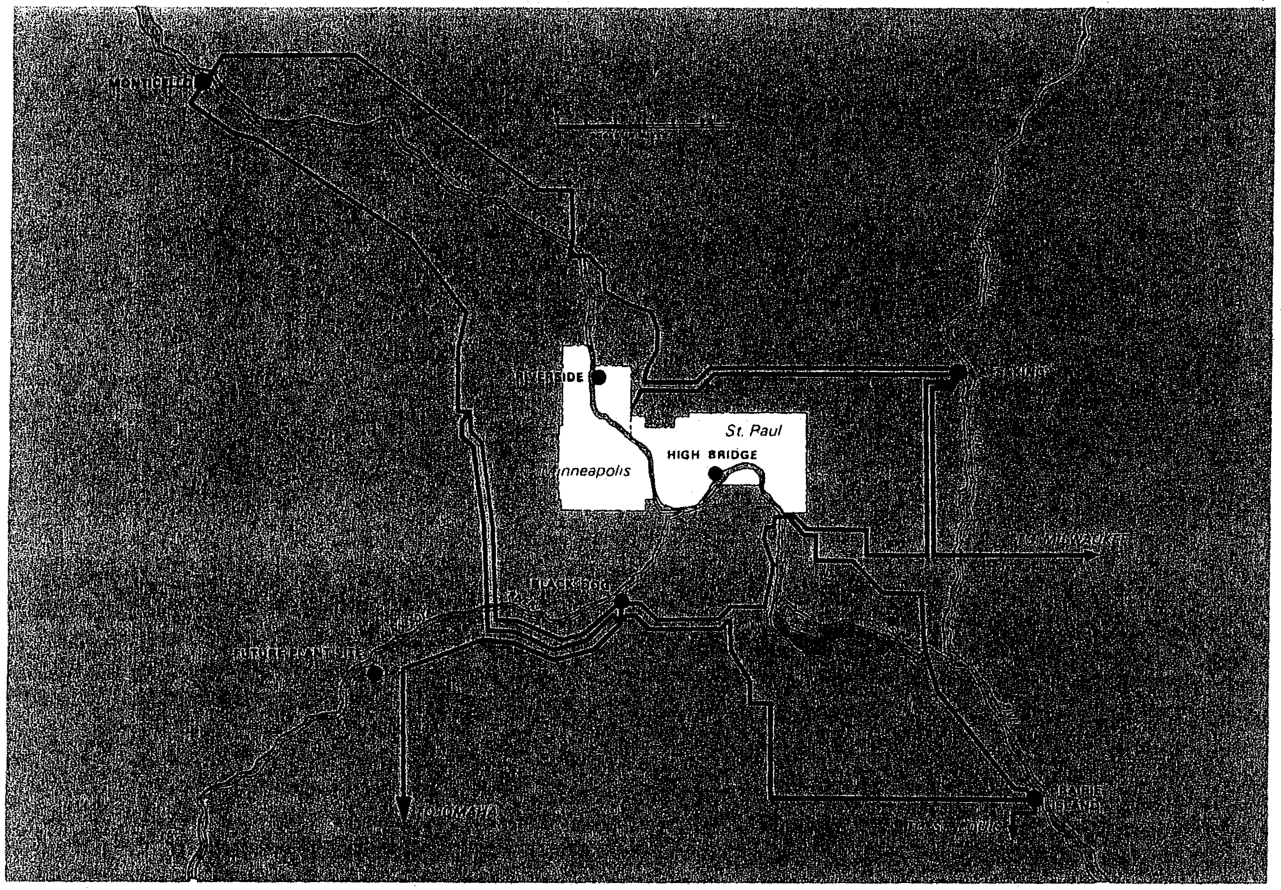
Both of the Indian sites at Prairie Island are on NSP's 560-acre plant grounds. The company is financing a major excavation by the state archaeologist, Dr. Elden Johnson of the University of Minnesota. See page 16.

Prairie Island was a natural stopping place for later Indians and for European explorers. The Frenchman Pierre LeSueur visited the grassy island about 1696 and named it "prairie" ("bald") because he saw relatively few trees.

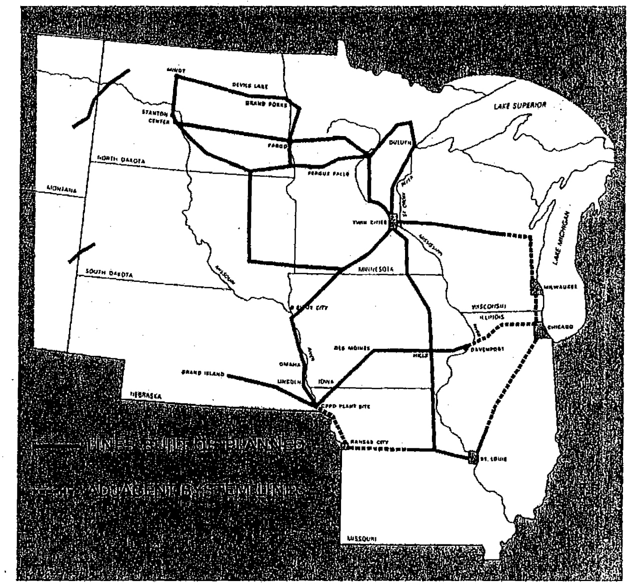
In 1886 some of the Indians who had been ordered to move west after an uprising during the Civil War were allowed back to Prairie Island from their Nebraska reservation. Today, descendants of these Sioux are among the farmers on Prairie Island.

Now NSP plans the most exciting change at Prairie Island since man first left footprints in its sandy shore. More power, benefitting more people, will be created by NSP than any Indian medicine men or French voyageurs dreamed about by an evening's smoky fire.

Yet outside NSP's plant, life will go on undisturbed for the almost two million residents within 50 miles radius. The company is making sure there can be no danger even to the plant's immediate



NSP's greatest concentration of customers is served by a network of generating plants connected by 345,000-volt transmission lines.



High-voltage transmission lines of NSP and other regional utility systems are connected into the 10,000 mile MAPP network to provide improved reliability and economic benefits.

neighbors, who raise dairy and beef cattle, soybeans, corn, and cannery crops. Commercial carp fishing will continue. So will sport fishing for crappies, bass, walleye, and other fish, and hunting for ducks, pheasant, and deer. Pleasure boating and commercial shipping, which use U.S. lock and dam No. 3 about one mile downstream from the site will be unaffected by the plant's operation.

In fact, NSP is designing the atomic power plant to be safer, neater, cleaner, and less trouble for its neighbors than most any other kind of large industrial plant that might locate in a rural place. And the company has considerable atomic-power experience.

NSP customers double their demand for electricity every 10 years. That's a big order. The Prairie Island reactors are ideally located to tie into new 345,000-volt lines that circle the area of largest demand on NSP's system.

The plant also will be connected with lines to other power suppliers in Chicago, St. Louis, and Kansas City. Construction of those lines is being coordinated by NSP and 53 other members of a regional power organization called the Mid-Continent Area Power Planners (MAPP).

Nuclear power

All large power plants are much alike in the way they generate electricity. What sets them apart is the fuel or mechanical force used to operate the plant generator.

Nuclear fuel produces an astonishing 100,000 times as much energy as the same weight of coal! When compared with gas or oil, the nuclear advantage is even better.

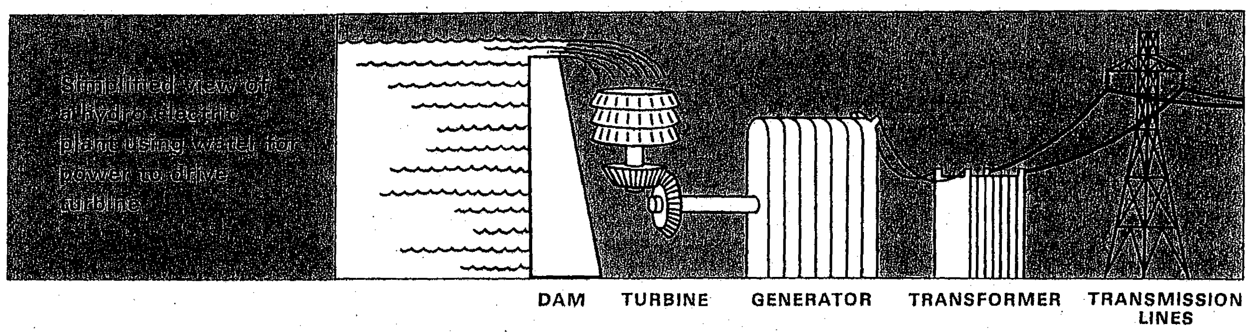
Inside a special furnace known as a nuclear reactor, useful heat is created when certain types of uranium atoms are broken into smaller atoms.

These uranium atoms also release radiation: particles such as electrons, protons and neutrons, and Gamma rays which are similar to radio waves.

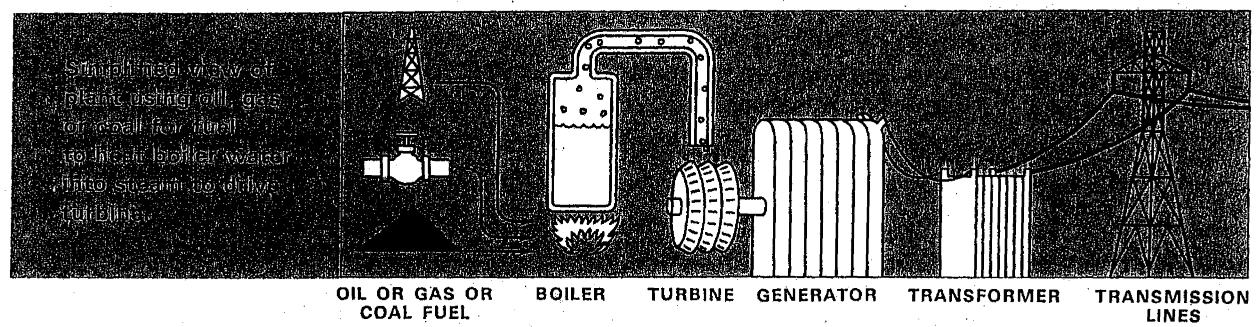
The flying neutrons trigger the splitting of more uranium atoms in a chain reaction. Inserting or withdrawing materials that absorb neutrons provides control of the heat production by regulating the number of splittings.

Radiation cannot be detected by human senses, but is easily found with ordinary photographic film or instruments such as a Geiger counter.

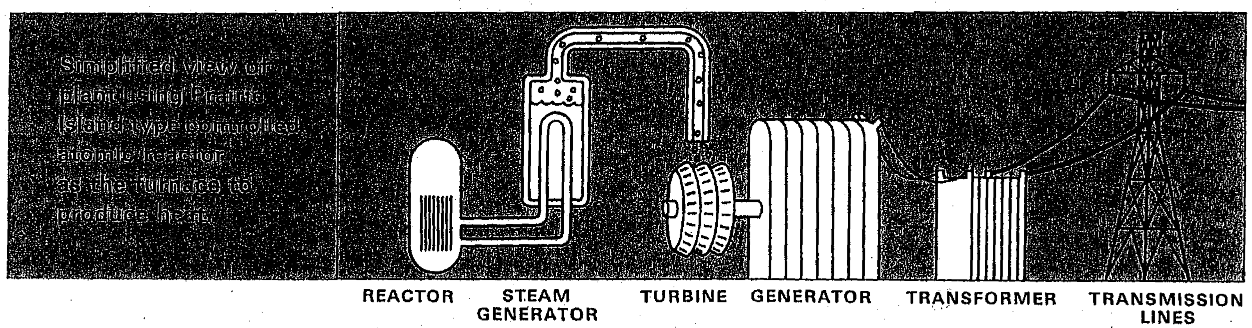
Shielding stops direct radiation near its source, so numerous special shields will be used at the Prairie Island plant. The remaining radioactivity will be controlled in the plant's solid, liquid, and gas waste-



Simplified view of a hydro electric plant using water for power to drive turbine



Simplified view of plant using oil, gas or coal for fuel to heat boiler water into steam to drive turbine.



Simplified view of plant using Prairie Island type controlled atomic reactor as the furnace to produce heat.

handling systems by using one or more of the following methods:

Filtering.

Removing radioactive minerals.

Distillation to reduce the volume of stored liquid.

Diluting the remaining liquid or gas.

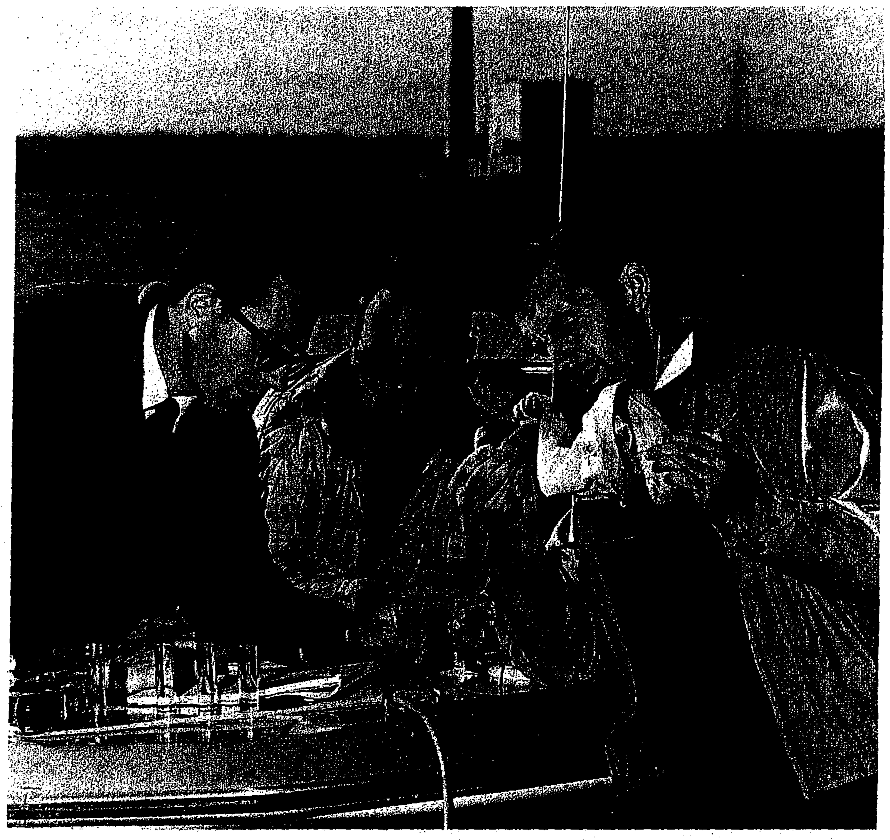
Storage for radioactivity to subside.

Removal to distant sites for permanent disposal.

When at the weakened levels approved by government agencies, the liquid radioactive materials will be released for dilution in the discharge canal downstream from the pipes which release condenser-cooling water. Radioactive gas, when at safe concentrations, will be released from vents at the highest point of the plant for dilution in the atmosphere.

Radioactive wastes from the plant will be monitored carefully by NSP to be certain the levels remain within Atomic Energy Commission (AEC) limits. Monitoring also will be done by government agencies and scientists from independent organizations.

Experts are hired by NSP to make sure heated discharges from the company's plants are not harming aquatic life. Testing the St. Croix River are Roscoe Collingsworth, left, consultant on fixed algae; Paul Lee, center, NSP engineering associate at the Allen S. King plant which is visible in background; and Dr. Alan Brook, expert on free-floating algae, from the University of Minnesota.



RADIATION has existed since the beginning of time and its strength varies from place to place. So the natural level of radiation around the Prairie Island plant site will be determined at least one year prior to fuel loading. To assure safety after start-up, total radiation strength and the most important sources will be monitored regularly at the following locations:

River upstream and downstream from the plant.

Mud from the bottom of the discharge canal and river.

Fish and other life in the river upstream and downstream from the plant.

Air, precipitation, and vegetation including crops up to several miles from the plant.

Underground water supplies up to several miles from the plant.

Milk from dairy herds up to several miles from the plant.

The two reactors at Prairie Island will be controlled by NSP operators aided by sophisticated controls and computers. The AEC requires that nuclear power-plant supervisors and technicians must be thoroughly trained and must pass written, oral, and operating tests given by the AEC.

Under watchful eyes of the AEC and state agencies, elaborate safeguards are taken at every atomic power plant to keep radioactive and heated discharges within safe limits. Containment of atomic explosion, however, is not a problem because the conditions needed for an A-bomb are not present.

Congress has made the AEC responsible for developing and safeguarding peaceful uses of atomic energy. These are the steps taken for the Prairie Island plant to meet AEC requirements:

Experts in nuclear science who are members of the AEC Division of Reactor Licensing made a careful review of NSP's plant description and preliminary safety analysis report. When approval was gained, NSP's application went to the Advisory Committee on Reactor Safeguards for review. That is an independent group of men recognized for national standing in scientific and engineering specialties. When they were satisfied, a three-man Atomic Safety and Licensing Board, including two experts in nuclear technology, conducted a public hearing at which NSP and the contractors were questioned. This was the final step before issuance of a provisional permit for construction.

At least a year before fuel loading, the company will submit its final description, safety analysis report, and technical specifications. For a second time, NSP's plans will be reviewed by experts of the AEC Division of Reactor Licensing and the Advisory Committee. When approved, an operating license will be issued to authorize loading of the reactor with fuel. During both construction and operation, the AEC Division of Compliance makes inspections to be sure AEC standards are being met.

Permits also must be obtained from the Minnesota Conservation Department to withdraw river water for cooling, from the Minnesota Pollution Control Agency (MPCA) to discharge the heated water into the river, and from both the Conservation Department and the District Corps of Engineers to build intake and discharge structures. The Minnesota Health Department must approve the power company's plans for monitoring radiation levels in the environment before and during plant operation.

Other agencies consulted by the company are the U.S. Public Health Service, U.S. Fish and Wildlife Service, and the appropriate County Board of Commissioners.

NSP is making sure that heated water discharged into the Mississippi River from the Prairie Island plant will meet Minnesota Pollution Control Agency limits. The company will conduct river-life studies before and after the plant is placed in service to assure the agency that no harmful changes take place. Studies of this type are being conducted for NSP's King and Monticello plants.

Experience with the heated discharges from existing power plants—nuclear and otherwise—shows that most of the heat goes into the air. The rest dissipates into surrounding water until the discharge cools enough to begin mixing with the other water layers.

One point about heated discharge water sometimes leads to confusion. It should be understood that control of heated water from the condenser has nothing whatever to do with the control of radioactive liquid wastes. Positive control is achieved by keeping these liquids in separate pipes, as shown on page 13.

Condenser coolant is composed of water taken from the river by means of the intake canal. Large objects are screened from the water. Then the water is pumped through tubes in the condenser to absorb heat from steam outside the tubes. The steam is reduced to water and returned to the steam generator.

Condenser-cooling water contains a small amount of natural radioactivity when it comes from the river. In its swift journey through the plant, the water becomes heated but gains no more radiation.

Normally, steam in the condenser is not radioactive. But even if it should become radioactive temporarily, there is no chance this radiation could escape into the discharge canal and river. The reason is that the river water in the condenser is under atmospheric pressure of about 14 pounds per square inch while steam in the condenser is in a partial vacuum condition. No steam could escape in case of an internal condenser leak because the river water would be sucked into the steam lines. This untreated water would corrode equipment. So instruments are installed to detect such leaks and signal for immediate repairs.

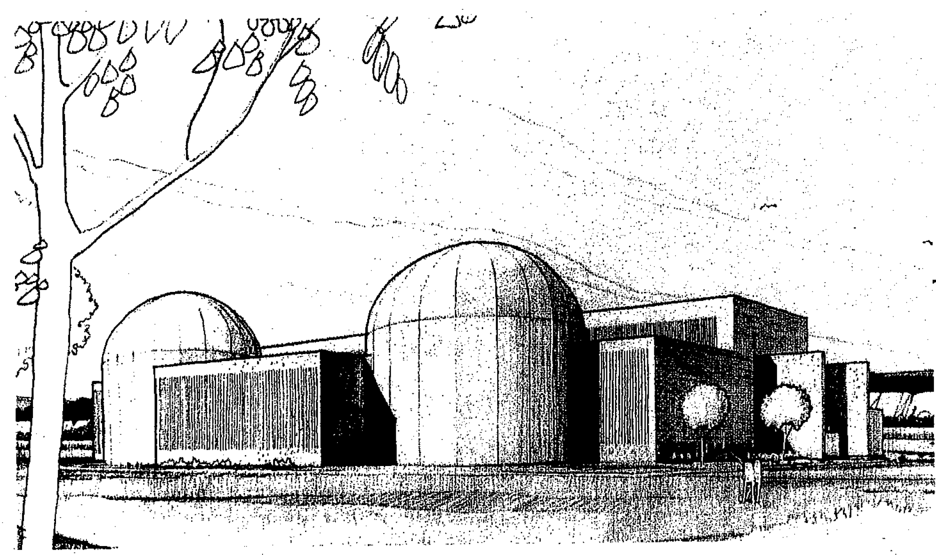
After absorbing heat in the condenser, the cooling water is piped to booster pumps and then through one of two paths:

If the temperature is already within limits, the cooling water may go directly into the discharge canal.

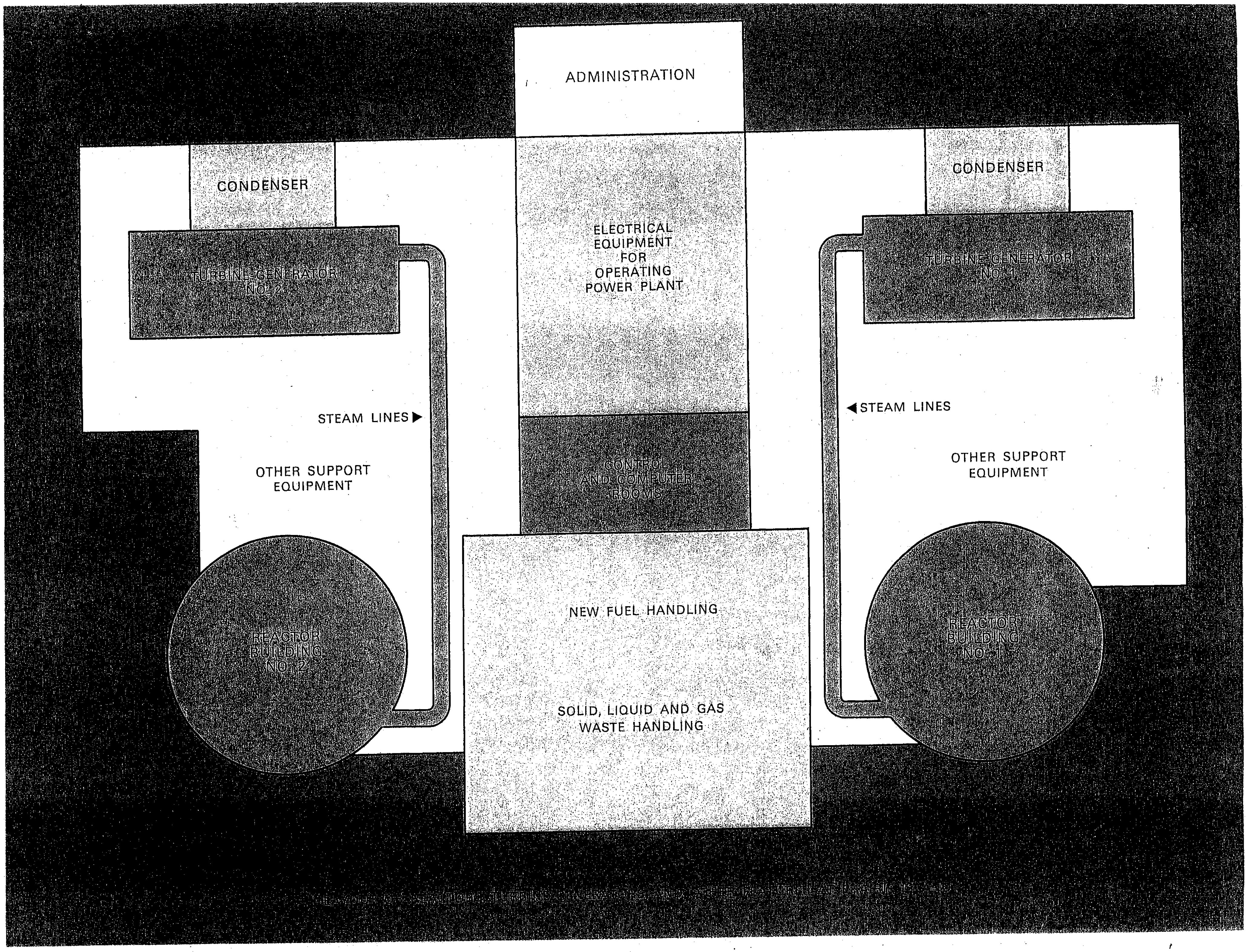
If the temperature is above the limits, some or all of the water may pass through cooling towers before going to the discharge canal. Cooling towers are long, tall frameworks of panels that resist corrosion. The water is allowed to drop down the panels so air can remove heat by the familiar process of evaporation.

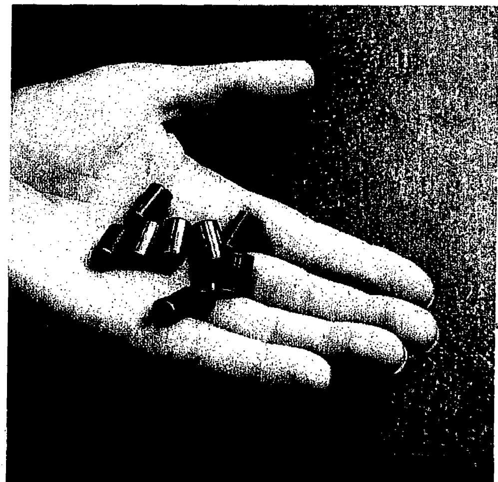
The Prairie Island Plant

SITE preparation began in 1967 at NSP's 560-acre property on Prairie Island. Major construction started in 1968. Total cost will be $200 million with a peak construction crew of about 700 and a permanent plant staff of about 95.

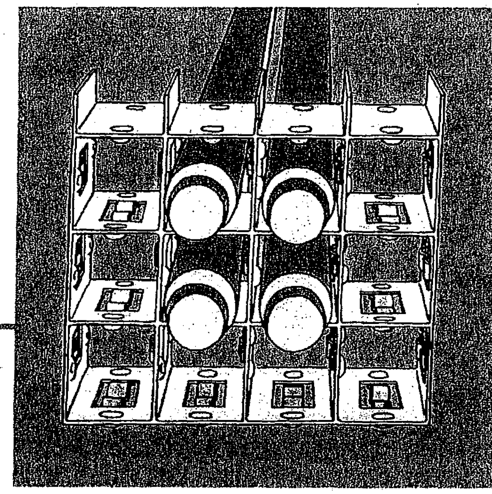


Major features of the plant are described on the following pages:

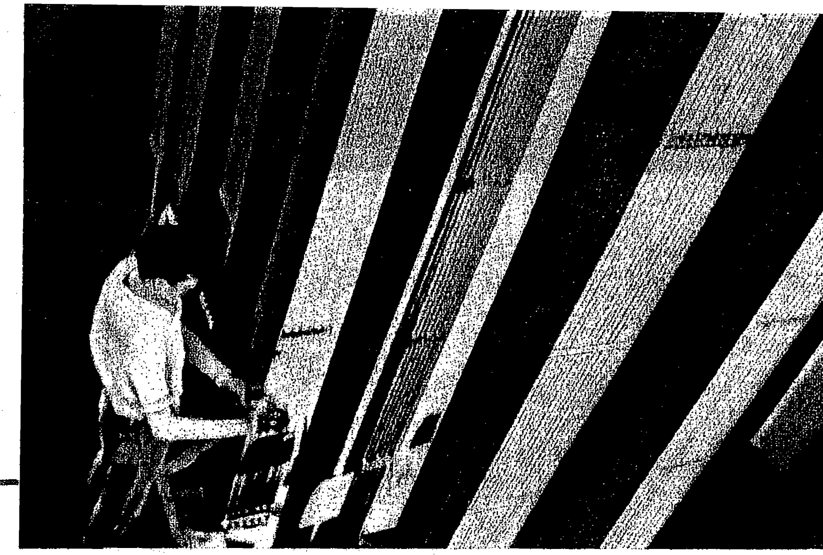

ADMINISTRATION
CONDENSER
CONDENSER
ELECTRICAL EQUIPMENT FOR OPERATING POWER PLANT
TURBINE GENERATOR NO. 2
TURBINE GENERATOR NO. 1
STEAM LINES
STEAM LINES
OTHER SUPPORT EQUIPMENT
OTHER SUPPORT EQUIPMENT
CONTROL AND COMPUTER ROOMS
REACTOR BUILDING NO. 2
REACTOR BUILDING NO. 1
NEW FUEL HANDLING
SOLID, LIQUID AND GAS WASTE HANDLING



FUEL consists of 120,000 pounds of uranium dioxide shaped into small pellets having a ceramic appearance.



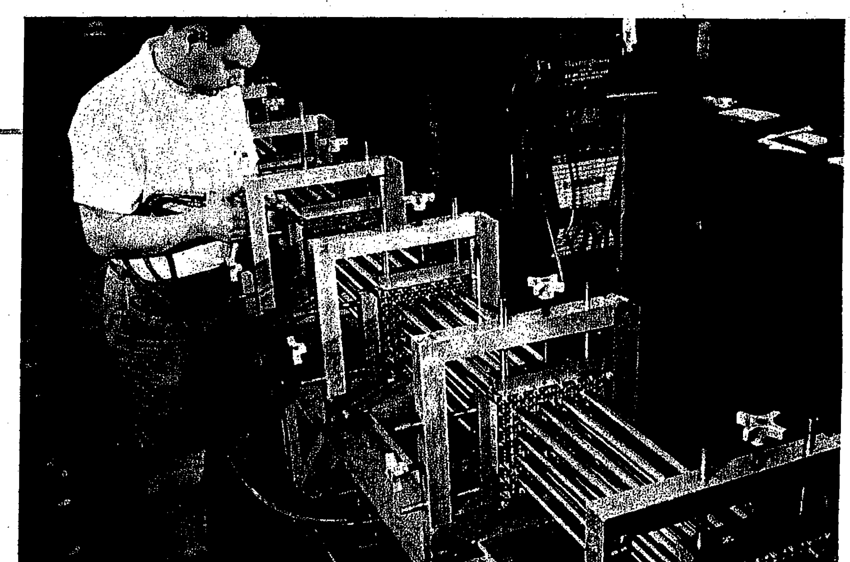
RODS of zircaloy metal, welded shut at top and bottom to contain pellets in end-to-end position, are held in parallel positions.

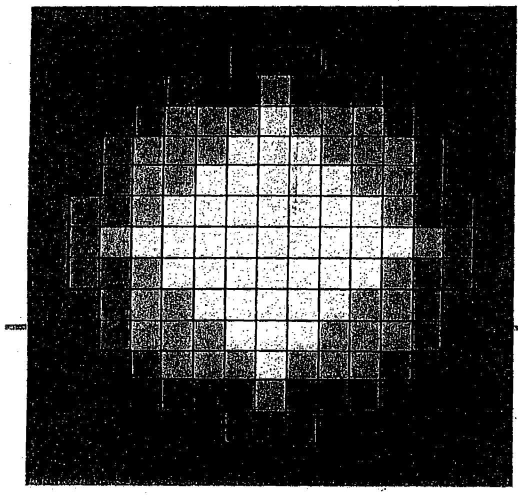


ASSEMBLY of rods and pellets allows primary coolant to flow smoothly around the rods.

Reactor features and radiation barriers

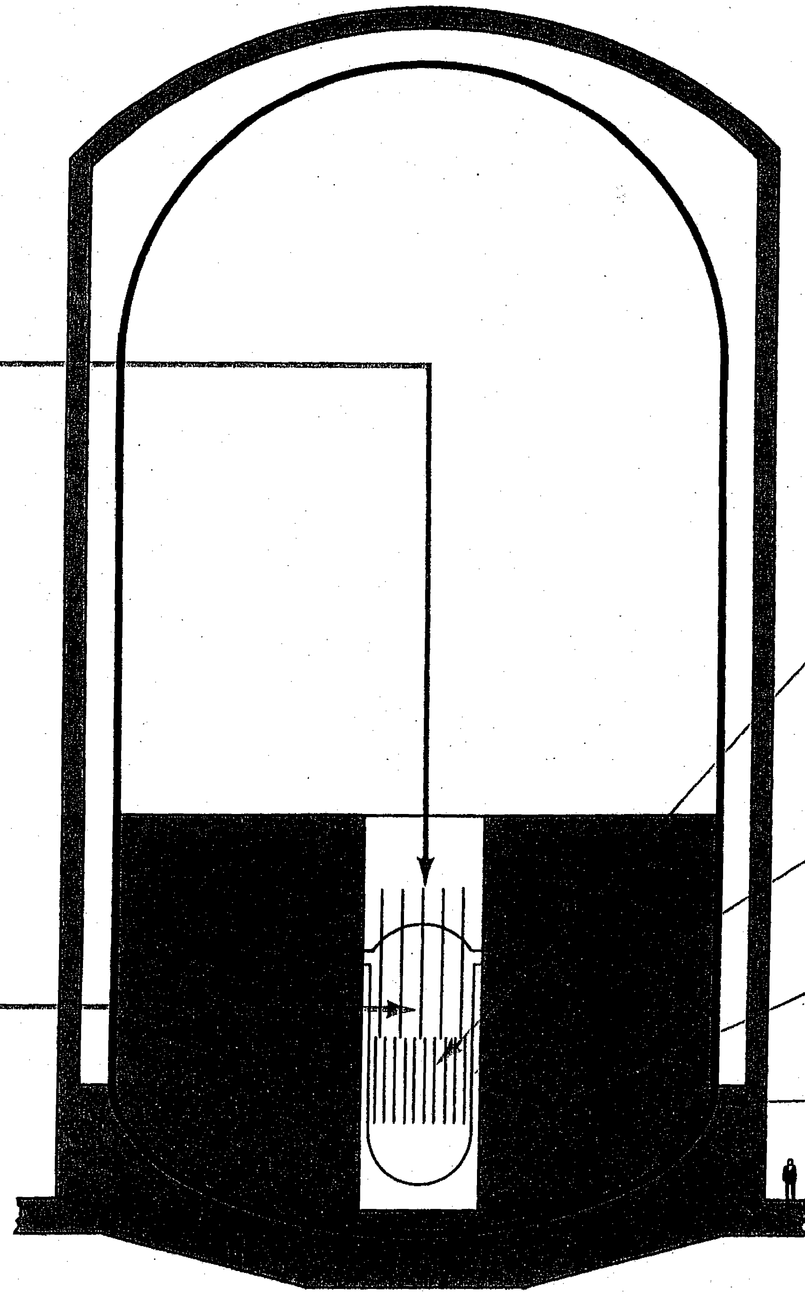
ATOMIC reactions are controlled by absorbing free neutrons with rods of silver-indium-cadmium metal within the core, and by injecting absorbent liquid boron into the primary coolant.





CORE of reactor, seen from above. Assemblies are moved toward center at annual refuelings, with newest identified by dark blue squares. Oldest in light blue are removed for reprocessing.

ONTROL rods are housed in eel tubing and placed inside 3 of a reactor's 121 fuel ssemblies. The adjustable ontrol rods replace 16 of ie 196 stationary fuel rods these assemblies.



Many barriers stop direct radiation

The most important are:

CORE containing fuel pellets, zircaloy tubing, silver-indium-cadmium rods, and liquid boron . . . all absorb radiation

REACTOR VESSEL of steel

SUPPORTS of concrete

CONTAINMENT VESSEL of steel

SHIELD BUILDING of concrete

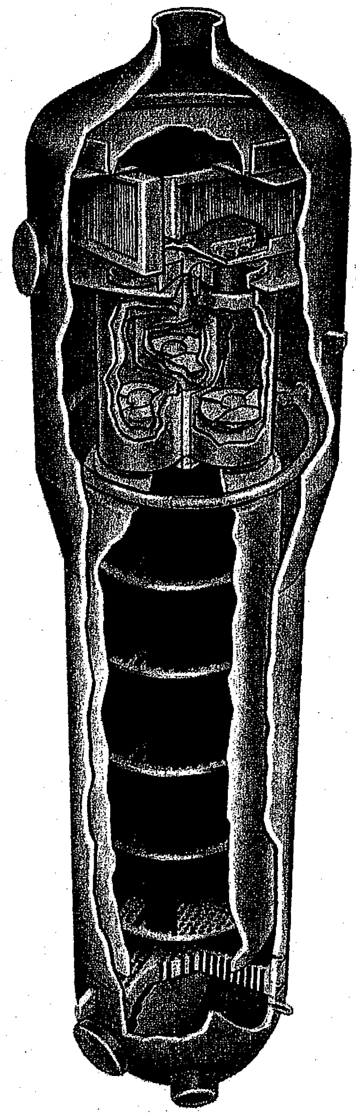
COOLANT CIRCUITS

SEE SCHEMATIC

TWO PIPE loops which meet in reactor vessel carry primary coolant of treated water.

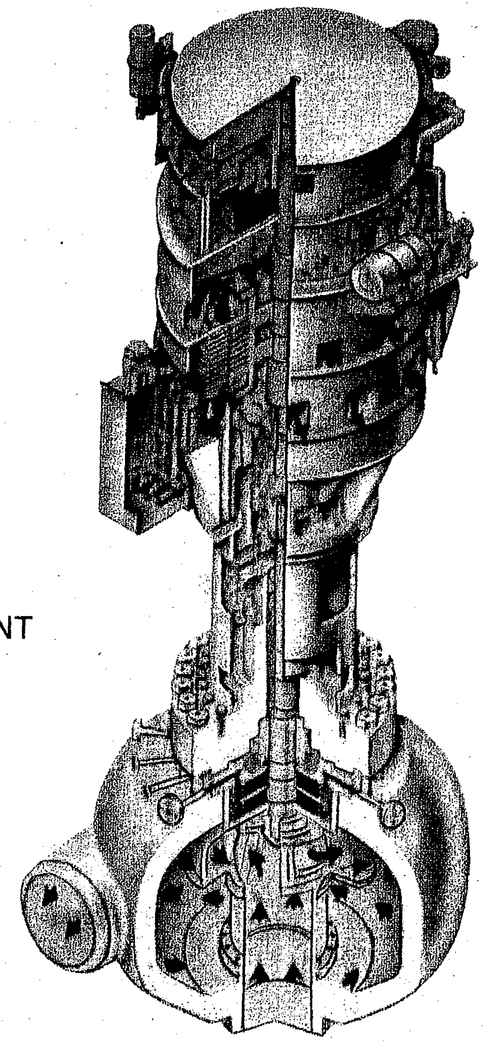
PRESSURIZER in one loop maintains pressure of 2,235 pounds per square inch so primary coolant remains water despite 560° F heat.

COOLANT PUMP of 6,000 horsepower in each loop moves primary coolant at almost 15 feet per second through reactor core.



STEAM GENERATORS

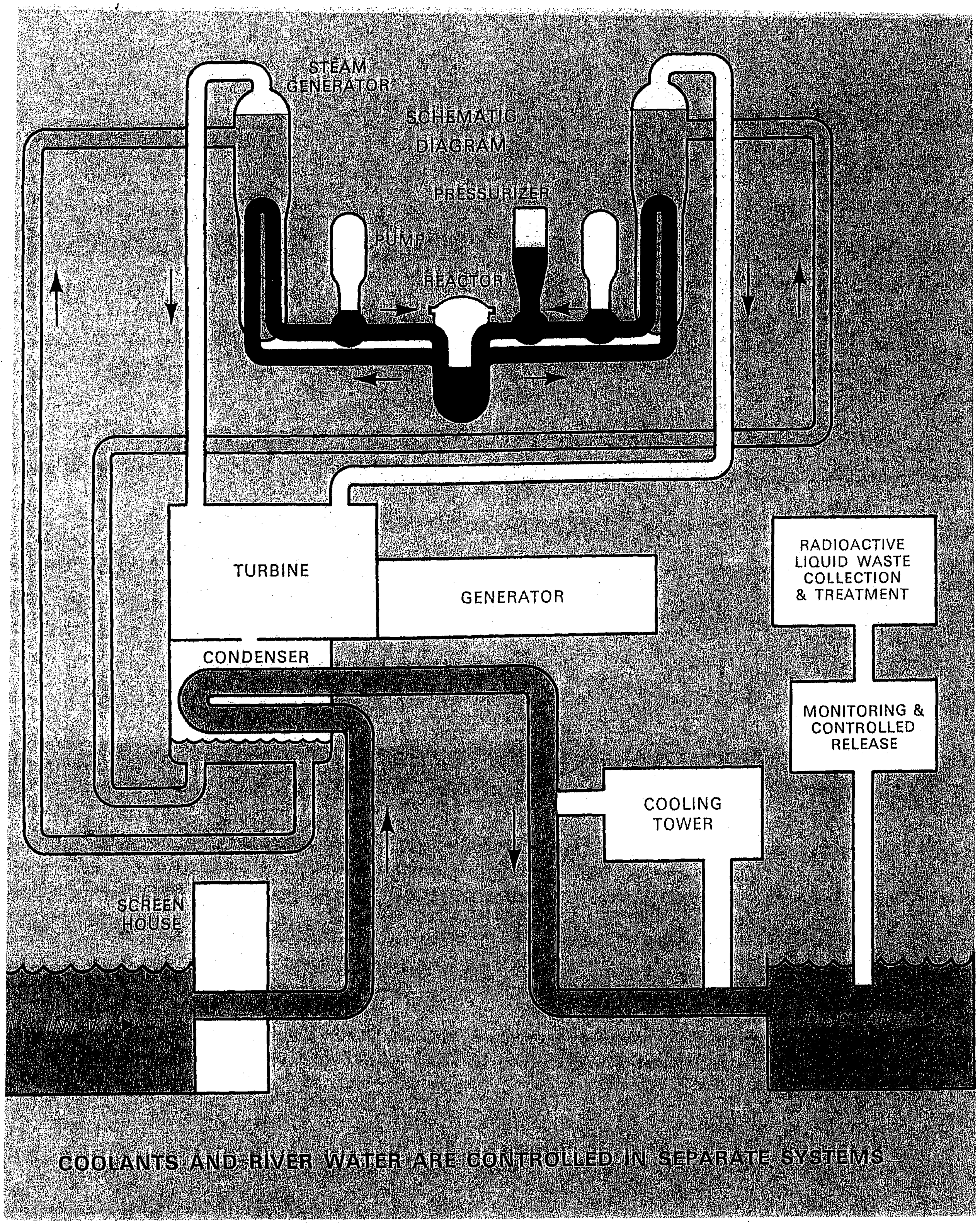
STEAM GENERATOR in each loop allows heat of primary coolant to boil secondary coolant of treated water that flows outside primary coolant tubes.



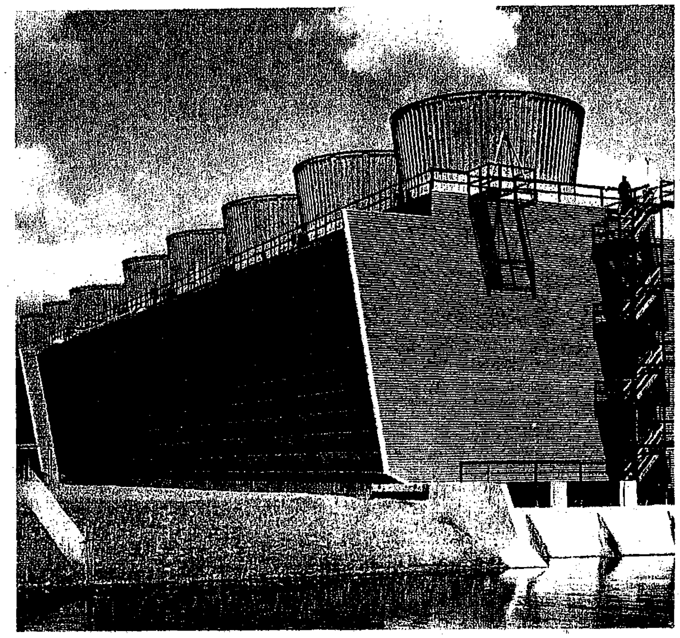
COOLANT PUMPS

TURBINE-GENERATOR shaft is turned 1,800 times per minute by the resulting secondary coolant steam that is under 720 pounds per square inch pressure and 510° F heat.

CONDENSER changes secondary coolant steam to water, which is then pumped back to steam generators.



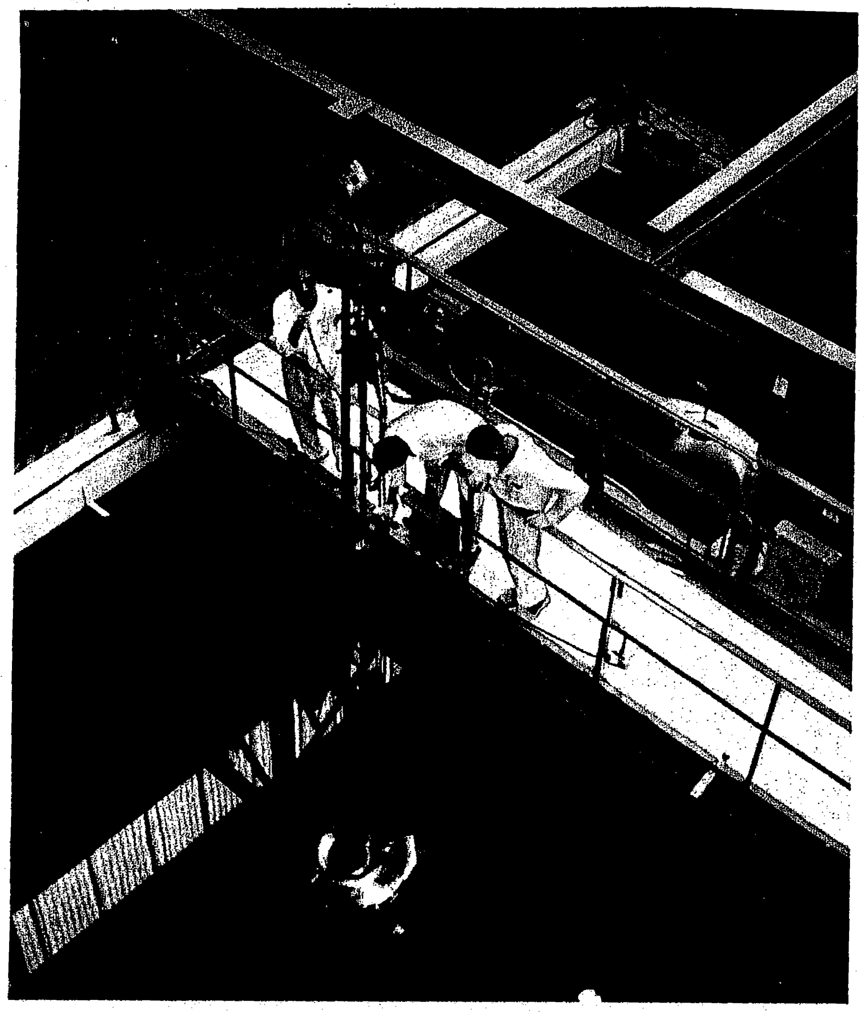
COOLING TOWER



SCREENHOUSE screens river water from intake canal. In condenser this water takes heat from secondary-coolant steam outside condenser tubes.

DISCHARGE CANAL and river usually receive the water.

COOLING TOWERS at times supply evaporative cooling of some water, which then goes to the discharge canal.



Fuel and waste handling facilities

NEW FUEL HANDLING

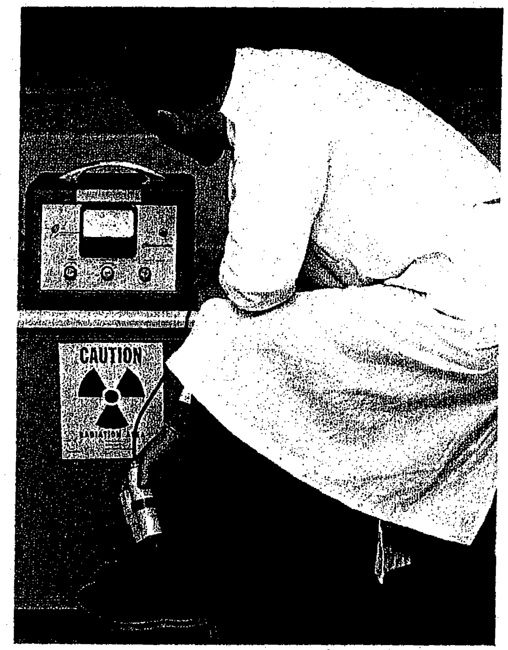
Fuel installed in assemblies arrives at plant by railroad for storage in RACKS. During refueling, assemblies are transferred through water of spent fuel pool and TRANSFER TUBE.

SPENT FUEL HANDLING

REACTOR CAVITY is flooded for refueling because water is effective radiation shield that can be seen through. REACTOR VESSEL TOP is removed, new fuel assemblies installed in core, spent fuel assemblies removed via tube to underwater racks in SPENT FUEL POOL where heat and radioactivity can "cool" to safe levels. Later, spent fuel is shipped in special casks to private reprocessing companies.

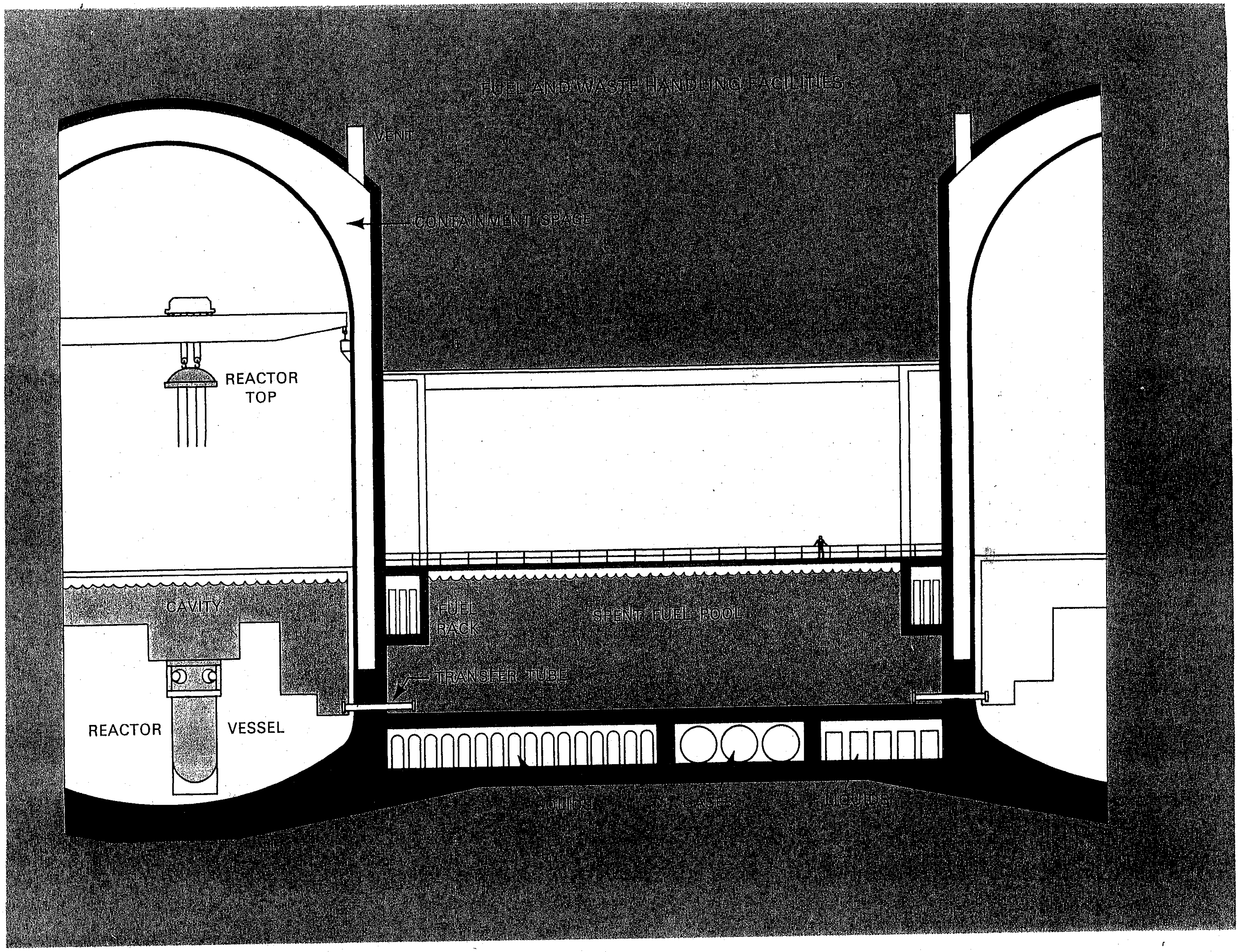
GAS WASTE HANDLING

Radioactive gas mostly is krypton and xenon in the primary coolant system. The GAS is removed and piped to tanks for storage until radioactivity "cools" to government standards. Then it is released in controlled amounts through VENTS atop each reactor building. Air in CONTAINMENT SPACE usually is not radioactive but is monitored anyway, filtered if necessary, and released from vents to dilute in atmosphere in controlled amounts that meet government standards.



LIQUID AND SOLID WASTE HANDLING

Liquid radioactive waste may come from plant laundry, shower, handwashing, laboratory, equipment drains, leakage (every drip is saved), decontamination of equipment, filtering, and chemical treatment of the coolant water. Some LIQUID is held up in tanks for treatment and monitoring until it meets government standards, then is diluted in the river in controlled amounts. Radioactive SOLIDS are shipped out of state in special drums for permanent disposal.


FUEL AND WASTE HANDLING FACILITIES
VENT
CONTAINMENT SPACE
REACTOR TOP
CAVITY
REACTOR VESSEL
FUEL RACK
SPENT FUEL POOL
TRANSFER TUBE
SOLIDS
GASES
LIQUIDS

Man on top at the AEC

Dr. Glenn Seaborg

THE CHAIRMAN of the Atomic Energy Commission is an atomic scientist who has shared in the discovery of nine elements. He is Dr. Glenn Seaborg, winner of the Nobel prize in chemistry, the Enrico Fermi Award, and 26 honorary degrees.

"In more than 20 years of operating reactors of various types," says Dr. Seaborg, "there has not been a single accident that has caused any known injury to the public outside of AEC plant areas. The safety record of personnel working inside AEC-contractor plants has been phenomenally good."

In fact, they are safer than industry in general, Dr. Seaborg points out.

The hard rules of the AEC in protecting the public from dangerous radiation levels take two major paths. "First, extensive safeguards are provided to prevent accidents," says Dr. Seaborg. "Secondly, all reactors are provided with substantial safeguards to minimize the consequences of accidents in case these precautions should somehow fail."

Declares Dr. Seaborg, "Perhaps I can best summarize my feelings about safety by saying that I would not fear having my family residence within the vicinity of a modern nuclear power reactor built and operated under AEC regulations and controls."

Digging into the past.....

NSP's Prairie Island plant site is rich ground for the Minnesota state archaeologist, Dr. Elden Johnson of the University of Minnesota, whose excavation of the site is sponsored by NSP.

Dr. Johnson directed a thorough survey of the entire area in summer 1967, and found nothing significant where the plant will rise. But at the south edge of the grounds, his team discovered 10 certain and six probable Indian burial mounds, most of which have been worn flat by 80 years of agriculture. They also found signs of an Indian village some 1,000 feet by 400 feet in oval shape. See page 2.

"These mounds were constructed sometime around 800 A.D.," Dr. Johnson says. "Prairie Island is important because we know relatively little about Indian life during this period in southern Minnesota and nearby Wisconsin," he says. Pottery and other objects placed in the graves are important goals for Dr. Johnson.

"A different group of Indians lived in the village between 1400 and 1500 A.D.," he says. "Because the site has been pasture, it is the only undisturbed village of this age in the region," Dr. Johnson says. The style and arrangement of housing, and the village population, are other important goals.

The Prairie Island area was important to Indians because it provided them with meat and clothing, fish, birds, wild rice, tobacco, rock and bone for tools and smoking pipes, and clay for pottery. Wood furnished building materials, fuel, and tools. Five major rivers and countless streams within 50 miles radius made Prairie Island a transportation gateway.

THE MOUND BUILDERS

"Mound builders lived periodically at Prairie Island in a small group," says the archaeologist. "They ranged over 200 miles to southwestern Minnesota on summer buffalo hunts, and often commuted north 50 miles to a fishing and hunting camp near Marine-on-the-St. Croix." The hunters and fishermen of Prairie Island harvested only wild rice and smoking tobacco.

The men chipped spear points, axe heads, hide scrapers, and other tools out of local stone or animal bones. Handles were wood. Women made pottery without benefit of a potter's wheel. Their cooking urns of local clay had fabric-impressed ornamental marks on the outside, and pointed bottoms which were set in the firewood when cooking.

But the most distinctive feature of these Indians was burial under large circular mounds of earth. Some mounds contained one body, a few had many successive burials. Burial mounds apparently were a true invention by Indians of the Ohio-Mississippi River valleys. Today, few undisturbed mounds remain for study by archaeologists.

"The fate of Prairie Island's mound builders is a mystery," says Dr. Johnson.

THE VILLAGERS

"While earlier Indian ways of life reached Minnesota by passage of ideas from group to group, a new way of life arrived about 1,000 A.D. by migration of colonists from the south," says Dr. Johnson.

They first appeared in Minnesota near the mouth of the Cannon River. That is some four miles south of Prairie Island, and it happened several hundred years before the village.

"It's not yet clear whether Prairie Island village founders were from the Cannon River site or were new colonists," says Dr. Johnson.

Farming pushed hunting, fishing, and wild-food collecting into a secondary role. Villages grew larger and more permanent, with the Prairie Island settlement existing a couple hundred years.

Dr. Johnson wants to know if it had the features of villages farther south: a central plaza surrounded by temples and homes.

"Distinctive tools elsewhere included small triangle-shaped arrow heads of chipped stone, like those we've found at the village site," says Dr. Johnson.

Pottery of this era found at the village has more decorative shapes and designs than earlier pottery.

Prairie Island Indians cleared trees from the Mississippi River bank and tilled the rich loose soil with sharpened digging sticks and hoes made of buffalo shoulder blades attached to sticks.

"What happened to the villagers also is a mystery," says Dr. Johnson.

"We are puzzled over the relationship between early Minnesota Indians and those of historic times such as the Dakota-Sioux-Assiniboine, Chippewa, and Iowa-Oto nations."

A sure bet is that while Dr. Johnson is wrestling with these questions he wouldn't mind uncovering remains of a fort Pierre LeSueur ordered built somewhere on Prairie Island in 1696. The outpost was used just a couple years, and so far the structure's clay floor and limestone fireplace have escaped detection by any exploring archaeologist.

The Minnesota State Archaeologist, Dr. Elden Johnson, supervises his excavating crew in careful preliminary mapping of ancient Prairie Island sites. In the NSP-sponsored study, Johnson hopes to shed new light on village dwellers of 1400 to 1500 A.D. and burial-mound builders of about 800 A.D.

control rod assemblies of cadmium-indium-silver alloy encased in steel, plus liquid boron injected in controllable amounts into the primary coolant.

RADIATION BARRIERS:
Fuel pellets themselves, zircaloy metal tubing, steel reactor vessel containing control rods of cadmium-indium-silver alloy in steel tubing and also containing liquid boron in primary coolant water, steel containment vessel, air containment space, concrete containment building, and periodic use of water barriers, storage container, and filtering.

TEMPERATURES:
Fuel pellets 4,000° F, average reactor coolant temperature 576° F. Temperature of river water used to cool condenser will meet discharge standards to be set by the Minnesota Pollution Control Agency.

NET STATION HEAT RATE:
10,700 btu/hour.

PRIMARY COOLANT:
Treated water and liquid boron, at 576° F average and pressure of 2,235 pounds per square inch in reactor core.

SECONDARY COOLANT:
Treated water at 510° F and pressure of 720 pounds per square inch at turbine. Steam flow 7,400,000 pounds per hour.

CONDENSER COOLING WATER:
Screened river water under atmospheric pressure.

COOLING TOWERS:
Structures which allow air to cool water trickling down over corrosion-resistant panels. Temperature of condenser cooling water is regulated in accordance with government standards before being returned to river.

TURBINE:
1,800 rpm, tandem-compound (single shaft), three-cylinder reheat unit using 40-inch last-stage buckets.

GENERATOR:
659,000 kva rating, cooled with 60 pounds per square inch hydrogen gas. Output 19,000 volts, alternating current.

SUBSTATION OUTPUT:
345,000 volts and 161,000 volts, alternating current.

PLANT EMPLOYMENT:
About 95.

PLANT CONSTRUCTION EMPLOYMENT:
Average 150 over four years with peak of about 700.

OVER-ALL DESIGN AND CONSTRUCTION RESPONSIBILITY:
Northern States Power Company.

ARCHITECT-ENGINEER:
Pioneer Engineering and Service Company, Chicago.

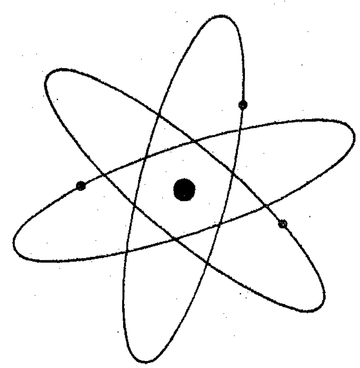
REACTOR, STEAM SYSTEM, AND TURBINE-GENERATOR SUPPLIER:
Westinghouse Electric Corporation, Pittsburgh, Pa.

Specifications

Northern States Power Company's

PRAIRIE ISLAND

Nuclear Electric-Generating Plant



LOCATION:
560-acre site 28 miles southeast of Minneapolis-St. Paul, six miles northwest of Red Wing, Minn., on peninsula named Prairie Island, in Mississippi River.

FEATURES:
Two independently controlled atomic reactors, two turbines, two generators, supporting equipment, and electric substation. Facilities for processing intake and discharge cooling water, nuclear fuel, and radioactive wastes in solid, liquid, and gas form.

TOTAL COST:
$200 million.

CAPACITY:
Reactor #1: 550,000-kilowatts, to begin operation in 1972.
Reactor #2: 550,000-kilowatts, to begin operation in 1974.

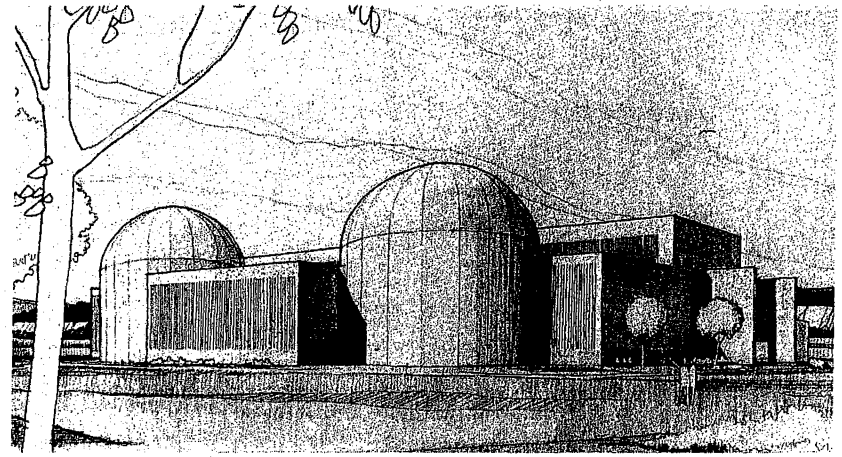
REACTOR TYPE:
Pressurized water.

FUEL:
Pellets of dioxide uranium-238 slightly enriched by artificial method with uranium-235.

FUEL LOADING:
120,000 pounds of uranium in 121 assemblies in each reactor core, equivalent in energy to 6 million tons of coal. Refueled 40 assemblies at a time, once a year. Other reactor remains operating.

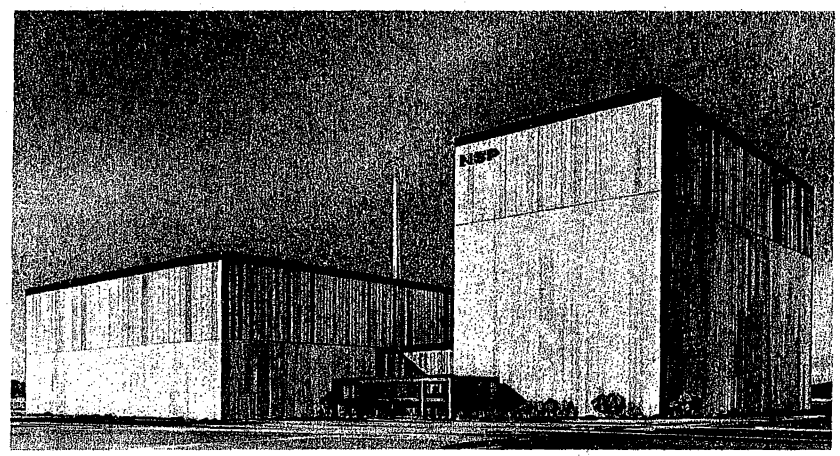
REACTOR CONTROL:
Absorption of free neutrons in each reactor core by 33 movable

PRAIRIE ISLAND
near Red Wing, Minn.
Two units of 550,000 kilowatts scheduled to begin operating in 1972 and 1974.



NORTHERN STATES POWER COMPANY'S NUCLEAR ELECTRIC-GENERATING PLANTS

MONTICELLO
near Monticello, Minn.
Adding a generating capacity of 545,000 kilowatts to NSP's fast-growing system in 1970.



• NORTHERN STATES POWER COMPANY • 414 NICOLLET MALL, MINNEAPOLIS, MINNESOTA 55401 •

MINNESOTA STATE UNIVERSITY
MANKATO

July 4, 2008

Ron Johnson, President
Prairie Island Indian Community Tribal Council
5636 Sturgeon Lake Road
Welch, MN 55089

Mike Wadley, Site Vice President
CC: Jim Holthaus, License Renewal Environmental Project Manager
Prairie Island Nuclear Generating Plant
1717 Wakonade Drive
Welch, Minnesota 55089

EXHIBIT
D

Re: update on progress in Bartron village site (21GD02) excavations

To the Tribal Council and to Xcel Energy:

We again extend our deep gratitude to the Prairie Island Indian Community and the Tribal Council for your years of support in our continuing research on the Native American occupations on and around Prairie Island. We also gratefully acknowledge Xcel Energy's cooperation and support in the Bartron village research project this year. There are too few examples of this level of cooperation across communities, and we thank everyone involved for their patience and sensitivity.

The Red Wing region is of immense importance in understanding the foundations of historical Indian life stretching from the eastern woodlands out onto the prairies and plains and from the central Mississippi Valley up to the northern lakes. Here, the great nations we now know as the Dakota, Ho-chunk, Ioway, Otoe, and Missouria, among others, lived, met, feasted, prayed, traded, married, raised their children, and died. The sites they left behind are central parts of Indian cultural history and are important to *all* people as our common human history. Archaeological research is one of the only tools we have to study ancestral lives, and along with oral history and oral tradition, it helps us remember, learn from, and honor the past.

Among the major village sites in the Red Wing area, the Bartron village has long remained too poorly understood. Excavations conducted there from the late 1940s to the late 1960s have never sufficiently been tied together for us to understand the site as a whole, and indeed there are many questions that were either never answered or in some cases even asked in the first place. The work we began this summer is designed to provide a basis for addressing some of these asked and unasked questions, and to provide a more synthetic overall impression of the site – its boundaries, components, and condition. Since our analysis is not yet complete, this letter merely gives you some initial information. Please, therefore, consider it preliminary and subject to change as our work progresses, and exclusively referential to the Bartron village site.

What is talked about here is primarily about the archaeology field school. The geophysical survey done by Don Johnson is under specific contract with Xcel and will be reported separately. What I can say is that it was successful beyond expectations in providing data to relocate mound loci and other important

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areas. The field school goal was mostly to assess the potential for contact-era occupations at the site, and to investigate a particularly important feature that Elden Johnson called a "possible wall trench" in his 1968 work. The information here will be expanded and revised as Emily Hildebrant completes her MS thesis this fall. Copies of the thesis will be provided to the Council and Xcel Energy when it is completed.

Assessment of previous work
Although investigation of the Bartron site goes back at least to the turn of the 20th Century, scientific excavations there began in 1948 under the direction of Dr. Lloyd Wilford. Wilford's work, though, was confined to the cultivated field now owned by Mrs. Charles Suter, and is not germane here. The specific work that is relevant to this year's field activities is Elden Johnson's excavations in the 1960s.

Please note that I do not wish to impugn Dr. Johnson or cast doubt on the results of his total body of work. He was a pioneering figure and a fine archaeologist, and many of the state's senior archaeologists today were trained under his tutelage. Indeed, he was among the first archaeologists in Minnesota to stress the importance of working with descendant communities. However, it must be acknowledged that some of his methods would not be considered acceptable today. For example, in 1969 at the Bartron village site he had a mechanical grader operator strip the upper 60cm of a 15m by 20m area that he knew to be intact (that is, undisturbed). His goal in this was to look for deep pit features because, in other areas of the site, he had found particularly important and impressive specimens of pottery, stone and bone tools, etc. In doing so, he undoubtedly destroyed other important information. This would NEVER be done today and it breaks my heart to know that it was done then. Yet, at the time it was considered an acceptable action, and it was done in good-faith. As well, as you will note below, the results of his 1968 work would have been different if he had not run out of time. His aborted effort to determine the existence of a possible wall trench led to a significant misperception in the literature that the current project can finally correct.

Overall, my assessment is that he was overextended. He had too many students in the field and too many excavation units open at one time to see and deal with all of the features and artifacts that were being documented and recovered. In addition, his and the student's field notes and maps leave many details quite unclear. Again this was par for the time and is not a real criticism of him, but rather of state of the discipline in the late 1960s.

History of investigations and status of data
Although we have some information on the site excavations that took place in 1948, 1968, and 1969, we also know that limited excavations took place in 1960, 1967, and 1980. As yet, no field notes, maps, or reports have been found that provide details on the 1960 or 1980 work. There are field notes from the 1967 work, but no map has been located and thus the excavation units cannot be tied to any real world coordinates or to other excavations at the site. With specific regard to the 1980 work, the details may be included with other data on that year's work on Prairie Island, but this has yet to be determined.

The artifact collections of the Minnesota Historical Society (MHS) include materials from the 1948, 1967, 1968, 1969, and 1980 investigations, but the whereabouts of the 1960 artifacts is unknown. The original field maps from Wilford's 1948 work seem to be lost, although some data on the location of the excavation units is contained in the student's field notes (interestingly, Elden Johnson was the mapper that year) and maps were prepared for Marshall McKusick's 1950s MA thesis at the University of Minnesota. The MHS has graciously lent us the original, hand-drawn excavation maps from the 1968 and 1969 work so that we can completely redraft a proper map (the map presented in Gibbon 1979, the only published map, has some major errors and omissions). All in all, the records are in comparatively good and complete shape, with some notable exceptions. Finding the missing notes and artifacts remains an important goal of our work, and the MHS is assisting in this effort.

Precontact components

For many years, amateur artifact collectors and professional archaeologists have known that the primary occupation at the Bartron village was what we call "Oneota". This archaeological taxon, first used back in the 1920s, is the word we use to collectively describe the material culture (ways of making stone and bone tools and pottery) of those whom we now know to be ancestral Chiwere, but also some Dakota and Dhegiha Siouan-speaking peoples. It is not a very useful term anymore, but it is what we have to work with.

Because of the differences in material culture seen in the various Red Wing villages, archaeologists have long puzzled over the fascinating dynamics of interaction among peoples from many separate Native American groups across the region. Among these villages, researchers believed that the Bartron village most clearly contained the local expression of Oneota culture, and was probably ancestral to the Oneota culture seen slightly later in the Blue Earth and possibly the LaCrosse regions. The Oneota occupation at the Bartron village gained importance to archaeologists because, among the Red Wing villages, it seemed to be relatively early and "pure" – that is, unaffected by what seem to be influences from other groups living elsewhere in the Midcontinent. Non-local influences are seen primarily at other large villages such as Mero, Bryan, and Silvernale that date to a similar time – ca. A.D. 1100 – 1300. Johnson's description of a possible wall trench at Bartron was, therefore, particularly significant because such structures were typical of Middle Mississippian culture, centered near St. Louis, Missouri, but were not typical of local construction techniques. If present, it would be the only example of a Mississippian wall trench structure in the region. Unfortunately, even though Johnson was circumspect, this aspect of the site somehow became more factual than potential, and it entered the literature.

Radiocarbon dates on Bartron site materials acquired at different times by Elden Johnson and Orrin Shane (then at the Science Museum of Minnesota) were ambiguous, suggesting either an early, ca. A.D. 1050, or a late, ca. A.D. 1400 date for the site. This led to widespread speculation and debate in the archaeological literature, especially because the origins of Oneota culture remain obscure. Some researchers suggest that Oneota culture is the result of non-local (i.e. Mississippian) influence on local, Late Woodland peoples starting around A.D. 1050, while other researchers see culture change as a locally driven process happening independently of and prior to Mississippian influences spreading into the area. Thus, Bartron has become a key site in understanding the processes of culture change and the emergence of Oneota culture in the region.

One of the interesting preliminary findings of our work at the site this year is that there appears to be more of a Late Woodland (ca. A.D. 700 – 1000) presence than suggested by earlier work at the site. Late Woodland occupations are primarily differentiated from Oneota occupations by the pottery: Late Woodland pottery is tempered with grit and decorated with continuous bands of textile and tool impressions, while Oneota pottery is tempered with crushed shell and decorated with discrete geometric patterns of trailed lines and punctates. The reasons why we recovered more Late Woodland than Oneota materials at the site this year are unclear.

We were fortunate to discover seven pit features (basin-shaped pits that contain concentrations of artifacts and organic remains), each of which we carefully excavated. Importantly, the mystery of the possible wall trench was solved by the discovery of these pit features. In excavation unit #10 from the 1968 work, Johnson's students had excavated to 40cm in depth when he saw soil staining. To Johnson, this suggested a wide, shallow trench extending to the northeast and southeast (that is, forming a right angle). He expanded his excavation unit to the north and south to try to follow the pattern, but it was not apparent, and being out of time, he abandoned the effort. Upon re-excavating the unit and digging a mere three centimeters deeper (to 43 cm), we found that the soil staining was in fact due to the presence of four large pit features, the tops of which had blurred together in the soil. Hence, there was no wall trench at all and we can now formally reject this as possible evidence of Mississippian influence in Red Wing. This is an important clarification that has broad implications for Red Wing and Mississippian studies in general.

The functions of the pits is as-yet unknown. The soil was collected in its entirety and is being processed to recover even the smallest artifact (down to 0.25mm). There will be adequate wood charcoal to acquire high precision radiocarbon dates of these features, and this will hopefully put to rest at least some of the questions about the timing of the Late Woodland and Oneota occupations at the site. Xcel Energy has offered to fund dates for two of the features following the protocols I established with Lawrence Livermore National Laboratory. This will be a very significant step forward in understanding the site and in refining our understanding of Native American heritage in the area.

Historical components

One of the most intriguing aspects of the Bartron site is the presence of what are described as "contact era" items such as glass beads, scraps of brass, and clay pipe fragments. Johnson reported finding such items in the 1960 and 1968 work, and he suggested that they may relate to the long-lost 1694-1696 fur trading post that Pierre Charles LeSueur established among the Prairie Island Dakota. Importantly, when Johnson described the possible wall trench, he suggested that it was approximately a meter wide and had a closed corner, which would have been typical of French-period outpost construction. The contact period in Minnesota lasted from ca. 1650 to 1850, and is one of the most important and yet poorly known periods in Red Wing archaeology. In part this is because it is a relatively brief time span, but also because the artifacts are quite rare and most of the contact era sites have since been destroyed by development (such as Chief Red Wing's camp where the city of Red Wing now exists). This period is essential to study because it is precisely here that archaeology and oral tradition intersect.

As noted above, the possible wall trench was not a wall trench, and therefore it clearly cannot be evidence of LeSueur's fort. Further, we recovered no artifacts dating to the contact era during this field season. Thus, this component of the Bartron site remains obscure but nevertheless fascinating and important to continue researching.

Condition and extent

When Wilford began his investigation in 1948, he noted that part of the site was in a cultivated field and part was in pasture. By the late 1960s, the pasture had grown into woodland, and by 2008, the woodland had become a dense forest. To facilitate the geophysical and archaeological investigations, Xcel personnel cleared out the underbrush. All mature vegetation was left standing. The cultivated part of the field has been under continuous use. Interestingly, although Johnson suggested that the wooded portion of the site had not been cultivated, our excavations did reveal the presence of a shallow plow-zone in the soil. It is therefore likely that the site was cultivated for a short period long enough before 1948 for it to have become a grassy field. This conclusion is supported by aerial photographs dating from 1938 and 1949.

Based on the geophysics and the archaeology, we can conclude that the site is in good condition. This includes both the cultivated and wooded portions of the village and associated mound group located to the southeast. Although unapparent on the surface, the locations of mound remnants, traces of houses and refuse pits, as well as possibly a palisade or log wall, are clearly visible. The northern site limits were formerly drawn at where the old Nauer farm access road was, but the geophysics indicates that the site persists past that location. Further research using geophysical and archaeological methods should be undertaken in these specific areas to continue to assess the extent and character of the site. Clearly, the village area and mound remnants that are in the cultivated field will continue to be disturbed, and it would be worth discussing some sort of minimization efforts, such as no-till farming, with the landowner.

Conclusions

The research undertaken at the Bartron village site this summer was successful in answering our research goals. Although we did not find the French presence we were looking for, "negative" findings still give us information about the village site. The project also attracted good attention to the importance of this work and of cooperation among researchers, descendant communities, landowners, and state and federal agencies. Our findings have already and will continue to help refine our knowledge of Native history in the Red Wing area, and we look forward to collaborating on future work. Please feel encouraged to ask any questions you may have. We will be in touch again soon with further information.

Sincerely,

Ronald C. Schirmer, Ph.D.
Assistant Professor
Department of Anthropology
Minnesota State University, Mankato

Emily Hildebrant
Graduate Student
Department of Anthropology
Minnesota State University, Mankato

Information published by IPPNW / Ulm Physician's Initiative – January 2008

Childhood Cancer in the Vicinity of Nuclear Power Plants

The 2007 "KiKK"* Study – IPPNW Physicians Issue Warning:

"Young children develop cancer more frequently when they live near nuclear power plants (NPP).
It has to be assumed that radioactive emissions from NPP stacks are indeed not as harmless as previously believed.
Now it is time to act."

Ulm, January 11th 2008 **Young children living near to German nuclear power plants develop cancer and leukaemia more frequently than children living further away from them. There is a 60% increased rate of cancer and approximately 120% of leukaemia. These are the findings of the "Epidemiological Study of Childhood Cancer in the Vicinity of Nuclear Power Plants" (KiKK Study), commissioned by the German Federal Office for Radiation Protection (BfS). Although the design of the study, carried out by the Mainz Cancer Registry, is generally held to be correct, interpretation of the study's findings is vigorously disputed by the authors[1]. Indications of an increase in the incidence of childhood cancer near nuclear power plants have been found for over 20 years[2], but they have not as yet been taken sufficiently seriously. The correlation has been unequivocally confirmed by the KiKK study. Now it is time to act.**

Background to the 2007 KiKK Study

The KiKK Study was called for in 2001 by IPPNW and the Ulm Physician's Initiative in a large-scale public relations campaign[3], because several studies carried out by Dr. Alfred Körblein of the Munich Environmental Institute[4], - including a study on NPPs in the Bavarian region initiated by IPPNW – had shown a significantly higher incidence of childhood cancer in the proximity of nuclear power plants. Only after massive pressure and over 10,000 letters of protest to the authorities and ministries did the Federal Office for Radiation Protection (BfS) accept the necessity for further studies[5]. The study was then commissioned by the BfS in 2003 to be carried out by the Mainz Cancer Registry[6].

There had already been reports of significant increases in the levels of leukaemia around English nuclear installations in the 1980s. There were also sharp increases in rates of leukaemia around the reprocessing plants at Sellafield and La Hague.

An increased incidence of leukaemia found close to the Krümmel nuclear power plant caused much concern from the beginning of the 1990s onwards. Few studies on the subject were known, however, and most of those that existed showed nothing conspicuous in the vicinity of nuclear power plants – at least in the official versions:

1992[7] and 1997[8] – Two studies by the Mainz Cancer Registry (Director: Prof. Michaelis, Institute for Statistics and Documentation of the University of Mainz (IMSD)), covered the periods of 1980 to 1990 and 1980 to 1995 respectively. The childhood cancer rates in the vicinity of the 20 German nuclear installations (of which three were decommissioned nuclear power plants and two were research reactors) were examined. Main finding – nothing conspicuous[9].

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* „KiKK“ stands for „Epidemiologische Studie zu Kinderkrebs in der Umgebung von Kernkraftwerken“ (Epidemiological

The "Michaelis" study has been consistently criticised since 1992 by Prof. Roland Scholz in numerous IPPNW[10 11] and other publications[12 13], A renewed analysis of the data in the IMSD studies in 1998 by Dr. Körblein and Prof. Hoffmann[14] showed that there was a significant increase in the rate of childhood cancer within a radius of 5 kilometres. The increase was to be found only when operational nuclear power plants were taken into account, not the decommissioned plants, nor the research reactors. The increase was only found amongst infants under the age of 5 years old.

Methodology and findings of the 2007 KiKK Study

The results of the KiKK study were published in December 2007 in the European Journal of Cancer[15] and in the International Journal of Cancer[16]. The study covered all 16 large reactor locations where the 20 nuclear power plants in Germany were in operation during this period of time (period of study: 24 years, 1980 – 2003). Since the Lingen and Emsland locations are only two kilometres apart, they were combined into one study region. In the first part of the study a total of 1592 under-fives with cancer were compared to a control group of 4735 children. The distance between the children's homes and the power plants was precisely determined to within 25 meters. The main questions posed by the study were: "Do children under five years old more frequently develop cancer when living near a nuclear power plant?" and " is there a negative distance trend?" (In other words: does the risk increase the nearer one lives to the plant?) The results showed not only a 60% increase in the cancer rate and a 117% increase in leukaemia in infants within the 5 kilometre radius, but also a significant increase in the risk of cancer and leukaemia the closer one lived to the nuclear power plant.

In the second part of the study, which covered a shorter period of time and a selection of diagnoses (leukaemia, lymphomas and tumours of the central nervous system), it was tested whether other risk factors (confounders) could have had any appreciable effect on the main result of the study – the negative distance trend. This proved not to be the case for any of the studied risk factors. The proximity of residence to the nuclear power plant remains the only plausible influencing factor.

On the discussion on the "small number" of cases

After the findings of the study were published in December 2007, the authors frequently emphasised appeasingly, that the study basically "only" dealt with a small number of cases of cancer. 37 cases were observed where 17 would have been expected statistically. This means that in a period of 24 years there was less than one additional leukaemia case a year. The 20 additional cases were only to be found within the 5 kilometre radius and were all cases of leukaemia. The reciprocal distance rule implicit in the study, however, adds up to a total of 127 additional cases amongst infants for the whole region under study.

Moreover, it can be assumed that such effects do not confine themselves to small children. Older children and adults could also be affected. However, the rates of cancer development amongst these groups have not yet been the subject of a comparable systematic study anywhere in the world.

It seems to me that the argument is significant that the KiKK study, in its methods and the questions it posed, was not set up to determine the exact number of additional cases of cancer at all. One can always find larger or smaller numbers of ill children according to the random selection of the size of the study area and using different distance rules. The latest KiKK study has a methodological strength, however, in testing the distance trend (which was also the main question posed by the study). This overcame the disadvantage of classically dividing the area into circular sections. But the KiKK study is inappropriate for determining the absolute number of cases. The authors' reference to the small number of cases is obviously meant to soften the highly charged controversy over the results of the study. In any case, the study proves that there is an increased risk that correlates to the proximity to nuclear installations. That the absolute number of additional cancer cases is not higher is in part due to the fact that the area around nuclear power plants is usually thinly populated.

Controversial interpretation of the KiKK study – was it only coincidence?

The authors of the study were at first surprised by the results they had arrived at. They quickly pointed out that the raised levels of childhood cancer and leukaemia in the vicinity of nuclear power plants could not be explained by radioactive emissions. They claimed that the doses of radioactivity calculated to be in the vicinity of nuclear power plants are below the average dose from natural background radioactivity. Since this is not compatible with current radiobiological thinking, they did not rule out the possibility of coincidence as an explanation.

The findings of the 2007 KiKK study invalidate those of the previous studies by the Mainz Cancer Registry (IMSD 1992 and 1997). This should not really be a surprise, since Körblein had already pointed these effects out many times, as had Körblein and Hoffmann in their reanalysis of the IMSD study in 1998. For this reason, Körblein was strongly attacked by the Mainz Cancer Registry and accused of "data dredging"[17]. However, the 2007 KiKK study completely confirms the IMSD reanalysis of 1998. The authors belonging to the Mainz Cancer Registry have also admitted in the meantime that their earlier studies had already shown an increased cancer and leukaemia risk for infants living in close proximity to German nuclear power plants.

So what is the cause? "Coincidence" already has a long and sad tradition as an ultimate and helpless example of interpretation in radiological causality research. Let me remind you of the attempts made to explain the raised levels of childhood leukaemia in the area near the Krümmel power plant and Geesthacht nuclear research centre. Previous inexplicable clusters were given as the explanation for another inexplicable cluster. Was it once again simply coincidence? Yet coincidence as an explanatory model was clearly held to be improbable by the external expert's group, commissioned by the BfS to supervise the drafting, the execution and evaluation of the KiKK study[18]. In referring to coincidence, the Mainz authors are ignoring the current state of research.

Already in the summer of 2007, a comprehensive meta-analysis by Baker et al. on leukaemia in children living near nuclear power plants[19] caused a sensation. They examined data contained in a total of 17 international studies carried out in Germany, Spain, France, Japan and North America during the period between 1984 and 1999. Epidemiologists at the University of South Carolina discovered an enhanced risk of between 14 and 21% of developing leukaemia for children under nine years of age, depending on distance. All of the people examined under the age of 25 had an increased morbidity probability of about 7-10% and the rates of mortality were raised by 2-18%.

Correlation between the rate of morbidity, emission measurements, calculation model for radiation exposure and the biological effects of radionuclides

In Germany, children that are living near nuclear power plants develop cancer and leukaemia more frequently that those living further away. This has long been only a supposition, but has now been clearly proven and is officially accepted[20].

If emissions have been correctly measured by monitoring the areas surrounding nuclear installations, as has been claimed by both the NPP operators and the regulatory authorities, then either the currently accepted calculation models for determining radiation exposure of local residents are incorrect, or the biological effects of incorporated radionuclides have been badly underestimated, at least for young children or embryos.

The results of the KiKK study compel us to critically review not only the measurement of emissions by the operators but also the rules for calculating dose measurement and the risk models on which they are based. Any of these three steps could help solve the contradiction between the allegedly low doses and the severe effects referred to by the authors.

A separate inquiry into the boiling water reactor design type is also necessary

Boiling water reactors (BWR) have only one main cycle in their design. Pressure water reactors (PWR) have two separate main cycles, which means that BWRs have one less barrier holding back radioactive material from the surrounding area. The weak point can be found in the machine room of the NPP where highly radioactive hot steam is transported out of the reactor itself to the turbines.

In order to eliminate one individual location as the sole cause of the morbidity rate, the data in the study was assessed 16 times, each time excluding one location. In every case the exclusion did not change anything related to the main result of the study – a negative distance trend. It was not tested, however, whether there was a difference in risk levels when comparing BWR or PWR design types. This question could be answered easily enough using the existing study data.

There is enough evidence to show that the BWRs in Germany (currently Brunsbüttel, Krümmel, Phillipsburg 1, Isar 1, Gundremmingen B + C; in the past Würgassen) have higher levels of emissions. According to the annual reports of the government, environmental radioactivity and radiation exposure[21] of BWRs are appreciably higher than those of PWRs, though within the currently accepted limits.

It is now time for us to act. The indications over many years that there are increased levels of morbidity near to NPPs have now been scientifically proven by the KiKK study.

Noone can rule out the possibility of an increased risk for older children and adults living near NPPs. A systematic investigation of the type of the KiKK study has still to be carried out for these groups.

The previous mode of measuring emissions and reporting them needs to be put to the test. We can no longer rely on the information given by the NPP operating company. There needs to be official monitoring without any gaps and measured values must be made public.

Previous assumptions about radiation risk, and the emission limits for radiation that are based on these, need to be critically re-examined and adapted to current international research findings.

In addition, the data in the KiKK study should be separately assessed according to whether the location is a BWR or PWR.

We should primarily think about the people affected – the precautionary principle is long overdue.

Further cases of cancer near to NPPs have to be prevented. The only kind of reactor that does not present a cancer risk is a decommissioned reactor.

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Internet links (in German)

www.ippnw-ulm.de   www.ippnw.de   www.alfred-koerblein.de

www.bfs.de   www.umweltinstitut.org   www.kinderkrebsregister.de

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