U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-454
License No:	NPF-37
Report No:	50-454/99005(DRS)
Licensee:	Commonwealth Edison Company
Facility:	Byron Nuclear Power Station, Unit 1
Location:	4448 N. German Church Road Byron, IL 61010
Dates:	April 1-22 1999
Inspectors:	Jerome Schapker, Reactor Engineer Brent Metrow, Illinois Department of Nuclear Safety (IDNS)
Approved by:	John M. Jacobson, Chief, Mechanical Engineering Branch Division of Reactor Safety

EXECUTIVE SUMMARY

Byron Nuclear Power Station, Unit 1
NRC Inspection Report 50-454/99005(DRS)

The purpose of this inspection was to verify the adequacy of licensee programs, procedures, equipment and supporting documentation for the Inservice Inspection Program (ISI). The following observations were made:

- ISI program requirements were implemented in accordance with Regulatory and American Society of Mechanical Engineers (ASME) Code requirements. (Section M1.1)

- The steam generator inspection program for the recently replaced (first cycle) steam generators (SG) was conservative and included 100% examination of SG tubing in SGs B, C and D and secondary side visual examination for loose parts and sludge lancing for all four SGs. The examination and maintenance of the steam generators and Class one and two components were performed satisfactorily. (Section M1.2)

- The Flow Accelerated Corrosion Program is modeled to the most current industry guidelines. Repairs and replacements use upgraded materials to reduce wear rates. (Section M1.3)

- Procedures were thorough and documentation was completed per procedure and applicable Code requirements. (Section M3)

- The knowledge and performance of the engineering staff and contractors in the area of ISI was good. The licensee staff was intimately involved in emerging issues and resolution of problems. (Section M1.2, M4)

- The Master Assessment Plan (NOP-38) contained detailed assessment tasks. The in-process assessment of inspection contractors appeared rigorous. (Section M7)

Report Details

II. Maintenance

M1 Conduct of Maintenance

M1.1 Observation of Inservice Inspection Program

a. Inspection Scope (73051,73052)

The primary focus of the inspection was to verify the licensee's program and procedures regarding proper implementation of ISI and maintenance of ASME components for the Byron Generating Station, Unit 1.

The inspectors reviewed ISI program documents including the outage inspection plan for this ninth refueling outage at Byron Unit 1. This is the first outage in the second ISI interval at Byron 1. There were no relief requests implemented during this outage. The inspectors interviewed Commonwealth Edison (ComEd) personnel within the Station Engineering group responsible for completion of examinations and tests within the ASME Section XI and Flow Accelerated Corrosion programs.

b. Observations and Findings

Personnel from Raytheon (the ISI contractor), and ComEd implemented the ISI program in accordance with the 1989 edition (no addenda) of Section XI. Raytheon and ComEd personnel worked to ComEd procedures which had been revised to address 1989 Section XI requirements.

c. Conclusions

The Inservice Inspection Program was implemented in accordance with applicable ASME Code and regulatory requirements.

M1.2. Inservice Inspection Observations

a. Inspection Scope (73753, 73755)

The inspector reviewed qualifications and certifications of inspection personnel and observed NDE of components during the outage. The inspector reviewed NDE data and repair records generated during the outage.

b. Observations and Findings

The inspectors observed portions of the steam generator (SG) tubing eddy current test (ET) for SG's B, C and D and the following ultrasonic test (UT) exams:

Obs #	Line –Item #	Description	Code Class
9-016	1FW86AA-16" C03	Valve to Pipe Weld	2
9-051	1RC02AA-31" J08	Pipe to Elbow Weld	1
9-119	1RC04AA-12" J07	Valve to Pipe Weld	1
9-094	1RC-01-R S01 thru S18	RV Studs	1
9-006	1CV05B-8" C26	Pipe to Elbow Weld	2/1

The inspector observed portions of the following liquid penetrant test (PT) exams:

9-051	1RC02AA-31" J08	Pipe to Elbow Weld	1
9-139	1RC-01-PC	Flywheel Keyway Exam	NA
9-093	1RH-02-AB RHES-01	RHR HX B Skirt Weld	2
9-127	1RC30AB-1½" W01	Pipe to Elbow	1

As part of these observations, the inspector noted the identification of individuals performing these examinations, and serial numbers for equipment and batch or lot numbers for consumable materials used during these examinations. The qualifications and certifications of the Raytheon individuals performing examinations were reviewed. This documentation included licensee and third party review and acceptance of the NDE certifications. The inspector reviewed manufacturer's certificates of conformance for consumable PT and UT materials used during the outage. All documents reviewed above were found acceptable.

During UT of the reactor vessel (RV) studs, initial results revealed a crack indication appearing approximately midway through the length of stud #3. The indication was shadowy or not sharp, and appeared in one location around the circumference of the top head examination surface. The Level II examiner reported this and the next day ComEd Level III personnel arrived to further investigate. Their investigation revealed that with the standard UT scope, i.e. one whose repetition rate is internally determined based on screen size and not adjustable to accommodate unusual configurations (such as 82" long, 7" round RV studs), sometime such "ghost" indications would be seen. The ComEd Level III, using a UT scope with a variable repetition rate, demonstrated that decreasing the rate below approximately 750 pulses per second would make the indication disappear. The Level III inspector characterized it as a "standing wave" induced electronically in the system when the UT scope was not listening for the return before sending out the next pulse.

The inspector reviewed selected data packages including linearity and calibration data, examination data, percentage coverage calculations, NDE summary reports and indication evaluation reports. The inspector determined the methods, extent and techniques of examination complied with the ISI program and applicable NDE procedure, and the results were within acceptance criteria as outlined in the applicable NDE procedure and ASME Code. NDE results from prior examinations were used to compare with current results. The recording, evaluating and dispositioning of indications complied with the applicable procedure.

During maintenance of the reactor coolant system Loop A isolation valve (1RC8002A) several internal areas of damage were identified. The valve guide had become dislodged resulting in two areas of mechanically induced damage in the valve body. Also the valve disc seat, disc face, guide retaining ears and disc guide lug on the reactor side of the valve were damaged. Station maintenance although not initially aware of

possible ASME Code consequences stemming from repair to this Class 1 valve, sought participation from the ISI group during resolution of the problem. The damaged valve internal parts were replaced or corrected as recommended by Westinghouse and the valve body was examined to Code Category B12.50 which requires visual inspection of the valve body interior surfaces. The two areas of damage to the valve body were measured. The damaged areas were evaluated to IWB-3519.1(a) of the applicable ASME Code.

The inspector reviewed videotape of RV in-vessel visual inspection recorded during the outage. The video was clear and the ability to detect 1/32" as well as 1/64" lines on an 18% neutral gray card was documented. Videotape included the inside surface of the RV head, the head control rod drive and thermocouple funnels and penetrations, the RV flange surface, upper structure keyway lugs, hot leg nozzles, core baffle areas, and lower core plate. No anomalies were noted on the corresponding report.

The licensee performed 100% ET examination (bobbin coil) of the tubes for SG's B, C & D. The inspector observed the acquisition of data and resolution analysis of the data, and verified that contract personnel were performing the examination in accordance with applicable procedures, Electric Power Research Institute (EPRI) Steam Generator Examination Guidelines Revision 5, and applicable Byron Technical Specification (TS) requirements. Due to the primary loop stop valve damage referenced above, the SG-A tubing was not examined this outage. The SG examination exceeded the TS requirements for sampling and no defective tubes were identified. Seven tubes were examined with a plus point coil to characterize distorted ET indications. The plus point coil did not identify any degradation in the seven tubes with the distorted indications. Visual examination (VT) of the secondary side of the SG's did not identify any degradation, one small foreign part (flexitalic gasket piece) was found and retrieved. The VT camera and lighting equipment and retrieval process was state of the art, enabling the finding and retrieval of a hair like material. Sludge lancing was performed in all four SG's with less than 15 pounds of sludge retrieved from each SG.

Previous baseline examination of the SG's tubing identified some tubes were in contact with adjacent tubes in the horizontal position. The Unit 1 replacement SG's design has a "floating" tube bundle. Other licensee's with this design had inspected their SG tubing and found that the tube contact problem corrected itself after one to two cycles of operation in the installed vertical position. The licensee screened the tubes which had been reported as touching and those reported as close proximity by ET inspection. Inspection results only identified 7 tubes in SG-B, and none in C & D, which remained in contact or close proximity (.025 to 0.125 inches). The preservice examination identified a total of 215 tubes (SG's B, C, & D) in contact or near proximity. Of all the tubes that were previously identified as in contact and the 7 tubes in SG-B which still show near proximity, none were degraded. The seven tubes in SG-B will be inspected at each outage to verify that the tubes separate in time and to assure degradation (wear) does not occur.

c. Conclusions

The inspector found the examination personnel to be properly qualified. The ISI activities are controlled and monitored. The staff was involved with emerging issues and review of data. The participation of two ComEd Level III individuals during investigation of the RV stud #3 UT indication demonstrated the good level of management overview

of problems. The staff decision to involve the ISI group in the evaluation of the damage to the Class 1 valve demonstrated a good questioning attitude. It appears the tube contact issue is self correcting as previously experienced at other licensees with this SG design. The SG inspection program continues to be aggressive.

M1.3 Flow Accelerated Corrosion Program (FAC) Review

a. Inspection Scope

The inspector reviewed the FAC program and observed repair activities in progress.

b. Observations and Findings

The inspector noted that 117 components were examined under the FAC program during this outage. The station engineering group uses the CheckWorks computer program to select examination areas. Update of the Unit 2 FAC program had been recently completed. Future update for Unit 1 was planned. The station replaced a large portion of the extraction steam system from the turbine check valves back to the Moisture Separator Reheater (MSRs) which included 12", 8" and ½" lines with FAC-resistant Chrome-Moly carbon steel piping. All tees, elbows, valves except for two, and any short interconnecting pipe less than 12 feet in length were replaced.

The inspector observed heat treatment of field welds 84 and 86 using heat treatment procedure BMP 3000-13 Revision 0. The inspector reviewed the procedure and work packages 980100912-01 for line 1ES13BA-8" and 980100918-01 for 1ES13BB-8". Minor discrepancies in the work packages were brought to the attention of the project engineer and were appropriately corrected.

The inspector noted that magnetic particle testing (MT) was performed on the areas where thermocouples had been attached to the piping near the welds to monitor the heating process. After removal of thermocouples and light buffing of the approximately 1.5"x1.5" area, MT was then performed.

c. Conclusions

The licensee's FAC program appears to be conservative and follows the industry guidelines. Repairs or replacements were upgraded to corrosion resistant material.

M3 Maintenance Procedures and Documentation

M3.1 ISI Procedure Review

a. Inspection Scope (73052)

The inspector reviewed the following procedures related to NDE:

Procedure/Rev	Date	Description
NDT-B-1/8	February 1999	MT of Class 1 and 2 Components
NDT-C-1/4	February 1999	UT Equipment Checks
NDT-C-2/25	February 1999	UT of Welds
NDT-C-5/4	February 1999	UT of Vessel Welds > 2" Thick

NDT-C-55/2	February 1999	UT of Welds using Refracted Longitudinal Wave
NDT-D-2/12	February 1999	PT of Class 1 and 2 Components
NDT-F-1/0	February 1999	NDE Forms
NDT-Z-1/1	February 1999	Flaw Evaluation and Exam Volume Calculation
NDT-E-2	January 1999	Multi-frequency Eddy Current Acquisition of SG Tubing at Byron/Braidwood
NDT-E-3	January 1999	Evaluation of ET Data for SG Tubing at Braidwood/Byron

SG Eddy Current Analysis Guidelines, revision 2 dated 1/27/99.
Site Specific Performance Demonstration Program (ET) Revision 0, 1/27/99.

b. Observations and Findings

The inspector reviewed the above procedures to ASME Code 1989 edition. No discrepancies were identified. During the outage Raytheon personnel demonstrated the ability of procedure NDT-C-55 to detect flaws to the station's Authorized Nuclear Inservice Inspector (ANII).

c. Conclusions

The NDE procedures were thorough and met applicable NRC regulatory and American Society of Mechanical Engineers (ASME) Code requirements.

E8 Miscellaneous Engineering Issues (92903)

E8.1 (Closed) VIO 50-454/97021-2: Liquid penetrant examination performed improperly. Examination was re-performed using the correct process by a qualified Level II examiner. The original examiner was retrained/counseled in the correct procedural requirements.

E8.2 (Closed) IFI 50-454/ 97021-1: Replacement steam generators were found to have 315 tube to tube contact during the preservice ET examination. The licensee has implemented adequate examination and tracking of the tubes in contact to assure that any degradation will be appropriately recorded and dispositioned, reference paragraph M1.2a.

E8.3 (Closed) IFI 50-454/97013-3: During reviews of engineering activities for the Byron and Braidwood SG replacements, the NRC noted that the SG feedwater nozzle may not be accessible for the required ASME Code coverage for Section XI inservice inspection, due to the restraint installation on the SG.

The licensee employed the services of the corporate "C" Team (Nondestructive examination specialist) to determine wether the inspectibilty of the feedwater nozzle could meet applicable Code requirements. The C Team contacted two NDE subcontractors to submit proposals for performing the ultrasonic examination (UT) process. The C Team selected the most feasible methodology and performed measurements of the UT accessible area with the restraint installed.

The inspector reviewed the proposed examination plan to inspect the feedwater nozzle with the restraint in place. The method proposed utilized a manual UT procedure using transducers with various angles. This method was able to acquire the inspection volume required by the ASME Code. The proposed inspection plan meets the required volumetric examination requirements.

M4 Maintenance Staff Knowledge and Performance

a. Inspection Scope

The inspector interviewed several ET analyst and technicians and observed their work.

b. Observations and Findings

The inspector observed the ET examination and informally interviewed several analysts involved in resolution of ET data. The analysts were knowledgeable and experienced in the examination requirements. All of the analysts were required to pass the site specific performance demonstration examination which includes the acquisition/analyst procedures and the SG Eddy Current Data Analyst Guidelines. All analysts were required to be certified as a Quality Data Analyst (QDA) Level IIA per the EPRI PWR Steam Generator Examination Guidelines Appendix G.

c. Conclusions

The inspector concluded that the knowledge and performance of the ET resolution analyst was good.

M7 Quality Assurance in Maintenance Activities

M7.1 Self-Assessment of ISI

a. Inspection Scope

The inspector interviewed ComEd personnel within the Nuclear Operations group responsible for implementing the station Master Assessment Plan (MAP). The inspector reviewed assessment documents including procedures, personnel qualifications, assessment schedules, detailed assessment plans, checklists, and various assessors' handwritten notes for assessment of ISI program activities.

b. Observations and Findings

The inspector reviewed ISI-related assessment activities conducted since the last ISI outage. The Nuclear Operations group switched to "assessment" (formerly labeled "audit") in December 1998 as their primary method of independent, periodic evaluation of station activities affecting quality. Assessment of ISI activities collectively is accomplished through two broad areas of assessment: Engineering and Maintenance.

Within the Engineering category, programmatic aspects of ISI such as development and maintenance of the ISI plan, selection of areas for examination, applicability of relief requests, etc. are assessed. The Byron Engineering MAP had assessment of ISI and FAC scheduled to begin June 23, 2000. The inspector interviewed the Engineering

assessor and reviewed procedure NOP-38, Master Assessment Plan, Revision 0, and the Engineering MAP. Within NOP-38 functional areas (e.g. Engineering, Maintenance, Operations) are divided into critical areas (e.g. within Engineering there exists CA-22 covering ISI, Inservice Testing (IST), Check Valves, Air Operated Valves (AOVs), Motor Operated Valves (MOVs), Maintenance Rule, Equipment Qualification (EQ), FAC, etc.). Each sub-attribute (e.g. ISI and FAC) within a critical attribute is further divided into numerous detailed assessment tasks which must be addressed during assessment of the sub-attribute. Check valves was the only aspect of Engineering critical attribute CA-22 ongoing during the outage.

Within the Maintenance category, elements of ISI and FAC were the subject of nuclear oversight assessment NOA-06-99-019 that was ongoing during this outage. This assessment of maintenance and inspection contractors included in-process observations of work activities, document reviews and interviews to determine if contractors were performing activities in a safe and quality manner, and to ensure adherence to 10 CFR 50, Appendix B criteria. The inspector interviewed the assessment team leader and reviewed the assessment notification document. The inspector reviewed the assessment plan and reviewed handwritten notes of this ongoing assessment. The inspector reviewed a PIF generated as a result of this assessment team identifying improper documentation for foreign material exclusion controls on Unit 1B condenser hood work.

c. Conclusions

Master Assessment Plan (NOP-38) contained detailed assessment tasks. Ongoing assessment of inspection contractors (NOA-06-99-019) appeared rigorous.

V. Management Meetings

X1 Exit Meeting Summary

On April 22, 1999, the inspection results were presented to the licensee management. The licensee acknowledged the findings presented. The licensee did not identify any material provided to the inspector during the inspection as proprietary.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

B. Adams, Regulatory Assurance Manager
M. Baker-Lindsay, Nuclear Oversight Assessment Team Leader
A. Britton, QC Supervisor
R. Colglaizer, NRC Coordinator
G. Contrady, Engineering Program Supervisor
K. Dhaese, FAC Coordinator
G. Hagemann, Containment ISI Coordinator, RV IVVI
J. Hutchinson, Programs Group
R. McBride, ISI Coordinator
D. McLaughlin, ES Replacement Project Manager
R. Roton, Executive Assistant
D. Sible, Nuclear Oversight Engineering Assessor
J. Smith, Steam Generator Program Engineer

Raytheon

B. Focer, NDE Level II
K. Hall, NDE Level II, ISI Supervisor (Nights)
M. Kickbush, NDE Level II, FAC Supervisor
J. Miller, NDE Level II
R. Nizol, NDE Level II
S. Petera, FAC NDE Level II
R. Scerine, NDE Level II
T. Spelde, ISI Supervisor

Hartford

J. Hendricks, ANI/ANII
D. Oakley, ANI/ANII

NRC

B. Kemper, Resident Inspector

INSPECTION PROCEDURES USED

Sections of the following Inspection Procedures (IPs) were used for this inspection:

IP 73051:	Inservice Inspection - Program Review
IP 73052:	Inservice Inspection - Procedure Review
IP 73753:	Inservice Inspection Observations
IP 73755:	Inservice Inspection Data Review & Evaluation

ITEMS OPENED, CLOSED AND DISCUSSED

Opened

None

Closed

50-454-97021-01	IFI	Replacement steam generator tube to tube contact.
50-454-97021-02	VIO	Liquid penetrant examination improperly performed.
50-454-97013-03	IFI	Accessibility of the replacement SG's feedwater nozzle to shell weld for ISI examination.

Discussed

None

LIST OF ACRONYMS USED

AOV	Air-Operated Valve
ANII	Authorized Nuclear Inservice Inspector
ASME	American Society for Mechanical Engineers
ComEd	Commonwealth Edison Company
ET	Eddy Current Testing
EQ	Equipment Qualification
CR	Condition Report
DRS	Division of Reactor Safety
EPRI	Electric Power Research Institute
FAC	Flow Accelerated Corrosion
FMR	Field Monitoring Report
FW	Feedwater System
IFI	Inspector Follow up Item
ISI	Inservice Inspection
IST	Inservice Testing
IVVI	In-Vessel Visual Inspection
MOV	Motor-Operated Valve
MS	Main Steam System
MSR	Moisture Separator Reheater
MT	Magnetic Particle Testing
NDE	Non-Destructive Examination
NO	Nuclear Operations (ComEd)
NRR	Office of Nuclear Reactor Regulation (NRC)
PIF	Problem Identification Form
PT	Liquid Penetrant Testing
QDA	Quality Data Analyst
RCS	Reactor Coolant System
RT	Radiographic Testing
RV	Reactor Vessel
SG	Steam Generator
UIS	Upper Internal Structure
UT	Ultrasonic Testing
VT	Visual Testing
VIO	Violation
WR	Work Request