U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report Nos:	50-282/98019(DRS); 50-306/98019(DRS)
Licensee:	Northern States Power Company
Facility:	Prairie Island Nuclear Generating Plant
Location:	1717 Wakonade Dr. East Welch, MN 55089
Dates:	October 13-16, 1998
Inspectors:	R. Glinski, Radiation Specialist M. Mitchell, 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 50-282/98019; 50-306/98019

This inspection consisted of a review of the chemistry program as it relates to plant water quality and analytical capabilities, the Offsite Dose Calculation Manual (ODCM) and the subsequent implementation of the Radiological Environmental Monitoring Program (REMP), selected radiation protection controls, and self-assessment activities. The inspection resulted in the following conclusions:

- The REMP program and the land use census were well implemented, and the 1997 data demonstrated that there was no discernable impact on the environment from plant operations. The plant's lower limits of detection (LLD) for drinking water were inconsistent with NRC guidance and industry standards, and plant personnel planned to revise the ODCM to meet the regulatory guidance (Section R1.1).

- Plant water quality for both the primary and secondary systems remained excellent. There were notable improvements in secondary system chemistry through effective management of the ion exchange equipment and the plastic coating of 50% of the condenser tubesheet (which will be applied to the untreated portions during the next outage). The hideout return studies confirmed improved secondary water quality and indicated minimal steam generator fouling (Section R1.2).

- Chemistry sampling lines were maintained in good operating condition. Throughout the plant, radiological postings and controls were generally well maintained and associated surveys were well performed. The inspectors observed good work practices and no significant radiological impediments to routine work were identified (Section R1.3).

- Plant personnel alertly analyzed soil excavated from a landlocked area to the applicable environmental LLDs and detected very low concentrations of plant radionuclides. The contaminated soil was stored properly and the inspectors discussed with management that the ODCM should be revised to include this newly found effluent pathway. The licensee has included the landlocked area in its 10 CFR 50.75(g) file (Section R2.1).

- Chemistry personnel were knowledgeable of their various responsibilities, demonstrated good laboratory practice, and displayed ownership of chemistry department activities. The analytical performance of the chemistry staff was excellent as evidenced by blind quality control data for a variety of analytes (Section R4.1).

- Overall, the quality assurance activities and materiel condition of the laboratory and process instrumentation were excellent, as evidenced by quality control checks and laboratory intercomparison data. In addition, the control of standards and reagents was effective (Section R7.1).

- A comprehensive chemistry/REMP self assessment program was conducted by plant personnel. These actions identified areas for improvement and the identified issues were appropriately followed up for proper resolution (Section R7.2).

- In response to hot particle contaminations during the forced outage, the radiation protection staff took appropriate steps to identify the scope and source of the contamination and the radworker dose due to the contaminations. Plant personnel then established specific corrective actions to address the root cause, and their response to this incident demonstrated a thorough and effective management of emergent radiation protection issues (Section R7.3).

Report Details

IV. Plant Support

R1 Radiological Protection and Chemistry (RP&C) Controls

R1.1 Implementation of the Radiological Environmental Monitoring Program (REMP)

a. Inspection Scope (IP 84750)

The inspectors reviewed the 1997 Annual Radiological Environmental Monitoring Report, the Offsite Dose Calculation Manual (ODCM), and the Technical Specifications (TS). The inspectors also observed air particulate/iodine and surface water sampling, and interviewed various plant staff regarding the operability and materiel condition of the sampling equipment and implementation of the REMP.

b. Observations and Findings

The inspectors observed that the REMP sample collector's air and water collection techniques ensured sample integrity and he was knowledgeable of appropriate sampling principles. The collector appropriately labeled and packaged the samples, and he also properly tested the air sampling train for leakage. The water sampling was conducted appropriately, as the container was rinsed with the sample media prior to sample collection, as required by procedure. During interviews, this individual indicated that recent problems due to condensation on air sampling components were easily solved by placing plastic bags over the affected components. The inspectors determined that the REMP sample collector was sufficiently knowledgeable of sampling requirements, equipment, and transport; and no operability or materiel condition issues regarding the sampling equipment were identified. The inspectors observed that some of the vegetation around the P-4 air sample location could potentially impede air flow to the sampler. Plant personnel acknowledged this observation and have made plans to address this issue.

The inspectors noted that the 1997 REMP was submitted by the TS-required date and that the report contained the information required by the ODCM. The report listed problems with either the collection or analysis for only six of the required samples (one milk and five air), and since the reasons for these deviations were primarily weather related or were due to the strike of the contract carrier for the samples, specific actions to prevent recurrence were unnecessary. Plant staff properly maintained the air sampling equipment and flow calibrations with a secondary standard. The calibrations were performed quarterly to ensure that sample flow was accurately determined.

The inspectors noted that the required lower limit of detection (LLD) in the ODCM for iodine-131 (I-131) and tritium were listed as 15 and 3000 picocuries per liter (pCi/l), respectively, since no drinking water pathway existed. However, during interviews with plant personnel and REMP data review, the inspectors noted that while a municipal drinking water sample was collected, groundwater from various wells was also used as drinking water. The inspectors discussed with radiation protection (RP) management

that NRC guidance in a Branch Technical Position and in NUREG-0472, "Standard Radiological Effluent Technical Specifications of PWRs", stated that the appropriate LLDs for these radionuclides in samples from a drinking water pathway were 1.0 and 2000 pCi/l, respectively; and that water used as drinking water should be analyzed to the more stringent drinking water pathway LLDs. The applicable water samples are currently analyzed to LLDs of 1.0 and 175 pCi/l such that a change in station practice was not required, however the appropriate LLDs were not required by the ODCM. Plant personnel indicated that the ODCM requirements would be revised to be consistent with industry standards and NRC guidance. This planned ODCM change, along with the potential ODCM change discussed in Section R2.1, will be reviewed as an Inspection Followup Item (IFI 50-282/ 98019-01; 50-306/98019-01)

The REMP program included the collection and analysis of air, water, vegetation, fish, aquatic invertebrates, and bottom and shoreline river sediment. Thermoluminescent dosimeters (TLD) were used to measure direct radiation and were exchanged quarterly. The quality assurance data of the vendor radioanalytical laboratories demonstrated excellent analytical capabilities. The results from the REMP sampling and analyses, including the analyses of supplemental onsite and offsite groundwater wells, indicated that plant operations did not have a discernable radiological impact on the environment.

The inspectors compared the 1996 and 1997 Land Use Census data to ensure that the preparation was in accordance with the ODCM and that proper reviews for changes that could affect the assessment of offsite doses were conducted. No changes to the ODCM sampling locations from 1996 were identified as a result of the Land Use Census and the offsite dose modeling did not require any changes from the previous year.

c. Conclusions

The REMP program and land use census were well implemented, and the 1997 data demonstrated that there was no discernable impact on the environment from plant operations. The inspectors noted that the required LLD for drinking water was inconsistent with NRC guidance and industry standards, and plant personnel planned to revise the ODCM to meet regulatory guidance.

R1.2 Control of Plant Water Quality

a. Inspection Scope (IP 84750)

The inspectors reviewed the Updated Safety Analysis Report (USAR), water quality procedures, primary and secondary water quality data for the past year, and hideout return studies from both units. The inspectors also interviewed plant personnel regarding past and future actions to improve plant water quality.

b. Observations and Findings

Primary and secondary (blowdown, feedwater, and condensate) water quality data for both units showed that chemical contaminants during power operations were controlled well within plant USAR and procedural requirements, which were consistent with the

Electric Power Research Institute (EPRI) Action Level 1 guidelines. The data also showed that reactor coolant chemicals for reactivity control (boron), pH control (lithium), and corrosion control (hydrogen pressure) were maintained within acceptable limits. There were occasional instances when deviations from various water quality levels occurred, and these were due to maintenance activities such as primary system valve tests during downpowers and steam generator (SG) flash tank inspections or a change of a SG blowdown filter. Licensee staff re-established the proper levels in a timely manner.

For a few weeks in early 1998, the hydrogen detector indicated that the Unit 1 hydrogen levels in the reactor coolant exceeded the USAR value of 35 cubic centimeters per kilogram of water. The staff determined that the detector was not functioning properly, as it had been "flooded" during the unit startup. After the detector was dried and cleaned, the values returned to the acceptable band. During this process, the staff maintained the volume control tank pressure to produce the expected hydrogen levels. Trending of Dose Equivalent Iodine (DEI) and xenon and argon gas levels indicated that there were no fuel integrity issues.

The excellent water quality of the secondary system was maintained through a combination of actions. The staff managed the change out of the ion exchange beds by monitoring for flouride breakthrough, as increased flouride would not contribute to system corrosion. Also, the treatment of 50% of the condenser tubesheet with a plastic coating effectively reduced condenser inleakage. Plant personnel have planned to coat the remainder of the condenser tubesheet during the next outage.

The inspectors reviewed SG hideout return data for both units and the data indicated significant reductions in contaminant return levels. The total return levels, coupled with the very slight prompt return of the contaminants, demonstrated that the contaminant levels in the SGs were extremely low. In addition, the calculated Molar Ratio Index (MRI) for each of the SGs indicated that the pH in the crevices would be near neutral, which was a notable improvement over previous return studies. Therefore, based on this combination of data, the chemical fouling of the SGs would be minimal.

The chemistry staff recently initiated a quarterly report which presents primary system radiochemistry data in categories such as corrosion products, control rod wear products, and fission products which should enable plant management to better recognize trends and improve assessment of the primary system.

c. Conclusions

Plant water quality for both the primary and secondary systems remained excellent. There were notable improvements in secondary system chemistry through effective management of the ion exchange equipment and the partial plastic coating of the condenser tubesheet (which will be applied to the untreated portions during the next outage). The hideout return studies confirmed improved secondary water quality and indicated minimal SG fouling.

R1.3 Radiological Controls within the Radiologically Controlled Area (RCA)

a. Inspection Scope (IP 83750)

The inspectors accompanied an RP Technician (RPT) during a routine plant walkdown to determine whether RP controls were effective. The walkdown was conducted throughout the Auxiliary Building and the Radwaste Storage Building. The inspectors also reviewed chemistry sample line materiel condition during the walkdown.

b. Observations and Findings

The inspectors noted that all sample lines and fittings were in good condition and without observable degradation or leaks. All radiation protection instrumentation observed in the plant was operable and within calibration. All personnel in the RCA were observed in compliance with good radiation protection practice, using time, distance and shielding as well as appropriate contamination protection practices. All postings for Radiation Areas, High Radiation Areas, and Locked High Radiation areas were appropriate. Radiation surveys conducted by the inspectors did not identify any incorrectly posted areas, and all Locked High Radiation Areas were found in the locked condition.

c. Conclusions

Chemistry sampling lines were maintained in good operating condition. Radiological postings and controls were generally well maintained and associated surveys were well performed. The inspectors observed good work practices and no significant radiological impediments to routine work were identified.

R2 Status of RP&C Facilities and Equipment

R2.1 Identification of a New Effluent Pathway

a. Inspection Scope (IP 84750)

The inspectors observed the landlocked area used for discharges of condenser water under specific circumstances. The inspectors also reviewed the licensee's 10 CFR 50.75(g) file and interviewed plant personnel regarding this new effluent pathway.

b. Observations and Findings

The inspectors discussed the periodic discharge of water drained from the condenser to an area designated as the landlocked area, which was similar to a drainage ditch. These discharges occurred during refueling outages when the suspended solids in the condenser drainage water were high. Under these circumstances, the licensee was prohibited by a State agency from discharging this water into the river, which was the routine effluent point. Therefore, the licensee then discharged this condenser water to the landlocked area. This water was analyzed for radionuclide content prior to discharge, but the results were below the applicable effluent LLDs.

As part of a modification of the landlocked area, the licensee excavated a significant amount of soil. Gamma spectrometry of the soil to the appropriate environmental LLDs detected low levels of plant radionuclides (cobalt-60, cesium-134, and cesium-137 at 10^{-7} microcuries per gram) in some of the soil. These nuclides were detected to a depth of approximately 45 centimeters at the near side of the landlocked area, and to a length of approximately 60 meters from the discharge point. The depth of the contamination decreased down the length of the landlocked area from the discharge point. The licensee packaged this contaminated soil and stored the containers in the barrel yard of the radwaste building. The soil which contained only cesium-137 at near background levels (from weapons fallout) was planned to be placed back into the landlocked area. The licensee will make record of this soil return in the 10 CFR 50.75(g) required file. The contaminated portion of the landlocked area was within the protected area, but this drainage area extended into the owner controlled area beyond the protected area fence.

Based on discussions with plant personnel, the radioanalytical results of the landlocked area soil, and past radiochemical analyses of turbine building sump sludge (IR 97017), the inspectors determined that the extremely low levels of radionuclides in the condenser drain water were being accumulated and concentrated by the landlocked area soil. As these discharges occurred on a periodic basis, the inspectors discussed with RP management that this practice should now be considered an effluent pathway and that a description should be included in the ODCM. Plant personnel indicated that this would be included in the ODCM. This potential revision of the ODCM, along with the ODCM change stated in section R1.1, will be tracked as an Inspection Followup Item (IFI 50-282/98019-01; 50-306/98019-01).

In addition, the inspectors reviewed the file that RP staff had prepared in accordance with 10 CFR 50.75(g) and a dose assessment for the condenser water effluents to the landlocked area. The 10 CFR 50.75(g) file contained the appropriate landlocked area information and the staff's dose assessment used appropriate methodology.

b. Conclusions

Plant personnel alertly analyzed soil excavated from the landlocked area to the environmental LLDs and detected very low concentrations of plant radionuclides. The contaminated soil was stored properly and the inspectors discussed with site staff that the ODCM should be revised to include this newly found effluent pathway. The licensee has included the landlocked area in the 10 CFR 50.75(g) file.

R4 Staff Knowledge and Performance in RP&C

R4.1 Performance of Chemistry Sample Collection and Analysis

a. Inspection Scope (IP 84750)

The inspectors interviewed chemistry staff and observed chemistry sampling and analysis activities. The inspectors also interviewed chemistry supervisory staff and reviewed chemistry technician proficiency data for laboratory analyses.

b. Observations and Findings

The inspectors observed that plant chemistry samples (primary and secondary water) were collected appropriately. The chemistry technician (CT) was experienced and knowledgeable regarding proper sample collection, analysis, and general laboratory practices. The CT also effectively used the chemistry laboratory database system to log quality control (QC) and analytical results. The inspectors observed that the materiel condition of the sampling panels was excellent and that CT ownership was evident for the chemistry work.

Although the chemistry department did not have a formal intracomparison program, the daily QC checks for a variety of analytes on the different laboratory instruments were conducted with standards having chemical concentrations which were unknown to the CTs. The concentrations of these "blind" QC daily check standards were changed regularly. For the past year, this trended QC data indicated that the CTs analytical performance was excellent. The inspectors noted that the sodium analysis by atomic absorption, with approximately 5% of the QC results outside the acceptance level, had the highest failure rate. In addition, the inspectors noted a positive bias in the boron titration QC results. Chemistry supervision indicated that this bias was caused by the autotitrator's delivery of approximately 1.5% more sample than expected. This method was used for boron analysis of the primary system and the purchase of a new autotitrator has been planned.

c. Conclusions

Chemistry personnel were knowledgeable of their various responsibilities, demonstrated good laboratory practice, and displayed ownership of chemistry department activities. The analytical performance of the CTs was excellent as evidenced by blind QC data for a variety of analytes.

R7 Quality Assurance in RP&C Activities

R7.1 Quality Assurance/Quality Control for Laboratory Instrumentation and Analyses

a. Inspection Scope (IP 84750)

The inspectors reviewed chemistry quality assurance/quality control (QA/QC) data for both chemistry and radiochemistry laboratory instrumentation, and also interviewed chemistry staff regarding overall laboratory QA/QC.

b. Observations and Findings

The inspectors reviewed the QA/QC data for the following instruments/methods and their associated analyses:

- Ion Chromatography - sulfate, chloride, flouride, sodium, boron ,lithium
- Wet chemistry/titration - boron
- Ultraviolet/visible spectrometry - silica

- Gamma Spectrometry - gamma emitting isotopes in air and coolant
- Liquid Scintillation Counter - tritium in effluent air
- Atomic Absorption - sodium, feedwater iron

The QC data for process instrumentation and for chemical and radiochemical laboratory instrumentation indicated that instrument performance had remained within acceptable statistical parameters. The staff effectively utilized QC charts to trend instrument performance, and the chemists reviewed the data regularly to check for biases, trends, and outliers; and to initiate corrective action. As an example, in response to anomalous efficiency and resolution data for the germanium detector #1, which was located at access control, the chemistry staff determined that the instrument electronics were overheating. The cabinet was subsequently rearranged and also modified to prevent this phenomenon. There were no recurrences of this problem.

The counting room staff tracked peak area, peak width, and peak location to gauge the gamma spectrometry system performance. The liquid scintillation counter QC data were also reviewed regularly for any adverse trends. The QC charts demonstrated that laboratory instrumentation performance was excellent. The calibrations and annual verifications of the radiochemical instruments utilized commercial radionuclide standards which were traceable to the National Institute for Standards and Testing (NIST). The inspector noted that the most recent calibrations were conducted appropriately and comparison to previous calibration data showed that the radiochemistry instruments have remained stable.

The laboratory participated in QA interlaboratory comparison programs for both chemical and radiochemical analyses. For 1997, the radiochemistry intercomparison results were excellent, as all reported values were in agreement with the known values. The chemistry intercomparison results passed at an 80% level, with some problems encountered for anions in the primary system matrix. The chemistry staff indicated that a recent analytical method change, which passed the intercomparison sample through a cation resin prior to analysis (which reflects the method used for plant chemistry samples), should lead to improved performance in the intercomparison program. The inspectors noted that this change was appropriate. The materiel condition of the laboratory and process instrumentation was very good, and all laboratory reagents were within the prescribed shelf life.

c. Conclusions

Overall, the QA/QC and materiel condition of the laboratory and process instrumentation were excellent, as evidenced by QC checks and QA intercomparison data. In addition, the control of standards and reagents was effective.

R7.2 Chemistry/REMP Program Audits and Self Assessments

a. Inspection Scope (IP 84750)

The inspectors reviewed the chemistry/REMP self-assessments, management observations of training and field activities, and observation reports prepared by Generation Quality Services (GQS) staff.

b. Observations and Findings

The inspectors noted that both REMP/chemistry management and GQS auditors had conducted numerous observations of field work, such as REMP/effluents sampling, laboratory QA/QC activities, data reports, ODCM setpoints, and training. The audits found that plant requirements and expectations were generally met by the site staff. However, a chemistry self-assessment determined that five procedures should be changed to indicate proper practice, and a procedure for the collection of an air ejector gas grab sample did not exist. The staff effectively followed up and resolved these issues. The management observations of classroom training indicated that the instructor's performance was generally satisfactory, and that the training was effective.

In addition, a corporate health physicist conducted an historical assessment of the REMP program. This individual concluded that the REMP included appropriate environmental media collection and analysis, but recommended an air sampler be added at the nearest residence. The RP management was reviewing this potential addition to the REMP. This corporate health physicist also accompanied an audit of the REMP contract laboratory in 1995, during which no problems were identified.

c. Conclusions

A comprehensive chemistry/REMP self-assessment program was conducted by plant personnel. These actions identified areas for improvement and the issues were followed up for proper resolution.

R7.3 Performance of the Error Reduction Task Force (ERTF) in Support of RP Issues

a. Inspection Scope (IP 83750)

The inspectors reviewed the licensee's ERTF Report 98-08. The inspectors also interviewed task force members to clarify the corrective action plans related to an incident where hot particle contaminations were identified following the cleaning of the incore instrumentation (ICI) system.

b. Observations and Findings

The licensee identified "hot particle" sources during an ICI system cleaning job in the Unit 1 containment on June 12, 1998, which was during a forced outage. The ICI cleaning was performed to remove small particles and grit from the thimbles which would allow for easier detector movement. Thirteen separate personnel contaminations

occurred during this evolution, involving eleven workers. The highest skin dose to any individual was 205 millirem, indicating that the actual radiation exposures were not significant. Although the safety significance was low, the RP staff determined that this job warranted further analysis and corrective action, and this issue was subsequently forwarded to the ERTF for review.

The ERTF reviewed past ICI system cleanings and found a possible correlation with hot particles and thimble tube work conducted in 1992. The ERTF concluded that the cause for the 1998 contaminations was identified because the work during the forced outage was limited, thus making the correlation more easily recognizable.

The inspectors reviewed the chronology of events and summary of factors that influenced human performance surrounding the event. The review of the ERTF report confirmed a good process for root cause identification. This report also identified weaknesses in written communications, work practices, work organization and planning, supervisory methods, training and qualifications, and the ability to manage change. The report also outlined specific corrective actions for each weakness. The inspectors determined that the recommended corrective actions properly addressed the root causes for these contaminations.

c. Conclusions

The licensee identified hot particle contaminations during the forced outage, and took appropriate steps to identify the scope and source of the contamination and the radworker dose due to the contaminations. The licensee's assessment of this evolution established specific corrective actions to address the root cause, and their response to this incident shows a thorough and effective management of emergent RP issues.

V. Management Meetings

XI Exit Meeting Summary

The inspectors presented the inspection results to members of licensee management on October 16, 1998. The licensee acknowledged the findings presented and did not identify any of the information reviewed as proprietary.

PARTIAL LIST OF PERSONS CONTACTED

Licensee Personnel

M. Agen, REMP Coordinator
D. Gauger, Senior Plant Chemist
A. Johnson, Radiation Protection Supervisor
D. Larimer, Radiochemistry Supervisor
S. Lappegaard, Radiochemistry Supervisor
D. Shuelke, Radiation Protection Manager
J. Sorenson, Plant Manager

NRC Personnel

P. Krohn, Resident Inspector
S. Thomas, Resident Inspector

INSPECTION PROCEDURES USED

IP 84750	Radioactive Waste Treatment, and Effluent and Environmental Monitoring
IP 83750	Occupational Radiation Exposure

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-282/98019-01	IFI	Planned changes to the ODCM to be consistent with NRC guidance regarding drinking water LLDs and effluent pathways
50-306/98019-01		

LIST OF ACRONYMS USED

CFR	Code of Federal Regulations
CT	Chemistry Technician
DEI	Dose Equivalent Iodine
EPRI	Electric Power Research Institute
ERTF	Error Reduction Task Force
GQS	Generation Quality Services
ICI	Incore Instrumentation
LLD	Lower Limit of Detection
MRI	Molar Ration Index
NIST	National Institute For Standards and Testing
ODCM	Offsite Dose Calculation Manual
pCi/l	picocuries per liter
QA/QC	Quality Assurance/Quality Control
RCA	Radiologically Controlled Area
REMP	Radiological Environmental Monitoring Program
RP	Radiation Protection
RP&C	Radiological Protection and Chemistry
RPT	Radiation Protection Technician
SG	Steam Generator
TLD	Thermoluminescent Dosimetry
TS	Technical Specifications
USAR	Updated Safety Analysis Report

PARTIAL LIST OF DOCUMENTS REVIEWED

Updated Safety Analysis Report, Table 4.1-9, Typical Reactor Coolant Water Chemistry

Technical Specifications, Section 6.7.5.C - Environmental Reports

Offsite Dose Calculation Manual

1997 Annual Radiological Monitoring Report

Radiation Protection Implementing Procedure (RPIP) #4731, Revision 5, "REMP Air Sampling"

RPIP #3006, Revision 3, "Primary Water Chemistry Guidelines"

RPIP #3002, Revision 5, "Secondary Water Chemistry Guidelines"

Unit 1 Cycle 18 Operation and Hideout Return Evaluation, dated December 31, 1997

Unit 2 Forced Outage Hideout Return Evaluation, dated February 27, 1998

Tritium Groundwater Sampling Results, dated July 14, 1998

Indian Community Well Water Tritium Results for 1998, dated October 5, 1998

Dose Rates from Excavated Landlocked Area Soil, dated October 1, 1998

Radiochemistry EBAR Analysis Results, dated September 14, 1998

1997 Chemistry Self-Assessment

Trip Report-Visit to Teledyne Brown Isotopes Midwest Lab, September 21-22, 1995

GQS Observation Reports 1998089, 1998142, 1998132, 1998150, 1998154, 1998159, 1998084, 1998079, 1998056, 1998088, 1998057