U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Licensee:	Northern States Power Company
Facility:	Prairie Island Nuclear Generating Plant
Location:	1717 Wakonade Dr. East Welch, MN 55089
Dates:	November 16 - 20, 1998
Inspectors:	R. Glinski, Radiation Specialist M. Mitchell, Radiation Specialist A. Kock, Radiation Specialist
Approved by:	G. Shear, Chief, Plant Support Branch 2 Division of Reactor Safety

EXECUTIVE SUMMARY

Prairie Island Nuclear Generating Plant
NRC Inspection Reports 50-282/98022; 50-306/98022

This inspection included a review of the licensee's radiation protection (RP) performance during the Unit 2 refueling outage, surveys to allow the unconditional release of turbine components, shut down chemistry and crud burst, As-Low-As-is-Reasonably-Achievable (ALARA) planning and implementation, and radworker performance. Overall, activities within the areas examined were well conducted and radiation protection support for the Unit 2 outage was effective.

- The licensee's ALARA reviews, radiation work permits, and job planning identified and effectively addressed radiological conditions for various outage tasks. The ALARA initiatives for this outage were appropriate and the various ALARA measures were effectively implemented by station staff to minimize dose. (Section R1.1)

- Overall, the RP staff exercised effective control of work practices and radiological conditions within the plant. Monitoring and control of contamination was successful as evidenced by the low number of personnel contaminations and the low levels of contamination detected. Although some minor RP issues were identified, the outage activities were conducted with an ALARA focus. (Section R1.2)

- Overall, the RP staff exercised effective control of work practices and radiological conditions in the containment, related to reactor head and upper internals lifts, and the fuel handling activities. Monitoring and control of radworker dose was successful as evidenced by the low collective dose as compared to dose estimates for these specific tasks, and the ALARA pre-job briefings were thorough. (Section R1.3)

- The licensee had effectively implemented the chemical additions and primary system venting during reactor shutdown which resulted in an overall reduction of the source term. (Section R1.4)

- Surveys conducted for the free release of turbine components were extensive and were conducted by experienced staff. Storage of released components was appropriate. (Section R4.1)

Report Details

IV. Plant Support

R1 Status of Radiation Protection and Chemistry (RP&C) Controls

R1.1 ALARA Reviews and Implementation for the Unit 2 Refueling Outage

a. Inspection Scope (IP 83729)

The inspectors reviewed several pre-job ALARA reviews, interviewed RP supervision regarding ALARA planning for the Unit 2 outage, assessed several ALARA reviews for upcoming jobs, and observed the implementation of ALARA measures and work activities throughout containment.

b. Observations and Findings

The inspectors noted that ALARA reviews for specific tasks were conducted by the Radiation Protection (RP) Superintendent prior to the development of the work packages and radiation work permits (RWPs). The ALARA reviews consisted of the following: (1) a review of historical files for radiological data and lessons learned, (2) pre-job briefing material for radiological conditions, protective clothing requirements, and RP coverage, (3) ALARA measures and engineering controls to minimize dose, (4) dosimetry requirements and hold points, and (5) low dose waiting areas. The inspectors noted that the ALARA reviews were thorough and were conducted in accordance with station procedure.

ALARA initiatives for this outage included the placement of lead shielding on a frame built over the letdown isolation valves and the development of a vault valves list. This valve list was posted at the containment entry and as a reference to help personnel locate the various valves to decrease the search time for the valves. In addition, the RP staff washed down the steam generator (SG) manways to decrease both dose rates and contamination levels. The contamination levels on the SG platform were historically low and there were no SG discreet particle concerns.

The inspectors observed a reactor head inspection, SG eddy current testing (ECT), and limited reactor coolant pump (RCP) work. The RP&C staff provided effective support for these various activities. In particular, the inspectors noted a radiation protection specialist (RPS) on the reactor head with the reactor engineer, but questioned whether the reactor engineer investigating the potential canopy seal leak should have worn a comfort mask to minimize facial contamination. The RPS noted that the removable contamination data did not warrant extra protection, and the engineer did not become contaminated during this inspection. The ECT crew worked with an appropriate ALARA focus, and the RPSs effectively used both headsets and remote dosimetry to monitor their work. The containment RPS staff surveyed the #21 RCP routinely after its placement onto the refuel floor, and the RCP was posted as a high contamination area when survey data indicated high removable contamination levels. No radworker practice concerns were identified during these tasks.

For the 12 task specific RWPs which were completed at the time of this inspection, the licensee expended less dose than expected by an average of more than 20%. Also, there was no radiation dose attributable to rework. Although the RP staff effectively controlled the radiation dose for most outage activities, the SG nozzle dam work will exceed the estimated dose, due to problems with the nozzle dam bolts which resulted in an extra SG entry (this involved dose rates of greater than 8 rad per hour). At the time of this inspection, the data did not indicate that any other jobs would exceed the dose estimate. And although the licensee had estimated that there would be approximately 6.8 rem for emergent work on the SGs, RCPs and canopy seal welds, the inspectors concluded that the licensee would complete the outage with a reasonable radiation dose that would be consistent with the original 84.7 rem estimate.

c. Conclusions

The inspectors determined that the licensee's ALARA reviews and RWP/job planning identified and effectively addressed radiological conditions for various outage tasks. The inspectors also noted that ALARA initiatives for this outage were appropriate and that the various ALARA measures were effectively implemented by station staff to minimize dose.

R1.2 Observation of Contamination and Airborne Radioactivity Controls, Radiological Postings, and Housekeeping

a. Inspection Scope (IP 83750)

The inspectors conducted walkdowns and observed various outage activities in the containment, auxiliary, and radwaste buildings. In addition, the inspectors interviewed RP staff regarding control of radiological conditions and reviewed radiological survey, personnel contamination, and whole body count data.

b. Observations and Findings

The inspectors' independent measurements around the reactor head and the cavity cleanup system demonstrated that the radiological postings and survey maps appropriately reflected current plant conditions. The inspectors noted that the RPS staff conducted routine surveys to ensure the information was current. In general, housekeeping was very good and no radiological impediments to work activities were observed. The inspectors noted that personnel dosimetry was worn as required, that survey meters and air samplers were within calibration, and that the concrete block shielding around the reactor cavity cleanup system effectively reduced the dose rates in the immediate area surrounding this equipment. Access to high radiation areas was appropriately controlled.

Contamination controls were effective, as potentially contaminated items were either within the designated areas or were bagged and labeled appropriately. However, the inspectors noted that two plastic bags containing eddy current reels were torn. Plant staff promptly double bagged and labeled these components. Review of outage personnel contamination data indicated that contaminations were minimal and involved

very low levels of radioactivity. Additionally, a skin dose assessment was conducted for only one worker and the calculated dose was well below the 100 millirem threshold for a skin dose assignment.

Monitoring for airborne radioactivity was extensive, as continuous air monitors (CAMs) and air samplers were located throughout containment in close proximity to work areas. The data for a variety of jobs demonstrated that airborne radioactivity greater than 1 DAC was detected only for the incore thimble tubing ECT. The airborne levels in specific areas ranged up to 3.5 DAC (primarily cobalt -58 and cobalt-60) and the workers were equipped with bubble hoods to prohibit internal dose.

RPS coverage for specific jobs and routine rounds was effective. The inspector observed that RPSs at the Radiologically Controlled Area and containment access points adequately briefed workers and exercised appropriate control of various tasks. The inspectors accompanied an RPS on containment rounds and noted that this individual conducted a thorough walkdown of ongoing jobs, radiation hotspots, remote radiation monitor alarms, and locations that were being setup for work.

c. Conclusions

Overall, the RP staff exercised effective control of work practices and radiological conditions within the plant. Monitoring and control of contamination was successful as evidenced by the low number of personnel contaminations and the low levels of contamination detected. Although some minor RP issues were identified, the inspectors noted that outage activities were conducted with an ALARA focus.

R1.3 Observation of Reactor Vessel Head and Upper Internals Movement in Preparation for Fuel Handling

a. Inspection Scope (IP 83750)

The inspectors observed the reactor vessel head lift, the ligament ultrasonic testing, movement of the upper internals of the reactor, and fuel handling activities. In addition, the inspectors attended pre-job briefings and interviewed RP staff regarding control of radiological conditions.

b. Observations and Findings

The inspectors attended the pre-job briefings for the reactor head lift, ligament ultrasonic testing, and upper internals movement tasks. Attendance at the briefings was mandatory for personnel involved in these evolutions. The pre-job briefings were well done and consisted of a detailed review of the lifting, moving, and testing procedures, the requirement to close the mechanical and personnel air locks, expected radiological conditions and controls, RP coverage and hold points, safety precautions, the RWP dosimetry and dress requirements, historical case studies, and specific job responsibilities. Time was allowed for questions from the various crews.

The inspectors observed the reactor head lift, ligament ultrasonic testing, and upper internals lift activities, and verified that radiological controls, such as high efficiency particulate air (HEPA) filter ventilation in the cavity, remote dosimetry monitoring, required protective clothing, and low dose areas, were utilized by site staff. Plant personnel also utilized headsets to establish effective communication between the RP staff on the upper level and the staff in the reactor cavity. The dose rates near the stud holes and in the waiting areas were closely monitored and the ultrasonic testing staff worked efficiently to accomplish their work quickly. As a result, the ultrasonic testing work expended less than one-third of the estimated dose for this testing activity. The reactor head and upper internals preparations and lifts were accomplished with 10% less dose than anticipated. The RP coverage for the upper internals lift was extensive, and the RPS surveyed for discrete particles effectively.

Although the reactor head lift job was completed with a collective dose below the estimate, the use of the Unit 1 load cell and problems with the coordination of the lift with the control room caused the containment purge (which consisted of HEPA and charcoal filters) and in-service purge ventilation to be turned off for a longer time than usually required. The delays allowed the airborne levels to increase and caused a refuel floor CAM alarm. After the cavity floodup was initiated, the level of airborne radioactivity was measured at 0.62 DACs (derived air concentration). As a result, several plant personnel on the refuel floor alarmed the personnel contamination monitors at access control, due to nasal contaminations. Further monitoring with the whole body counter demonstrated that the intakes would cause an internal dose well below the 10 millirem threshold for dose assignment. The inspectors reviewed this data and determined that the dose assessments used appropriate methodology

Monitoring for airborne radioactivity was extensive, as CAMs and air samplers were located throughout containment in close proximity to work areas. The RP&C staff limited the potential for airborne particulates by draping the reactor vessel head and wetting the upper internals until the cavity water level was sufficient to limit airborne particulate. The lifting rig crew wore hoods and either dust masks or face shields in areas where airborne particulate was possible.

The inspectors observed fuel handling activities, and noted that the radiological controls for radiation dose and airborne radioactivity were appropriate. In particular, the RPS staff monitored airborne tritium levels in the spent fuel and reactor cavity areas and determined that tritium was well below 1 DAC. The RPS staff also continuously monitored the radiation levels on the fuel handling bridge. These provisions ensured appropriate monitoring and control of exposures during fuel movement.

c. Conclusions

Overall, the RP staff exercised effective control of work practices and radiological conditions in the containment related to reactor head and upper internals lifts, and fuel handling activities. Monitoring and control of radworker dose was successful as evidenced by the low collective dose as compared to dose estimates for specific jobs. The ALARA pre-job briefings for these tasks were thorough.

R1.4 Reactor Coolant System (RCS) Shutdown Chemistry Controls

a. Inspection Scope (IP 83750)

The inspectors reviewed the RCS shutdown chemistry controls and results, and interviewed chemistry supervision regarding the crud burst results.

b. Observations and Findings

During the shutdown for this refueling outage, plant personnel performed an early boration with greater than 800 parts per million (ppm) boron prior to the RCS temperature decreasing below 400 degrees. Then the boron level was increased to the refueling level of 2500 ppm, which was followed by a hydrogen peroxide (H_2O_2) addition. The early boration, conducted in the presence of hydrogen, created an acid-reducing condition which removed iron from the primary system. Then, through the addition of H_2O_2, an acid-oxidizing condition was established which facilitated a large release of nickel and other corrosion products (crud burst) from the fuel bundles that were subsequently removed from the RCS by the purification system.

During this Unit 2 outage, the acid reduction phase was followed by a venting of the RCS hydrogen. For the acid-oxidizing phase, plant staff were able to achieve and maintain the oxygen levels between 2000-4000 parts per billion with a single addition of H_2O_2. The RP&C staff monitored the radiochemistry data, which indicated that these shutdown controls achieved a crud burst which was comparable to previous outages. The inspectors noted that the crud burst continued for several days, with a maximum concentration of 4.6E-1 microcuries per milliliter removed from the RCS.

c. Conclusions

The inspectors determined that the licensee had effectively implemented the chemical additions and RCS venting during reactor shutdown which resulted in an overall reduction of the source term.

R4 Staff Knowledge and Performance in RP&C

R4.1 Radiological Surveys for the Free Release of Turbine Components

a. Inspection Scope (IP 83750)

The inspectors reviewed the free release survey data and interviewed RP&C staff involved in the surveys performed to release the turbine components. The inspectors also walked down the turbine building area which contained some of the released turbine components.

b. Observations and Findings

Interviews with the RPS primarily responsible for this work indicated that this individual had ample experience with radiation survey equipment to conduct free release surveys.

The RP staff had a specific procedure to govern this process, which required a 100% survey of the areas most likely to be contaminated, such as the last row of turbine blades, the gland seal area, and the stationary cylinder thermal shield; and a 10% survey of the remaining areas. These surveys consisted of routine smears, massllin smears, and frisking; with the massllin smears counted in the tool monitor. Survey data demonstrated that no contamination was detected on any of the turbine components. The inspectors noted that there were large turbine components which had been released after surveys and these components were appropriately stored on the turbine deck.

c. Conclusions

Surveys conducted for the free release of turbine components were extensive and were conducted by experienced staff. Storage of released components was appropriate.

X1 Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management at an exit meeting on November 20, 1998. The licensee did not indicate that any materials examined during the inspection should be considered proprietary.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

J. Hill, Generation Quality Services
A. Johnson, Radiation Protection Superintendent
S. Lappegaard, Radiochemistry Supervisor
G. Malinowski, Radiation Protection Supervisor
D. Shuelke, General Superintendent of Radiation Protection and Chemistry
J. Sorensen, Plant Manager
P. Wildenborg, Health Physicist

NRC

P. Krohn, Acting Senior Resident Inspector, Prairie Island
S. Thomas, Resident Inspector, Prairie Island

INSPECTION PROCEDURES USED

IP 83750, "Occupational Exposure"
IP 83729, "Occupational Exposure During Extended Outages"

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None

PARTIAL LISTING OF DOCUMENTS REVIEWED

Radiation Protection Implementing Procedure (RPIP) #1704, "Eddy Current Testing and Steam Generator Primary Side Repair"

RPIP #1705, "Reactor Head Removal"

RPIP #1708, "Reactor Coolant Pump Seal Work"

Maintenance Procedure D58.2.5, Revision 0, "Unit 2 Reactor Internals Removal"

Maintenance Procedure D58.2.9, Revision 0, "Unit 2 Reactor Vessel Head Removal"

Radiation Work Permit (RWP) 2024, Revision 1, "Eddy Current Testing of Steam Generator Tubes, Setup/Test/Tube Mark"

RWP 2001, Revision 2, "Routine Outage Inspections"

RWP 2036, Revision 1, "Reactor Upper Internals Removal and Replacement"

RWP 2035, Revision 1, "Reactor Head Lift to 715' Level"

RWP 2048, Revision 3, "Reactor Coolant Pump Seals Remove/Inspect/Replace"

RWP 2114, Revision 1, "Reactor Head Visual Inspection and Associated Work"

RWP 2040, Revision 1, "Fuel Shuffle, Inventory, Rod Latch/Unlatch"

LIST OF ACRONYMS USED

ALARA	As Low As is Reasonably Achievable
CAM	continuous air monitor
DAC	Derived Air Concentration
ECT	eddy current testing
HEPA	High Efficiency Particulate Air
HRA	High Radiation Area
ppm	parts per million
RCA	Radiologically Controlled Area
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RP	Radiation Protection
RP&C	Radiation Protection and Chemistry
RPS	Radiation Protection Specialist
RWP	Radiation Work Permit
SG	Steam Generator