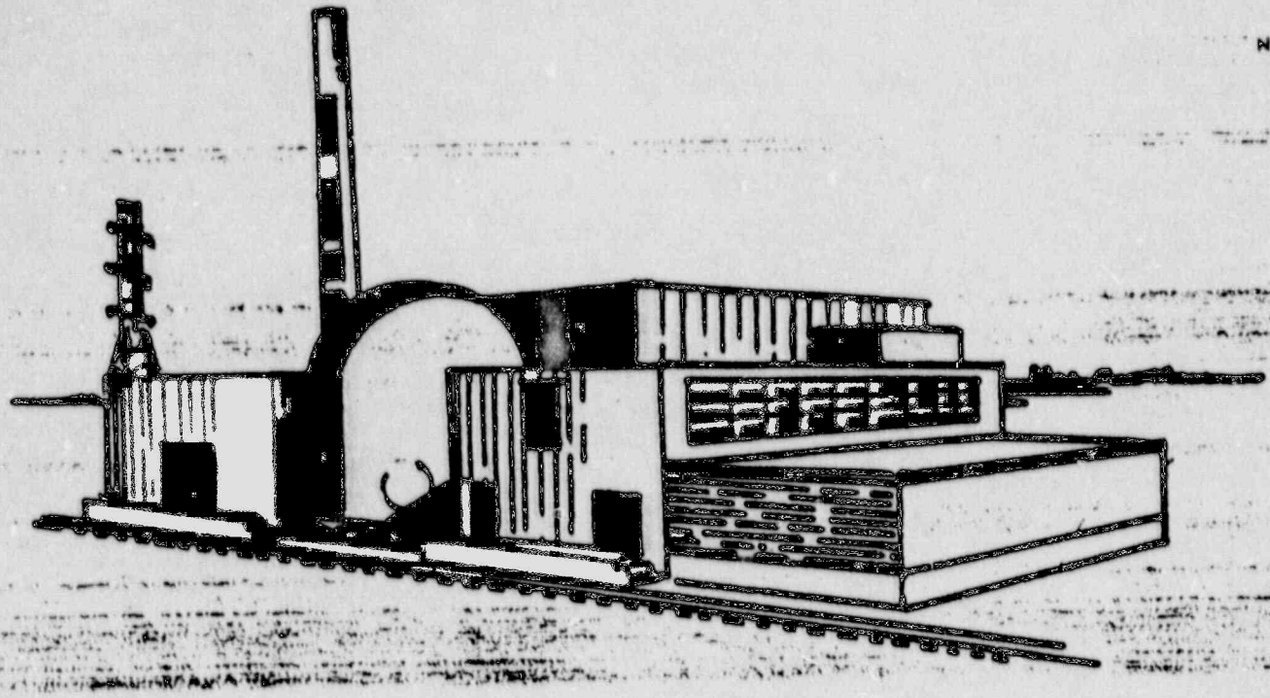

Pathfinder Atomic Power Plant

INCORPORATING INTEGRAL NUCLEAR SUPERHEAT

SIOUX FALLS, SOUTH DAKOTA

REPORT TO UNITED STATES ATOMIC ENERGY COMMISSION

DIVISION OF REACTOR LICENSING

LICENSE NO. DPR-11

SIX-MONTH OPERATING REPORT NO. 6

PLANT OPERATING EXPERIENCE

NOV. 19, 1968 TO MAY 19, 1969

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I. INTRODUCTION

Northern States Power Company's Provisional Operating License No. DPR-11 for the Pathfinder Atomic Power Plant requires that:

"Within 30 days after the completion of six months of operasion of the reactor (calculated from the date of completion of Phase II of the Power Operation Test Program), and at the end of each six-month period thereafter Northern States shall submit a written report to the Commission which summarizes the following:

(a) Total number of hours of operation and total energy generated by the reactor;

(b) Number of shutdowns of the reactor with a brief explanation of the cause of each shutdown;

(c) Operation experience including levels of radioactivity in principal systems; routine releases, discharges, and shipments of radioactive materials; and the results of any test analyses completed during the period including results of tests required by the Technical Specifications; a summary of experiments conducted; number of malfunctions in the control and safety systems with brief explanations of each; and a discussion of data obtained relating to superheater operation;

(d) Principal maintenance performed and replacements made in the reactor and associated systems including a report on various tests performed on components of the reactor and associated systems;

(e) A description of the leak tests performed pursuant to the Technical Specifications and the results of such tests including a description of any necessary corrective measures taken to meet the requirement of the Technical Specifications for assuring the specified containment leak tightness;

(f) Significant changes made in operating procedures and in plant organization;

(g) Radiation levels recorded at both on-site and off-site monitoring stations."

Section 50.59, 10 CFR 50, permits the holder of a license authorizing operation of a nuclear reactor to make changes in the facility, changes in procedures, and conduct tests or experiments, provided that the change, test or experiment does not involve a change in the Technical Specifications or an unreviewed safety question. The licensee is required to report such changes to the Commission.

II. REPORT SUMMARY

This six month report (NSP 6901) summarizes Pathfinder operations during the period of November 19, 1968 through May 19, 1969. There was no reactor operation during this period. The plant has been shut down since September 16, 1967.

Reassembly of the reactor components was nearly completed. All that remains is to install the demister and vessel head. The 40 poison shims used during power operation, component assembly bolting, vessel test specimens and all pieces of separator vanes recovered were placed in stainless steel baskets and set on the separator shelf.

All of the nuclear fuel is in storage in the fuel handling building. The thirty-six zero power test elements were transferred from the storage pool to the new fuel storage vault. Surveys showed a maximum of 10 mr/hr on contact with these elements. This was believed to be mostly smearable contamination which had collected on the elements while in the storage pool. Arrangements are essentially finalized for shipping all fuel off-site by the end of October this year. Licenses SNM-1133 and SNM-1118 as amended authorize the loading by NSP of Pathfinder's fuel into the approved shipping containers. These licenses are included in Appendix III. In addition, Department of Transportation Second Revised Special Permit No. 5261 has been received. This permit authorizes shipment of the Low Enriched Superheater elements in the original Westinghouse shipping containers.

Pathfinder systems have been modified for fossil fueled boiler operation. Lines from the reactor building have been closed with welded steel caps or blank flanges. Construction of the boilers and associated equipment is sufficiently complete to anticipate initial operations early in June.

The turbine-generator and several other items have been overhauled. Along with this work, most of the primary system was decontaminated. Decontamination factors ranged from 2 to 10. It is estimated that 1.5 to 2.0 Curies of radioactive material remain in the system.

Change No. 18 to the Technical Specifications was granted to allow recirculation of heating system air within the fuel handling building. Provisional Facility License DPR-11 was amended to allow NSP to possess, but not to operate, the deactivated Pathfinder reactor. The amendment also provides authorization to possess and store certain special nuclear and byproduct materials in the reactor facility pending their removal from the Pathfinder plant site. Byproduct Material License Number 22-08799-02 was received and authorizes use of the given byproduct material for instrument calibration and possession in piping in the fossil fueled power plant of activated corrosion products.

A total of thirteen shipments of radioactive waste were made during the reporting period. The total activity was calculated to be 33.395 Curies. All shipments were made to Sheffield, Illinois, for burial.

A meeting of the Pathfinder Safety Committee was held on March 19, 1969. Semi-annual audits of plant operation were conducted at that time.

Compliance inspectors, Mr. Jess Crews and Mr. George Smith, visited the site on March 28, 1969. As a result of an earlier Compliance visit, a Form AEC-592 siting NSP on an item of non-compliance was received on December 4, 1968. The Form states, "Contrary to the requirements of 10 CFR 20.201(b), 'Surveys', an arc cutting operation was initiated on a radioactive contaminated component (demister stand) on July 3, 1968, prior to making a survey that was adequate to determine compliance with the provisions of 10 CFR 20.103, 'Exposure of individuals to concentrations of radioactive materials in restricted areas.'" This activity and the actions taken to minimize the possibility of a recurrence of this or a similar type incident were included in the last six month report (NSP 6802).

III. REACTOR REASSEMBLY

Reassembly of the Pathfinder reactor components was initiated at this time as a matter of expedience. The number of personnel at Pathfinder to do this work is decreasing. Personnel exposures will be minimized, too, by replacing the radioactive components in the vessel. Also, the boiler fuel boxes were stored in the deep end of the storage pool. This space will be needed for loading of irradiated fuel into the shipping cask.

All of the steam separators were replaced in the vessel. All separator groups are fully seated except the group containing separators #34, 35 and 36, from which the nozzles were cut off for examination. This group, however, is pinned well enough to the side of the vessel to preclude its movement.

The boiler grid plate was not fully seated after lowering into the vessel. When the boiler core shroud was installed, the grid plate settled into place. The shroud did not seat easily and had to be pulled down on the north side with a number of bolts. The bolts were then removed, so that there are no bolts securing either the grid plate or shroud. All boiler fuel boxes and boiler control rods were replaced in the vessel.

At this time, two stainless steel baskets containing small parts were set on the separator shelf. One basket containing the 40 irradiated shims was placed between separator groups 10-11-12 and 13-14-15. The second basket was placed between groups 4-5-6 and 7-8-9 and contains the following items:

51	Separator vane pieces (This is all of the pieces retrieved from the reactor vessel and recirculation lines.)
1	Holddown baffle piece
16	Grid plate bolts
13	Shroud bolts
10	Vessel material sample capsules with chains
5	Chains from sample capsules sent for analysis.

The holddown assembly was set in position without any difficulty. The demister and vessel head were the only components not installed. It is not intended at this time to install the vessel head since the present means of cleanup is by the shield pool cleanup system.

The two irradiated antimony sources were removed from their beryllium annuli and transferred to a source handling basket in the storage pool. The process tubes containing the beryllium annulus inserts were not removed from the reactor.

In the process of reassembling the reactor, three foreign pieces were accidentally dropped into the vessel. Their description and locations are as follows:

1. Superheater control rod yoke identification cap consisting of a $1\frac{1}{2}$-inch long piece of 3/4-inch carbon steel pipe with a 1 inch high bail welded on. Its location is unknown.

2. Stainless steel hook for the hook tool. It is about 10 inches long of 1/4-inch rod and rests between two groups of separators on the separator shelf on the east side of the vessel.

3. Nylon guide for placing on a control rod extension while installing the holddown assembly. This is in the bottom of the boiler box in location R-BG-3.

No attempts were made to retrieve these articles.

IV. SYSTEMS MODIFICATIONS

Continuing work on the conversion of Pathfinder with the installation of fossil fueled boilers to provide steam for the turbine-generator required the cutting of several lines which were known to be internally contaminated with corrosion product deposits. These lines were either capped or extended into the boiler plant system. Safety analyses submitted with request for Amendments 47 and 48 apply to these plant modifications made under the provisions of Section 50.59(a) of 10 CFR 50. These safety analyses are included herewith in Appendix III.

Pipe cutting and welding operations were performed in accordance to procedures approved by the Pathfinder Operations Committee. Several sections of piping and two feedwater heaters that were cut out were shipped off-site for burial. Figure 1 is a portion of the Pathfinder simplified systems diagram and has been marked to show where lines have been cut and capped. Each system is discussed below:

A. Main, Dump and Auxiliary Steam. The main steam line was cut on the turbine building side of the reactor building. All of this pipe was removed to just downstream of the dump line lateral. A steel cap was welded on the end from the reactor The steam line from the boilers was welded to the line to the stop valves.

Dump line piping and the dump valve were removed to the condenser desuperheater. A steel cap was welded to the desuperheater pipe. The auxiliary steam supply for the air ejectors and the gland steam evaporator is from the main steam line through a new stop valve.

B. Reactor Safety Valve Discharge. The spool piece and approximately 15 feet of pipe on the condenser side of the reactor safety valve discharge isolation valve were removed. A blank flange was bolted to the isolation valve and a steel cap was welded to the end of the line to the condenser.

C. Feedwater System. The reactor feedwater line was cut on the turbine building side of the reactor building and closed with a welded cap. Instrument taps on the reactor side of the cut were also capped. The feedwater line was removed back to the tee with the bypass around No. 14 feedwater heater. This included the feedwater flow nozzle. The feedwater line to the new boilers ties in at this point. The original No. 14 feedwater heater was removed and shipped off site for burial. A new No. 14 feedwater heater with a higher water side pressure rating was installed. The 8-inch main feedwater control valve was removed and a spool piece was welded in its place. The 2-inch bypass feedwater control valve was also removed; caps were welded on the 2-inch lines near the 8-inch line.

All 8-inch boiler feed suction piping from No. 13 feedwater heater to the suction valves at the boiler feed pumps was removed from the system. No. 13 feedwater heater, its inlet, outlet and bypass valving and a section of piping back to the feedwater filters were removed. This heater was replaced in the system by the deaerator located in the boiler building. A 10-inch boiler feed pump suction line was installed from the deaerator to the boiler feed pumps. The line from the feedwater filters was extended to supply the deaerator.

In addition to the above, the condensate supply valve and piping to the desuperheater pipe in the condenser were removed. The tee into the discharge line of the condensate pumps was capped. The three nozzles into the desuperheater pipe were removed and pipe plugs were installed.

All piping and valves associated with the feedwater bypass from downstream of the filters to the reactor feed line were also removed.

D. Feedwater Heater Drain and Steam Supply Systems. Auxiliary steam supply to No. 14 heater was all removed. Only turbine extraction steam plus the miscellaneous drains supply this heater. Normal drain will be to the deaerator.

Extraction steam which went to No. 13 feedwater heater has been rerouted to the deaerator. The cascade drain line to No. 12 heater has been capped at No. 12 heater.

The flash tank steam outlet line which could be routed to either No. 12 heater or the condenser was cut and capped. All piping and the valve to No. 12 heater were removed and the line was capped close to the heater. The valve and some of the piping to the condenser were removed; a section of this line is being used in the new system.

E. Auxiliary Start-Up Heater. The auxiliary startup heater and all piping so associated were removed. The inlet from the purification line was removed and capped at the lateral at the purification line. The outlet to the feedwater line was removed as was this section of feedwater line. The purification system bypass which tied into the outlet line was also completely removed. The gland steam generator steam supply line was capped at the valve near this heater.

F. Purification System. As mentioned earlier, the steam outlet from the flash tank was cut and capped as was the purification bypass to the startup heater. The demineralizer outlet line to the condenser was removed to the condenser and capped at both ends. Sections of the flash tank safety valve discharge line to the condenser and the flash tank rupture disc line to the condenser were cut out and capped at both ends.

G. Off-Gas Removal System. The recombiner which was physically located between the two stages of the condenser air ejector was replaced by a pipe spool. The steam heating coil associated with this was also removed.

A flow path for off-gas removal was established by piping up the downstream side of No. 11 off-gas tank inlet valve to the upstream side of No. 12 tank discharge valve. These two valves were physically blocked open. Valve CV1269 was wired to close on a signal from the off-gas radiation monitor. The two off-gas tanks were removed prior to this report period.

The absolute filter in the vacuum pump discharge line which had previously been removed was reinstalled as before.

H. Miscellaneous Systems

The reactor recirculation pump gland seal return line to the condenser was cut and capped on the turbine building side of the containment building.

V. CHEMISTRY AND RADIATION EXPERIENCE

A. Chemistry

During this reporting period the reactor was open to the shield pool and on continuous cleanup via the pools cleanup system. Boiler fuel, superheater fuel, and some of the reactor internals are stored in the fuel storage pool which also was on continuous cleanup via the pools cleanup system. Water from these pools is monitored for pH, conductivity, chlorides, temperature, and gross beta activity. Gross beta activity fluctuated between 10^{-4} uCi/ml and 10^{-7} uCi/ml. Chlorides were usually undetectable (< 12 ppb) and never greater than 24 ppb. Other parameters remained constant throughout the reporting period.

B. Radiation Measurements

1. Routine

Because there were no reactor operations during this reporting period, there were no general surveys performed (radiation measurements at various power levels). General surveys will be initiated prior to and during boiler operation to detect radioactive material movement in the system.

There are presently three accessable areas designated as high radiation areas. They are the reactor building, the pools cleanup system, and the waste storage yard. The reactor building is a high radiation area due to trapped radioactivity in the water column piping and temporarily stored contaminated valves on the operating floor. The pools cleanup system is a high radiation area due to the filters and demineralizers which contain radioactivity producing a radiation field > 100 mr/hr. The waste storage yard contains solid waste in 55-gallon drums which read > 100 mr/hr. All these areas are controlled as required by 10 CFR 20.

2. Special

A large number of special surveys were conducted during the reporting period in connection with decontamination of the primary system, turbine overhaul, and system modification. A summary of radiation levels before and after decontamination is as follows:

Component	Before Decontamination (mR/hr)	After Decontamination (mR/hr)
#11 heater	1.5 to 7	0.5 to 3
#12 heater	1 to 500	1.2 to 10
Low Pressure Turbine	5 to 350	4 to 40
	360 to 2400 dpm/smear	100 to 200 dpm/smear
Hotwell	10 to 15	5 to 7
High Pressure Turbine	1 to 7	1 to 5
Turbine pieces	1 to 50	1 to 6
Steam Lead	to 130	to 75

Radiation levels encountered during system modification showed spots on three pieces of equipment reading >1 R/hr. They were the startup heater (1 R/hr), the feedwater line to the reactor (3 R/hr), and the flash tank line to #12 heater (1 R/hr). All pieces of equipment not used in the new system and containing significant amounts of radioactivity were removed. All pieces of equipment remaining in the system and containing significant amounts of activity were decontaminated.

C. Health Physics

1. Internal

Turbine overhaul personnel were required to submit urine samples and nasal smears during turbine overhaul. All samples were negative.

2. External

The major exposures experienced during the last six-months period were due to work during system modification. A rough breakdown is as follows:

Specific Work	No. of Workers	Total Exposure	High Exposure
Pipefitting	15	2970 mRem	510 mRem
Pipe cutting	4	3395 mRem	940 mRem
Instrumentation	1	470 mRem	
Health Physics	1	870 mRem	
Decontamination	6	920 mRem	250 mRem
Construction (laborers)	11	660 mRem	120 mRem
Electrical	5	380 mRem	100 mRem
Turbine Overhaul	11	420 mRem	100 mRem
Pipe cleaning and insulation removal	6	1570 mRem	520 mRem
Waste Handling	4	1430 mRem	670 mRem

D. Routine Releases

1. Liquid released to the Big Sioux River:

Month	Activity uCi	Avg Concentration uCi/ml	*Fraction of MPC
November	1.48×10^{3}	2.72×10^{-8}	0.0009
December	2.60×10^{3}	4.32×10^{-8}	0.0014
January	3.34×10^{3}	2.57×10^{-8}	0.0009
February	3.14×10^{3}	3.02×10^{-8}	0.0010
March	1.65×10^{4}	1.23×10^{-7}	0.0041
April	2.64×10^{3}	3.38×10^{-8}	0.0011

*MPC of 3×10^{-5} uCi/ml based on most restrictive isotope identified by routine gamma spectrometry analysis.

The average concentration was determined by gross beta times a correction factor for Zn-65. The efficiency for counting Zn-65 with the counter used is less than that of a mixture of fission products.

The average concentration is that which was released from the plant without taking credit for dilution in the river.

2. Gaseous Releases

There was no off-gas flow during this period. Stack gas and particulate monitors did not detect releases above background. Spectrums of CAM tapes indicated only traces of Zn-65 and Co-60.

E. Shipments

A total of thirteen shipments of radioactive waste were made during the reporting period. These included three high level shipments of 55-gallon drums, three shipments of contaminated pipe, and seven shipments of low level 55-gallon drums. Total number of pieces was 53 including two feedwater heaters and total number of drums was 526 including 42 high level drums. Total activity was calculated to be 33.395 Curies. All shipments were made to Sheffield, Illinois, for burial.

F. Radiation Incidents

There were no radiation incidents during the reporting period.

G. Off-Site Monitoring

Environmental data during the reporting period showed no increases or deviation Air sampled continuously at Pathfinder, Sioux Falls, and Vermillion showed less than 1.0 pCi/m^3. All fallout pot samples were normal. There were no significant differences in water samples measured upstream or downstream of the effluent ditch. All environmental film badges showed no detectable radiation exposure.

H. Decontamination of Primary System

Refer to Appendix I for a summary of the decontamination effort.

VI. CONSTRUCTION AND MAJOR MAINTENANCE

A. CONSTRUCTION

1. New Boiler Building General Construction

The forms for the boiler building foundation and the boiler footings were erected in November. The concrete pouring for the boiler building foundation and the boiler support pads was completed by the end of November.

The steel erection work for the boiler building was in progress by the end of November and essentially completed by the middle of January.

During January the installation of the first layer of the metal siding and roofing work was in progress. The concrete work on the building interior and preliminary electrical work for the boiler building began in January.

As of March 8, the metal siding on the boiler building was 90% complete.

2. Pipe Cutting

A considerable amount of piping has been removed from the original plant system. This is covered in Part IV, Systems Modifications.

3. New Equipment In The Boiler Building

The deaerator was moved into place on the second floor of the boiler building during the first week of February. Because of the size of the deaerator, a section of the second floor steel work and concrete floor had to be completed after the deaerator was in place.

A bank of electrical circuit breakers was installed during February and by the end of February steam was supplied to the unit heaters from the present plant heating system. By March 1, the plant cooling water system was tied into the new building and most of the gas piping to the boilers was in place.

The first week of April the boiler erection crew moved #13 boiler into position in the new building. The #12 and #13 forced draft fan motors were placed into position on the second floor.

By April 12 the #12 boiler had been placed in the new boiler building and at this time work at the gas regulating station was nearly completed. Work on the new stack was in progress.

As of April 26 the #11 forced draft fan motor had been placed into position on the second floor of the new building.

During the week of May 4 the #11 boiler was placed into position in the new boiler building.

By May 17 the hydrostatic test of #13 boiler had been completed and air pressure testing of the gas lines in the new building was completed.

As of May 19, the hydrostatic test of #12 boiler was in progress and at this time gas ignition had been established in #13 boiler.

B. MAJOR MAINTENANCE

The following items of major maintenance were completed during this reporting period:

1. Overhaul of the turbogenerator took place from 11 December 1968 to 20 February 1969. This overhaul was coupled with the decontamination of the turbine internals. Details of the decontamination of turbine parts and condenser may be found elsewhere in this report

   In general, the turbine and generator were found to be in excellent condition. Significant findings and maintenance work done are summarized below:

   a. Cracks were found in the stellite surface of #2 and #3 inlet valve plugs. These valves are considered by the manufacturer to be non-repairable and so may have to be replaced within a year or so.

   b. The LP steam seals were found to be badly eroded, an indication of insufficient heat in the sealing steam. Modifications to the gland steam supply system are necessary to alleviate the erosion problem.

   c. The turbine oil system was flushed thoroughly. Four cups of metal chips, scale, weld beads and other foreign materials were removed from the system as a result of the cleaning.

2. New bearings were installed in #12 cooling water pump.

3. Overhauled the #12 fuel handling building sump pump. The pump shaft was built up and new bearings installed.

4. Replaced the impeller housing on the turbine building cold sump pump.

5. Drained and cleaned the Bowser turbine oil conditioner.

6. Drained and cleaned the turbine oil reservoir.

7. Fabricated a six-compartment container for storage of reactor sources.

8. Overhauled the rotary vacuum pump.

9. Overhauled the acid transfer pump. Installed a new mechanical shaft seal.

10. Performed a routine overhaul of the #11 condensate pump and motor.

11. The #12 cooling tower precipitator was prepared for service. Several cracked sleeve-type bearings were repaired by welding.

12. The lime feed mixing boxes on the cooling tower makeup system were repaired by welding a 12" wide plate to all four sides of each of the two mixing chambers.

VII. PERSONNEL CHANGES

A. General

The Pathfinder plant technical supervisory staff organization remained essentially as reported in the previous six-month report (NSP 5802). The operating crew titles were changed to those shown on the following plant organizational diagram. The four regular shifts have three licensed senior reactor operators and one licensed reactor operator in the Steam Plant Operator positions. One additional licensed senior reactor operator and three additional licensed reactor operators will remain assigned to Pathfinder pending future assignment to the Prairie Island Plant. The plant organization now includes 39 personnel.

B. Plant Personnel Changes

1. R F Wagner, Instrument Supervisor, was transferred to the Sioux Falls Division office on January 1, 1969.

2. The following individuals were transferred to the Prairie Island staff on January 1, 1969:

   a. T E McFadden, Plant Results Engineer

   b. G T Goering, Engineer

3. The following individuals were transferred to the Prairie Island staff on April 1, 1969:

   a. J B Brokaw, Shift Supervisor

   b. D W Cragoe, Plant Equipment Operator

   c. M J Balk, Plant Equipment Operator

4. L C Shroeder, laborer, was transferred from the Sioux Falls meter department to Pathfinder on April 1, 1969.

5. R W Rekstad, laborer, was hired on May 1, 1969.

C. Operator Licensing

No additional operator licenses were obtained during this report period. The licensed reactor operator status is:

Senior Reactor Operators (6)

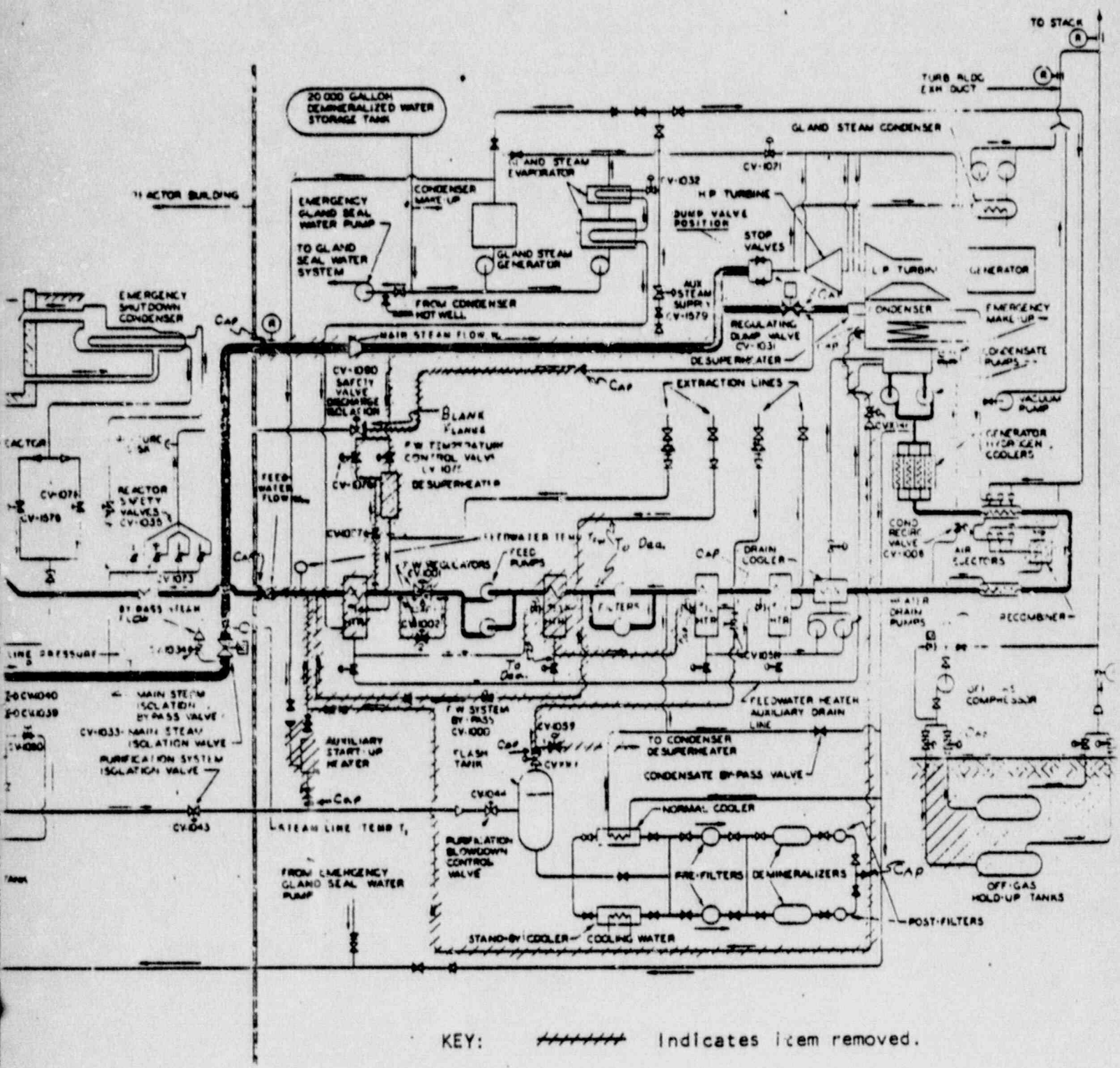
R T McKaughan	Assistant Plant Superintendent
R L Scheinost	Engineer
L V Triebwasser	Steam Plant Operator
D L Magill	Steam Plant Operator
D E Severson	Steam Plant Operator
R D Emerson	(No permanent shift assignment)

Reactor Operators (4)

R C Dolge	Steam Plant Operator
E W Kruse	(No permanent shift assignment)
R S Holthe	(No permanent shift assignment)
V R Stoefen	(No permanent shift assignment)

D. Summary

NSP Management has reviewed each of the above changes and finds that the organization as it exists on May 19, 1969, provides the technical and operational qualifications necessary for Pathfinder.



KEY: ~~~~~ Indicates item removed.

Pathfinder simplified systems diagram showing items changed from the initial system.

APPENDIX I

PRIMARY SYSTEM DECONTAMINATION

Decontamination of the primary system was undertaken by ATCOR, Inc., of New York. The project was accomplished in 2 phases. Phase I consisted of chemically cleaning the low pressure turbine and the condenser; Phase II consisted of cleaning the high pressure turbine, #4 steam lead, and #11 and #12 feedwater heaters.

Decontamination of the low pressure turbine and condenser with the exception of the turbine parts was started on 1-11-69 and completed on 1-13-69. Cleaning was accomplished in four steps:

1. Clean out the loose sludge from the hotwell. An enclosed area was constructed at the hotwell entrance where the loose material was scooped into drums.

2. Spray a 30% concentration of phosphoric acid solution onto the surfaces using a high pressure spray gun (hydrobrush). The chemical was supplied by Turco, Inc., and was inhibited. The chemical was chosen after laboratory experiment with scale from the turbine and condenser surfaces.

3. Spray a very weak citric acid solution onto the surfaces to prevent redeposition.

4. Spray a 0.5% nitrite-phosphate passivating solution to neutralize and protect the new surfaces.

Before starting, the low pressure cover was placed on the turbine and a poly cover was placed over the one open manhole. Approximately 500 gallons of the decon solution were applied using the hydrobrush. Surfaces were continuously wetted and remained wet for about 10 hours. Approximately 600 gallons of the first rinse and 250 gallons of the second rinse solutions were applied in the same manner. Samples of the liquid which was pumped to the turbine building hot sump showed from 6.15×10^{-2} to 1.13×10^{-1} uCi/ml and indicated from 400 to 500 mCi of activity were removed.

Radiation surveys before and after the decon effort indicate a decontamination factor of 2. Smearable levels were reduced by a factor of 10.

An area was set up on the turbine operating floor for decontamination of the turbine parts. The area was enclosed and contained two fiberglass tanks--one containing the decon solution and one containing the passivating rinse. Parts were moved in through the top with the overhead crane and soaked and scrubbed with the decon solution. Later the parts were rinsed before removal to the operating floor. A survey was conducted before and after decontamination to determine if they were acceptable. Some parts were cleaned twice when high smearable and fixed levels still existed.

In general there was a greater decontamination factor for the turbine parts than the turbine casing. An example of this is the low pressure lower outer diaphragm section:

	Before	After
frame exterior	3 - 12 mr/hr	1 - 3 mr/hr
frame interior	15 - 30 mr/hr	1 - 3 mr/hr
blading	3 - 6 mr/hr	1 - 2 mr/hr
smearable	4300 dpm	220 dpm

The high pressure turbine casing was cleaned by hand and the decontamination factor was approximately 2. No. 4 steam lead was lowered from 130 to 75 mr/hr after two decontamination attempts.

Decontamination of the shell side of #11 and #12 heaters was started on 1-29-69 and completed on 2-1-69. This was accomplished by filling with the phosphoric acid decon solution, allowing it to stand for 8 hours and then following with the same two rinses used before.

The solutions were introduced by pumping through the vent lines between valves FH-5 and FH-6, and between FH-8 and FH-9. The heaters were filled up to the top vent which is about 4 inches from the tube sheet. The solution was drained from the bottom.

Radiation measurements were taken before and after decontamination at 23 points on the heaters. As an example of the results the hotter spots read from 17 to 500 mR/hr before decontamination and from 1.5 to 10 mR/hr after decontamination. In general there was a decontamination factor of approximately 10. Of significance is the fact that only 500 mCi were removed from the heaters as measured from samples collected in the hot sump. It had been calculated that these two heaters contained 18.5 Curies which was over half the calculated inventory of the entire system. Approximately 1.3 Curies of activity were removed from the primary system by chemical decontamination. The decon solution containing this activity was packaged in 191 fifty-five-gallon drums and shipped off site for burial.

Decontamination was also performed at a later time on the hydrogen cooler covers, the inlet valves, and the section of steam line remaining in the system. The cooler covers had a thick deposit which read 5 mR/hr. The radiation level was reduced to $<$1 mR/hr. The inlet valve stems read up to 8 mR/hr and were reduced by chemical cleaning to $<$1 mR/hr. The remaining steam line contains about 30 mCi of activity. An attempt was made to remove the loose crud by using a wooden tool and physically scraping the inside of the pipe. Less than 1 mCi was removed in this manner.

There was a large reduction in the radioactive inventory by the removal of contaminated pipe and #13 and #14 feedwater heaters. A total of 51 pieces of pipe, the two heaters, and 4 drums of pipe pieces from the startup heater were packaged and shipped to Sheffield, Illinois, for burial. The calculated activity was 2.61 Curies.

It might be of interest to note that the total weight was 57,000 pounds, the volume 560 cubic feet, and the length of pipe about 600 feet.

We have attempted to calculate the remaining radioactivity in the system by subtracting the total activity removed from the original inventory as calculated by NUS. We substitute our calculated values for systems which were in error such as #11 and #12 heaters. The results show that 4.6 Curies were originally present, 3.6 Curies were removed, leaving approximately 1.0 Curies remaining in the system. This number may be from 0.5 to 1.0 Curies too low because of the conservatism used in calculating the inventory of the pipes and especially the two heaters removed from the system. A better estimate would be 1.5 to 2 Curies remaining.

This value is less than 1/10 of the value used in NUS's hazards analysis, which indicated we had no problems with 33 Curies in the system.

E L Watzl
Health Physics Supervisor

ELW/lmm

APPENDIX II

AEC CORRESPONDENCE

1. Change No. 18

Authorizes a change in the fuel handling building heating system to permit recirculation of air within the building. Also recognizes that as long as the reactor is not to be operated, systems modifications as listed in the change request may be made under the provisions of Section 50.59(a) of 10 CFR 50.

2. Amended Provisional Facility License

Authorizes NSP to possess, but not to operate, the deactivated Pathfinder nuclear reactor. The amendment also authorizes NSP to possess and store certain special nuclear and byproduct materials in the reactor facility pending their removal from the Pathfinder Plant site. (Appendix A - Technical Specifications to License not included).

3. By Product Material License Number 22-08799-02

Authorizes use of given byproduct material for instrument calibrations and possession in piping in fossil fueled power plant of activated corrosion products.

4. Special Nuclear Material License No. SNM-1118

This license, as amended, allows the loading of certain unirradiated Pathfinder fuel elements into authorized containers. A summary of the license is contained in this Appendix.

5. Special Nuclear Material License No. SNM-1133

Authorizes loading of irradiated boiler fuel into ATCOR shipping cask.

C O P Y

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

December 17, 1968

Docket No. 50-130

Northern States Power Company
Minneapolis, Minnesota 55401

Attention: Mr. L. O. Mayer
General Superintendent of Power
Production

Change No. 18
License No. DPR-11

Gentlemen:

This refers to your letter dated November 1, 1968, submitting Amendment No. 46 to your application for the Pathfinder Atomic Power Plant. The amendment relates to changes to the facility for fossil-fueled operation of the turbine. The requested facility changes include: (1) cutting and rerouting of the main steam line and feedwater line, (2) isolation of a feedwater heater and replacement of another feedwater heater with a deaerating heater, (3) installation of a new feedwater line from the new deaerating heater to the existing feedwater pumps, (4) alteration of the fuel handling building heating system, (5) modification of the fuel handling building floor drain system, and (6) necessary temporary connections to perform decontamination of piping and equipment in the existing turbine cycle of the plant. We have designated your request as Proposed Change No. 18.

We understand that the following conditions will exist during the performance of the requested facility changes:

1. The reactor will contain no fuel and all fuel that is on-site will remain stored in the fuel storage areas.

2. The containment isolation valves associated with the main steam line and feedwater line will remain closed.

3. The feedwater line will remain drained during the proposed pipe cutting operations and feedwater heater replacement and isolation.

4. During and after modification of the fuel handling building floor drain system, the liquid waste handling system will remain in operation as required by the Technical Specifications.

5. Established health physics and personnel protection practices and procedures will be observed during all facility decontamination and modifications.

6. All contaminated solutions or wastes resulting from decontamination operations and proposed facility changes will be properly contained and disposed of in accordance with AEC regulations.

On the basis of these considerations, we have determined that the proposed facility changes do not involve unreviewed safety questions.

The proposed change to the fuel handling building heating system would permit recirculation of air within the building rather than require a 100 percent outside air supply as specified in technical specification 4.9.8(b). The heating steam conserved in this manner would be used to heat the new boiler building. The proposed change will not result in significant hazards considerations not described or implicit in the safety analysis report as long as the above conditions exist, and there is reasonable assurance that the health and safety of the public will not be endangered. Accordingly, the last paragraph of Section 4.9.8(b) is hereby deleted from the Technical Specifications (Appendix A) of License No. DPR-11.

The other proposed changes to the facility will not require any changes to the Technical Specifications as long as the reactor is not to be operated. Therefore, these changes to the facility may be made without AEC authorization as provided for by Section 50.59(a) of 10 CFR 50.

Sincerely,

Peter A. Morris, Director
Division of Reactor Licensing

C O P Y

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

NORTHERN STATES POWER COMPANY

DOCKET NO. 50-130

AMENDED PROVISIONAL FACILITY LICENSE

License No. DPR-11
Amendment No. 4

1. The Atomic Energy Commission ("the Commission") has found that:

   A. The application for license amendment complies with the requirements of the Atomic Energy Act of 1954, as amended (hereinafter, "the Act"), and the Commission's regulations set forth in Title 10, Chapter I, CFR;

   B. There is reasonable assurance that the reactor facility can be possessed in the described condition at the location designated in the application without endangering the health and safety of the public;

   C. The Northern States Power Company is technically and financially qualified to engage in the activities authorized by the amended provisional facility license in accordance with the Commission's regulations;

   D. The issuance of the amended license will not be inimical to the common defense and security or to the health and safety of the public;

   E. The Northern States Power Company has furnished proof of financial protection which satisfies the requirements of 10 CFR Part 140; and

   F. Prior public notice of the proposed issuance of this amended license for possession of the deactivated Pathfinder nuclear reactor and its nuclear fuel does not involve significant hazard considerations different from those previously evaluated.

2. Provisional Facility License No. DPR-11, as amended, is hereby amended in its entirety to read as follows:

   A. This license applies to the controlled recirculation boiling water reactor owned by the Northern States Power Company (hereinafter, "NSP") and designated by NSP as the Pathfinder

nuclear reactor. The facility is located near Sioux Falls, South Dakota, and is described in NSP's application dated March 30, 1959, and amendments thereto, including Amendment No. 47 dated November 25, 1968, as modified by Amendment No. 48 dated March 10, 1969 (herein collectively referred to as "the application").

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses NSP:

(1) Pursuant to Section 104.b of the Act and Title 10, Chapter I, CFR, Part 50, "Licensing of Production and Utilization Facilities", to possess, but not to operate, the reactor as a utilization facility;

(2) Pursuant to the Act and Title 10, Chapter I, CFR, Part 70, "Special Nuclear Material", to possess and store at any one time up to (a) 800 kilograms of contained uranium-235 and (b) 224 grams of plutonium encapsulated as two 1-curie and two 6-curie plutonium-beryllium neutron sources; and

(3) Pursuant to the Act and Title 10, Chapter I, CFR, Part 30, "Rules of General Applicability to Licensing of Byproduct Material", to possess and store at any one time up to 200 curies of antimony-124 as antimony-beryllium neutron sources, and to possess, but not to separate, such byproduct material as may have been produced by operation of the facility or may be contained in the component parts of the facility.

C. This license shall be deemed to contain and be subject to the conditions specified in 10 CFR Part 20, Section 30.34 of 10 CFR Part 30, Sections 50.54 and 50.59 of 10 CFR Part 50 and Section 70.32 of 10 CFR Part 70 of the Commission's regulations, and is subject to all applicable provisions of the Act and rules, regulations and orders of the Commission now or hereafter in effect and to the additional conditions specified below:

(1) NSP shall not reactivate the facility or any system which is open to the reactor pressure vessel without prior approval of the Commission.

(2) NSP shall not dispose of the facility or the property occupied by the facility without prior approval of the Commission.

(3) Technical Specifications

The Technical Specifications contained in Appendix A, designated as Change No. 19, are hereby incorporated in this license. NSP shall maintain the reactor in accordance with the Technical Specifications. No changes shall be made in the Technical Specifications except as otherwise permitted by this license, by the Act, and by the Commission's rules and regulations.

(4) Records

In addition to the records heretofore required under this license and by applicable AEC regulations, including Section 20.401 of 10 CFR Part 20, NSP shall keep the following:

a. Records of inspections of the deactivated facility, including the results of surveys of radioactivity levels.

b. Records showing radioactivity released or discharged into the air or water beyond the effective control of NSP as measured at or prior to the point of such release or discharge.

(5) Reports

In addition to those reports required by applicable AEC regulations, NSP shall submit the following:

a. A report of any indication or occurrence of a possible unsafe conditon relating to the facility or to the public. For each occurrence, NSP shall promptly notify by telephone or telegraph the Director of the appropriate AEC Regional Compliance Office listed in Appendix D of 10 CFR Part 20, and shall submit within 10 days a report in writing to the Director, Division of Reactor Licensing, with a copy to the Regional Compliance Office.

b. A report to the Director, Division of Reactor Licensing, of the status of the deactivated Pathfinder facility, including the results of the surveys of radioactivity levels and the status of the special nuclear and byproduct

materials stored on the Pathfinder nuclear reactor facility site. The first report shall be filed six months after issuance of this amended facility license and each six months thereafter until such time as NSP files with the Commission's Division of Reactor Licensing its plan for dismantling of the facility, pursuant to Section 50.82 of 10 CFR Part 50, and receives Commission approval thereof.

D. This provisional facility license, as amended, is effective as of the date of issuance and shall expire at midnight, March 12, 1970.

FOR THE ATOMIC ENERGY COMMISSION

Peter A. Morris, Director
Division of Reactor Licensing

Attachment:
Appendix A - Technical Specifications

Date of Issuance: May 14, 1969

C O P Y

U.S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter 1, Parts 30, 32, 33, 34, and 35, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, own, possess, transfer and import byproduct materials listed below; and to use such byproduct material for the purpose(s) and at the place(s) designated below. This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, and is subject to all applicable rules, regulations, and orders of the Atomic Energy Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Northern States Power Company	3. License number 22-08799-02
2. 414 Nicollet Mall Minneapolis, Minnesota 55401	4. Expiration date: April 30, 1974
	5. Reference No.

6. Byproduct material (element & mass number)	7. Chemical and/or physical form	8. Maximum amount of radioactivity which licensee may possess at any one time
A. Cobalt 60	A. Sealed sources (Nuclear-Chicago Corp. Model RR-61)	A. 1 source not to exceed 100 millicuries and 1 source not to exceed 10 millicuries
B. Americium 241	B. Sealed source (NBS)	B. 1 source not to exceed 0.002 microcurie
C. Cesium 137	C. Any	C. 300 microcuries
D. Strontium 90	D. Any	D. 100 microcuries
E. Cobalt 60	E. Activated corrosion products in piping	E. 100 millicuries
F. Zinc 65	F. Activated corrosion products in piping	F. 4.5 curies

9. Authorized use

A. through D. Instrument calibration.
E. and F. Possession in piping in fossil fueled power plant.

License Number 22-08799-02

CONDITIONS

10. Byproduct material may only be used at Pathfinder Generating Plant, Route 2, Sioux Falls, South Dakota.

11. The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

12. Byproduct material shall be used by, or under the supervision of, L. L. Bach or E. L. Watzl.

13. A. Each sealed source containing byproduct material, other than Hydrogen 3, with a half-life greater than thirty days and in any form other than gas shall be tested for leakage and/or contamination at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

B. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

C. If the test reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired or to be disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the test with the Director, Division of Materials Licensing, U. S. Atomic Energy Commission, Washington, D. C., 20545, describing the equipment involved, the test results, and the corrective action taken. A copy of such report shall also be sent to the Director, Region IV, Division of Compliance, USAEC, 10395 West Colfax Avenue, Denver, Colorado, 80215.

U.S. ATOMIC ENERGY COMMISSION
BYPRODUCT MATERIAL LICENSE

Supplementary Sheet

License Number 22-08799-02

CONDITIONS

13. Continued

D. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the Commission or an Agreement State to perform such services.

14. Except as specifically provided otherwise by this license, the licensee shall possess and use byproduct material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in application dated March 10, 1969.

For the U.S. Atomic Energy Commission
Original Signed By
Robert E. Brinkman
by Isotopes Branch
Division of Materials Licensing
Washington, D. C. 20545

Date May 14, 1969

SUMMARY

Special Nuclear Material License No. SNM-1118

Pursuant to the Atomic Energy Act of 1954 and Title 10, Code of Federal Regulations, Chapter I, Part 70 and Part 71, Special Nuclear Material License No. SNM-1118, which expires March 31, 1970, was issued to Northern States Power Company on March 14, 1969. This license authorizes packaging of special nuclear material (Uranium enriched in the U-235 isotope), at the Pathfinder facility, for delivery to a carrier for transport in accordance with the provisions specified in the application. Exemptions are made from the requirements of Section 70.24, 10 CFR 70, insofar as this section applies to special nuclear material possessed under this license. Pursuant to 10 CFR 30, authorization to possess 5 millicuries (per assembly) byproduct material as contained in 32 fuel assemblies was granted.

Amendment 71-1 authorizes delivery to a carrier for transport, in triple barrel shipping containers (Westinghouse Electric Corporation Drawing C882D742) of Pathfinder fuel assemblies, containing uranium enriched to 6.95 w/o in the U-235 isotope. A maximum of 24 packages of 19 elements each are allowed per shipment.

Amendment 71-2 authorizes delivery to a carrier for transport, in UNC-1886 containers (United Nuclear Corporation Fuels Division drawings E-20259 and E-20259-2) the following Pathfinder fuel elements as specified:

(a) Maximum of two elements containing Uranium enriched to not more than 2.85 w/o in the U-235 isotope per container. (Not more than 3.79 Kg U-235 total).

(b) Maximum of one fuel element containing Uranium enriched to not more than 3.2 w/o in the U-235 isotope per container. (Not more than 2.25 Kg U-235.)

A maximum of 32 packages as Fissile Class III are authorized.

COPY

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

Docket No. 70-1196 License SNM-1133

LICENSE

Pursuant to the Atomic Energy Acto of 1954, as amended, and Title 10, Code of Federal Regulations, Chapter 1, Part 30 "Rules of General Applicability to Licensing of Byproduct Material," Part 70 "Special Nuclear Material," and Part 71 "Packaging of Radioactive Material for Transport," and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, possess, use, and transfer the byproduct and special nuclear material described below for the purpose designated below, in accordance with the regulations in said Parts and the conditions set forth below. This license shall be deemed subject to the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and to all applicable rules, regulations, and orders of the Atomic Energy Commission now or hereafter in effect.

1. Licensee:

   Northern States Power Company
   Minneapolis, Minnesota 55401

2. Purpose:

   Loading of the material specified in Item 3 of this license into the shipping cask specified in Item 4 of this license at the Pathfinder Plant, Sioux Falls, South Dakota and delivery to a carrier for transport of not more than one cask per vehicle as a Fissile Class III shipment.

3. Byproduct Material and Special Nuclear Material:

   Irradiated boiler fuel assemblies from the licensee's Pathfinder Reactor, as follows:

   a. Assembly Type:

      (i) Boiler fuel assemblies containing an average, before irradiation of 1.518 Kg. of U-235 as 2.2% enriched UO_2.

(ii) Boiler fuel assemblies containing an average, before irradiation, of 2.208 Kg. of U-235 as 3.2% enriched UO_2.

b. Maximum number of assemblies per cask loading shall be as shown in the following table:

Loading Configuration	Number of 2.2% Enriched Elements Described in 3.a.(i)	Number of 3.2% Enriched Elements Described in 3.a.(ii)	Number of Poison Rods
1	14	0	10
2	0	10	14
3	8	2	14

4. Shipping Cask:

ATCOR Modified VNDB Shipping and Storage Cask, Serial Number LS-6000-1, described in ATCOR, Inc. drawings LS-6000-1, sheets 1-5, modified as shown by Battelle Memorial Institute Drawings MOD-100 through 111, MOD-114 through 116, MOD-119, MOD-122 and MOD-124 through 128 and further modified by use of 1 1/2-inch, 160,000 UTS closure bolts. Cask to be equipped with the shipping basket described in ATCOR drawing 6449-R-6000-0 Rev. C and boron poison rods described on pages C-5 and C-5(C) of the ATCOR, Inc. report called the Safety Analysis Report for the Shipment of Pathfinder Irradiated Boiler Fuel, March 17, 1969. Poison rods to be arranged as shown on page C-3(A) of the above referenced report.

5. Expiration Date: May 31, 1974.

FOR THE ATOMIC ENERGY COMMISSION

R. B. Chitwood, Chief
Irradiated Fuels Branch
Division of Materials Licensing

Date of Issuance: May 16, 1969

APPENDIX III

SAFETY ANALYSES FOR PLANT MODIFICATIONS

1. Safety Analysis Summary For Amendment No. 47 to License DPR-11.

2. Safety Analysis Associated With Amendment Number 48 to Operating License DPR-11.

C O P Y

DOCKET NO 50-130

SAFETY ANALYSIS SUMMARY

FOR

AMENDMENT NO 47 TO LICENSE DPR-11

INTRODUCTION

This Amendment is requested to permit the operation of a converted system at the Pathfinder Plant. The turbine steam will be supplied by fossil fueled boilers. The reactor will be isolated from the system. A detailed safety analysis is attached to this Amendment.

ANALYSIS

The hazards analyzed are associated with operation of the system with activated corrosion products in the piping and equipment. The activity remaining in the system is essentially 100% zinc-65. Some of the equipment and piping surveyed and included in the total inventory will not be used in the converted system. Where feasible the inventory will be reduced by decontamination. To be conservative no credit is taken for either the removal of components or the decontamination. Further, the entire inventory of radioactive material is assumed to be in solution and available for release.

The hazards are divided into accidents and incidents. The accidents are extremely improbable or hypothetical. The incidents are considered to occur infrequently but are realistic. The hazards analyzed are listed in Table I.

The exposure of personnel is based on a person remaining at the site boundary during the passage of the entire release. The lung dose is based on a one-year exposure following the accumulation of the lung burden.

C O P Y

TABLE I

Accident	Radioactivity Released	Possible Exposure Gamma Dose	Possible Exposure Lung Dose
Main Steam Line Rupture	10.1 Ci ^{65}Zn	0.11 mrem	0.14 Rem
Feed Line Rupture	0.86 Ci ^{65}Zn	0.01 mrem	0.01 Rad
Boiler Explosion	3.96 Ci ^{65}Zn	0.03 mrem	0.04 Rad

Incident	
Boiler Tube Rupture	0.296 uCi/sec (1)
Steam Relief Discharge	2.0×10^{-2} uCi ^{65}Zn (2)
Forced Draft Preheater Leak	8×10^{-5} Ci ^{65}Zn/year (2)

(1) Present Tech Spec limit = 1.4 uc/sec

(2) Less than 10 CFR 20 limit at point of discharge

C O P Y

DOCKET NO 50-130

SAFETY ANALYSIS ASSOCIATED WITH
AMENDMENT NUMBER 48 TO
OPERATING LICENSE DPR-11

All of the nuclear fuel has been removed from the reactor and is now in storage in the fuel handling building. The radioactive material which now remains in the reactor building is composed of activated reactor structural components as the result of reactor operation and activated corrosion products. There are no detectable fission products in the building.

The main steam line and the feedwater line have been cut and capped with welded steel caps. All isolation devices which will be separated from the safety systems will be deactivated in the isolating position. The radiation monitoring program which was in effect during power operation will remain in effect. Access to and egress from the building and areas within the building will be controlled in accordance with 10 CFR 20.

The irradiated fuel is in storage in the fuel storage pool in the fuel handling building. The unirradiated fuel is in the new fuel storage vault in the fuel handling building. The description and analysis of the storage facilities and Core I fuel were submitted in ACNP 5905 as part of the original operating license application.

The description of the Core II fuel was submitted in ACNP 67525. The authorization to receive and store the Core II fuel was applied for in our Amendment No 42 and authorized in Change No 15 to the license, DPR-11.

Therefore, on the basis that the potential hazard in the reactor building has been greatly reduced from that which was analyzed in the original license application and the fuel storage is the same as that which was previously analyzed, the license change for which authorization is requested does not constitute a hazard to the health and safety of the general public.