FORM NIS-1 OWNERS' DATA REPORT FOR INSERVICE INSPECTIONS
As required by the Provisions of the ASME Code Rules

1. Owner Union Electric Co., P.O. Box 149, St. Louis, MO 63166
(Name and Address of Owner)

2. Plant Callaway Plant, P.O. Box 620, Fulton, MO 65251
(Name and Address of Plant)

3. Plant Unit 1 4. Owner Certificate of Authorization (if required) N/A

5. Commercial Service Date 12/19/84 6. National Board Number for Unit N/A

7. Components Inspected

Components or Appurtenance	Manufacturer or Installer	Manufacturer or Installer Serial No.	State or Province No.	National Board No.
Reference the Callaway Refuel 7 Inservice Inspection Summary Report, the Owner's N-3 Report, the Installer's N-5 Report, and the N-5 Addenda 7 for the systems listed on sheet 2 of 2.				

Note: Supplemental sheets in form of lists, sketches, or drawings may be used provided (1) size is 8 ½ in. x 11 in., (2) information in items 1 through 6 on this data report is included on each sheet, and (3) each sheet is numbered and the number of sheets is recorded at the top of this form.

FORM NIS-1 (back)

8. Examination Dates 11-23-93 to 5-11-95. Inspection Interval from 12-19-84 to 7-31-95.

10. Abstract of Examinations. Include a list of examinations and a statement concerning status of work required for current interval.

Reference the Callaway Refuel 7 Inservice Inspection Final Results.

11. Abstract of Conditions Noted.

Reference the Callaway Refuel 7 Inservice Inspection Final Results.

12. Abstract of Corrective Measures Recommended and Taken.

Reference the Callaway Refuel 7 Inservice Inspection Final Results.

We certify that the statements made in this report are correct and the examinations and corrective measures taken conform to the rules of the ASME Code, Section XI.

Date August 3, 1995 Signed Union Electric Co. By D S Hollabaugh
Owner David S. Hollabaugh

Certificate of Authorization No. (if applicable) N/A Expiration Date N/A

CERTIFICATE OF INSERVICE INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel inspectors and/or the State or Province of Missouri and employed by H.S.B.I. & I. Co. of Hartford, CT have inspected the components described in the Owners' Data Report during the period of 11-23-93 to 5-11-95 and state that to the best of my knowledge and belief, the Owner has performed examinations and taken corrective measures described in the Owners' Data Report in accordance with the requirements of the ASME Code, Section XI.

By signing this certificate neither the inspector nor this employer makes any warranty, expressed or implied, concerning the examinations and corrective measures described in the Owners' Data Report. Furthermore, neither the Inspector nor this employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with the inspections.

Date August 3, 1995

Howard J. Potter Commissions NB8285, MO16
National Board, State, Province and No.

FORM NIS-1 OWNERS' DATA REPORT FOR INSERVICE INSPECTIONS
As required by the Provisions of the ASME Code Rules

1. Owner Union Electric Co., P.O. Box 149, St. Louis, MO 63166
(Name and Address of Owner)

2. Plant Callaway Plant, P.O. Box 620, Fulton, MO 65251
(Name and Address of Plant)

3. Plant Unit 1 4. Owner Certificate of Authorization (if required) N/A

5. Commercial Service Date 12/19/84 6. National Board Number for Unit N/A

7. Components Inspected

SYSTEM NAME	SYSTEM DESIGNATOR	N-5 SERIAL NO.
Main Steam	AB	0177-AB-F
Main Feedwater	AE	0179-AE-F
Auxiliary Feedwater	AL	0207-AL-F
Reactor Coolant	BB	0276-BB-F
Chemical and Volume Control	BG	0306-BG-F
Reactor Makeup Water	BL	0096-BL-F
Steam Generator Blowdown	BM	0221-BM-F
Borated Refueling Water Storage	BN	0144-BN-F
Fuel Pool Cooling and Cleanup	EC	0128-EC-F
Essential Service Water	EF	0285-EF-F
Component Cooling Water	EG	0256-EG-F
Residual Heat Removal	EJ	0229-EJ-F
High Pressure Coolant Injection	EM	0181-EM-F
Containment Spray	EN	0202-EN-F
Accumulator Safety Injection	EP	0203-EP-F
Auxiliary Feedwater Turbine	FC	0137-FC-F
Misc. Building HVAC	GF	0077-GF-F

FORM NIS-1 OWNERS' DATA REPORT FOR INSERVICE INSPECTIONS
As required by the Provisions of the ASME Code Rules

1. Owner Union Electric Co., P.O. Box 149, St. Louis, MO 63166
(Name and Address of Owner)

2. Plant Callaway Plant, P.O. Box 620, Fulton, MO 65251
(Name and Address of Plant)

3. Plant Unit 1 4. Owner Certificate of Authorization (if required) N/A

5. Commercial Service Date 12/19/84 6. National Board Number for Unit N/A

7. Components Inspected

SYSTEM NAME	SYSTEM DESIGNATOR	N-5 SERIAL NO.
Fuel Building HVAC	GG	0078-GG-F
Control Building HVAC	GK	0080-GK-F
Auxiliary Building HVAC	GL	0103-GL-F
Containment Cooling	GN	0141-GN-F
Containment Hydrogen Control	GS	0131-GS-F
Liquid Radwaste	HB	0188-HB-F
Emergency Fuel Oil	JE	0129-JE-F
Compressed Air	KA	0151-KA-F
Containment Breathing Air	KB	0123-KB-F
Fire Protection	KC	0047-KC-F
Standby Diesel Generator (Piping)	KJ	0114-KJ-F
Floor and Equipment Drains	LF	0083-LF-F
Nuclear Sampling	SJ	0135-SJ-F

CALLAWAY REFUEL 7
INSERVICE INSPECTION
ABSTRACT

INTRODUCTION

Inservice Inspection (ISI) on ASME Class 1, 2, and 3 components and piping was performed prior to and during Refuel 7 at the Callaway Nuclear Plant. More specifically, this abstract covers ISI performed from November 22, 1993, through May 11, 1995. Refuel 7 is the last refueling outage of the the first ten-year inservice inspection interval. The following topics are addressed in this abstract report:

- Organizations responsible for ISI work during Refuel 7.
- Inspection agency responsible for ISI at the Callaway Plant.
- Codes, Regulatory Guides, and NUREGs applicable to the Callaway ISI Program Plan.
- Final reports contained in the Callaway Refuel 7 Inservice Inspection Summary Report.

ORGANIZATIONS RESPONSIBLE FOR ISI

The Union Electric organizations and outside vendors involved with ISI examinations prior to and during Refuel 7 are listed below.

- WESDYNE INTERNATIONAL: WesDyne was responsible for procedure development, procedure qualification, and performance of visual and ultrasonic examinations on the Reactor Pressure Vessel.

- WESTINGHOUSE NUCLEAR SERVICES DIVISION: Westinghouse was responsible for procedure development, procedure qualification, and performance of eddy current examinations on Steam Generators 'A', 'B', 'C', and 'D'.

- NUCLEAR ENERGY SERVICES (NES): NES was responsible for procedure development, procedure qualification, and performance of manual non-destructive examinations (NDE) on the Reactor Coolant Pump 'A' flywheel.

- UNION ELECTRIC NUCLEAR ENGINEERING (UENE): UENE was responsible for identification of welds and components to be examined by WesDyne, identification of steam generator tubes to be examined by Westinghouse, review of all ISI vendor non-destructive examination (NDE) procedures, field supervision of all ISI vendor activities, review of all NDE final data and results, and for development and supervision of the ASME Section XI Repair/Replacement Program. UENE also performed non-destructive examinations on balance of plant systems.

- UNION ELECTRIC QUALITY CONTROL (UEQC): UEQC was responsible for identification of components to be visually examined during Refuel 7, procedure development, procedure qualification, and performance of visual examinations (i.e., VT-1, VT-2, VT-3, and VT-4) identified in the Callaway ISI Program Plan. UEQC was also responsible for review of all visual examination data and results.

INSPECTION AGENCY

The inspection agency responsible for ISI duties as outlined in ASME Section XI was Hartford Steam Boiler Inspection and Insurance Company (H. S. B. I. & I. Co.).

CODES, REGULATORY GUIDES, AND NUREGS

ASME Section XI, 1980 Edition, Winter 1981 Addenda was the governing code for performance and selection of ISI examinations completed during Refuel 7. As specified in 10 CFR 50.55a, the 1974 Edition, Summer 1975 Addenda was used for component and weld selection for ASME Class 2 systems.

Specific NRC regulations or NUREGs identified in the Callaway ISI Program Plan are listed below.

- NRC Standard Review Plan, Sections 3.6.1 and 6.6 (NUREG-0800-1981)
- NRC Regulatory Guide 1.14
- NRC Regulatory Guide 1.26
- NRC Regulatory Guide 1.83
- NRC Regulatory Guide 1.147
- NRC Regulatory Guide 1.150

CALLAWAY REFUEL 7 ISI SUMMARY REPORT

The Callaway Refuel 7 ISI Summary Report is a compilation of a number of individual reports. These reports are listed below.

- NDE Performed on Balance of Plant Systems
- Visual Examinations of Piping, Components, and Supports
- Reactor Pressure Vessel 10-Year Inservice Inspection
- Steam Generator Tube Eddy Current Examinations
- Repair, Replacement, and Modification Index (N-5 Addenda 7)

Each report or summary listed above identifies components or welds examined, date(s) of examination, and the results of the examination. In addition, each report documents the procedures, equipment and consumable materials used, personnel certifications, and equipment calibration records, where applicable.

The "Owner's Data Report for Inservice Inspections" (Form NIS-1) presents the Section XI required information by referencing existing documents. These reference documents are the Callaway Refuel 7 Inservice Inspection Summary Report, the Owner's N-3 Report, and the Installer's N-5 Report. Each of these documents is retained as a permanent record at the Callaway Nuclear Plant.

CALLAWAY REFUEL 7
INSERVICE INSPECTION
FINAL RESULTS

INTRODUCTION

This document summarizes Inservice Inspections (ISI) performed at Union Electric's Callaway Nuclear Plant following Refuel 6 breaker closure and prior to Refuel 7 breaker closure. Refuel 7 is the last refueling outage in the first ten-year inservice inspection interval.

General conditions found during conduct of ISI during Refuel 7 and necessary corrective measures taken are summarized below. For clarity, the ISI work has been subdivided into the following categories:

- Manual nondestructive examinations (NDE) performed on balance of plant piping and components by Union Electric or Nuclear Energy Services.
- Visual examinations (i.e., VT-1, VT-2, VT-3, and VT-4) performed on piping, components, and supports by Union Electric Quality Control.
- Nondestructive examinations (NDE) and visual examinations performed on the Reactor Pressure Vessel by WesDyne International.
- Steam generator tube eddy current examinations performed by Westinghouse Nuclear Services Division.
- ASME Section XI repairs, replacements, and modifications performed by Union Electric.

MANUAL NDE PERFORMED ON BALANCE OF PLANT PIPING AND COMPONENTS

One hundred percent of the first ten-year interval nondestructive examinations (NDE) on Class 1 and Class 2 balance of plant welds and components required by the Callaway ISI Program were completed by the conclusion of Refuel 7. One magnetic particle (MT), eight liquid penetrant (PT), and ten ultrasonic (UT) examinations were performed during Refuel 7. A brief overview of the examinations performed and conditions noted is presented below.

REACTOR COOLANT PUMP 'A' FLYWHEEL:

The ten-year inservice inspection required by NRC Regulatory Guide 1.147 was completed on the Reactor Coolant Pump 'A' motor flywheel during the motor refurbishment in Cheswick, Pennsylvania. The ten-year inspection consisted of a magnetic particle examination on 100% of the flywheel surface area, ultrasonic examination of 100% of the flywheel volume, and liquid penetrant examination in the high stress bore and keyway areas. These examinations were performed by Nuclear Energy Services (NES). No rejectable indications were detected.

RESIDUAL HEAT REMOVAL HEAT EXCHANGER 'A':

An ultrasonic examination was performed on the Residual Heat Removal (RHR) Heat Exchanger 'A' tube sheet flange-to-bonnet weld to supplement examination data acquired during Refuel 5. Extended beam path ultrasonic techniques, not required by ASME Section XI, were used to increase examination coverage. No rejectable indications were detected.

MAIN FEEDWATER SYSTEM:

Thermal fatigue cracking in steam generator main feedwater lines has occurred at Diablo Canyon Unit 1 and at Sequoyah Units 1 and 2. These inservice failures were identified in NRC Information Notice 93-20, "Thermal Fatigue Cracking of Feedwater Piping to Steam Generators," dated March 24, 1993. In response to these inservice failures, an ultrasonic examination was performed on the Steam Generator 'C' feedwater nozzle-to-pipe weld during Refuel 7 (reference Callaway Work Document No. P538209). This was an out-of-scope examination not identified in the Callaway ISI Program Plan. No evidence of thermal fatigue cracking or any other service related indication was detected.

BORON INJECTION TANK MODIFICATION (CMP 90-1008) PRESERVICE INSPECTIONS (PSI):

The Boron Injection Tank was removed from service and 2" NPS bypass piping was installed per Callaway Modification No. CMP 90-1008. A total of nine Class 2 welds were installed to bypass the Boron Injection Tank. This bypass piping is part of the High Pressure Safety Injection (HPSI) System that is currently exempt per Callaway's first ten-year ISI Program Plan. The second ten-year ISI Program Plan rules, however, will be based on the 1989 Edition of ASME Section XI. The 1989 Edition of ASME Section XI requires that 7.5% of the total population of ASME Class 2 welds (i.e., newly installed plus original construction welds) in the HPSI System be examined by both volumetric (ultrasonic) and surface (magnetic particle or liquid penetrant) examination methods. In anticipation of these new 1989 rules, a baseline (PSI) ultrasonic examination and a liquid penetrant examination were performed on five of the new HPSI pipe welds. No rejectable indications were detected.

VISUAL EXAMINATIONS ON PIPING, COMPONENTS, AND SUPPORTS

SYSTEM LEAKAGE, INSERVICE, AND FUNCTIONAL PRESSURE TESTS:

A system leakage pressure test was completed on 100% of all Class 1 piping and components during Refuel 7. The visual examination for leakage (VT-2) was performed with the Reactor Coolant and associated systems at normal operating temperature and pressure. No pressure boundary leakage was identified.

One hundred percent of the first ten-year interval, third 40-month period pressure tests required by the Callaway ISI Program Plan on Class 2 and 3 piping and components were completed by the conclusion of Refuel 7. Approximately 42 system inservice or functional pressure tests on Class 2 or Class 3 piping systems were completed following Refuel 6 breaker closure and prior to Refuel 7 breaker closure. No rejectable pressure boundary leakage or material degradation was detected during these pressure tests. Minor "non-pressure boundary" leakage or degradation was documented, and subsequently either evaluated to be acceptable or corrected.

TEN-YEAR ISI HYDROSTATIC PRESSURE TESTS:

Callaway invoked the alternative pressure test rules of Code Case N-498-1. The Office of Nuclear Reactor Regulation granted permission to use this code case in NRC letter from Leif J. Norrholm, dated January 30, 1995. Code Case N-498-1 rules allow a VT-2 examination for leakage during an inservice or functional pressure test in lieu of the ten-year ISI hydrostatic test for ASME Class 1, 2, and 3 systems. Based on this, no ten-year ISI hydrostatic tests were performed during Refuel 7. As noted in the preceding section, all system leakage, inservice, or functional tests were completed, thus meeting the alternative hydrostatic pressure test rules of Code Case N-498-1 for Callaway's first ten-year inservice inspection interval.

REACTOR COOLANT PUMP MAIN BOLTING:

A visual examination (VT-1) was performed on the 24 Reactor Coolant Pump 'A' main bolts during Refuel 7. No degradation, corrosion, or indication of failure was detected.

REACTOR PRESSURE VESSEL TEN-YEAR INSERVICE INSPECTION

Callaway Nuclear Plant is a four loop Westinghouse NSSS plant with a Combustion Engineering fabricated Reactor Pressure Vessel. Except for the hot leg nozzle examinations, the vessel ten-year ISI was performed in accordance with ASME Section XI, 1980 Edition, Winter 1981 Addenda. The hot leg nozzle examinations were performed in accordance with ASME Section XI, 1989 Edition to satisfy the second ten-year ISI Program Plan. All vessel shell weld examinations performed also satisfy the requirements of Regulatory Guide 1.150.

NONDESTRUCTIVE EXAMINATION OF THE REACTOR PRESSURE VESSEL:

Automated ultrasonic examinations were performed on the assessible portions of the vessel shell welds, bottom head welds, flange-to-shell weld, nozzle-to-vessel welds, nozzle safe-end welds, and nozzle inside radius sections. In addition, manual ultrasonic examinations were performed on the 54 stud hole thread ligaments and the flange-to-shell weld from the flange mating surface. In total, there were 104 vessel welds or specific areas that were ultrasonically examined. The Westinghouse Reactor Vessel Inspection Tool was used for the automated ultrasonic weld and nozzle examinations. The UDRPS 2 (Ultrasonic Data Recording and Processing System) was used for data acquisition and analysis.

Analysis of the ultrasonic data showed no evidence of service or 'crack like' indications in the examination areas. A total of 120 ultrasonic indications were detected. All 120 indications were located in vessel welds or nozzle safe-end welds. No indications were found in the inside radius areas or the stud hole thread ligaments. Each of the indications detected was sized, characterized, and evaluated in accordance with ASME Section XI, IWA-3000. All were determined to be acceptable for continued service with no requirement for additional evaluation, analysis, or successive examinations.

VISUAL EXAMINATION OF THE REACTOR PRESSURE VESSEL INTERIOR AND INTERNALS:

A small remotely operated submarine (mini-sub) outfitted with a video camera was used to visually examine the accessible areas of the Reactor Vessel interior, lower internals support lugs, upper internals assembly, and lower internals assembly. The upper and lower internals assemblies were removed from the vessel and stored in the refueling pool for these visual examinations.

There was no evidence of excessive, severe, or abnormal material distress, corrosion, wear, or degrading conditions found during these visual examinations.

CONTROL ROD DRIVE MECHANISM (CRDM) HOUSING WELD EXAMINATIONS:

Liquid penetrant examination was performed on 4 of the peripheral Control Rod Drive Mechanism (CRDM) housing welds. No rejectable indications were detected.

STEAM GENERATOR TUBE EDDY CURRENT EXAMINATIONS

Callaway Nuclear Plant is a four loop Westinghouse NSSS plant with Westinghouse Model F steam generators. The steam generator tube material is Inconel-600. The first ten tube rows are thermally treated with the remaining tubes being mill annealed. The tubes are hydraulically expanded into the tubesheet.

SCOPE OF TUBE EDDY CURRENT EXAMINATIONS:

Eddy current examinations were performed in accordance with Callaway Technical Specification 4.4.5. One hundred percent of the unplugged tubes in Steam Generators 'B' and 'C' were scheduled for full length examination using a standard bobbin coil probe. In addition, a total of 300 tubes in Steam Generator 'B' and 300 tubes in Steam Generator 'C' were scheduled for examination with a motorized rotating pancake coil (MRPC) in the hot leg expansion region to inspect for signs of Primary Water Stress Corrosion Cracking (PWSCC). The scheduled bobbin coil examinations detected two distorted tubesheet indications in Steam Generator 'C'. One of these indications was confirmed to be a multiple axial indication with MRPC and appeared to initiate from the tube outside diameter. As a result of detecting this and subsequently other indications, MRPC examinations in the tube sheet region were increased to 100% of the mill annealed tubes above row ten in all four steam generators. In addition, a sample of thermally treated tubes were inspected in all four steam generators.

HOT LEG TOP-OF-TUBESHEET TUBE TRANSITION INDICATIONS:

Crack indications were detected in 29 tubes in the hot leg top-of-tubesheet transition area. Analysis showed circumferential, axial, and multiple cracks initiating from both the tube inside diameter (ID) surface and also the outside diameter (OD) surface. Cracking was discovered in mill annealed tubes only. No crack indications were detected in the thermally treated tubes. Cracks initiating from the ID are due to Primary Water Stress Corrosion Cracking (PWSCC). Cracks initiating from the OD are likely the result of Outside Diameter Stress Corrosion Cracking - InterGranular Attack (ODSCC-IGA). This damage mechanism results from localized attack at the tube grain boundaries in regions that are stressed (tubesheet expansion region) and that are exposed to high temperatures and a concentration of corrosion products. Tubes most subject to ODSCC-IGA are in the sludge pile region. Callaway performed tube shot-peening during Refuel 5 (Spring 1992) to mitigate tube damage from PWSCC and performed chemical cleaning during Refuel 7 that should reduce the risk of damage from ODSCC-IGA. The indication type and total number of indications for each steam generator are listed below.

Indication	Steam Generator 'A'	Steam Generator 'B'	Steam Generator 'C'	Steam Generator 'D'
ID Crack	9	0	2	1
OD Crack	2	0	12	2
Unknown Initiation	1	0	2	0
Circ. Crack	6	0	3	1
Axial Crack	6	0	8	1
Volumetric Indication	0	0	5	1
Total No. tubes	11*	0	15*	3

* One tube had both circumferential and axial crack.

ANTI-VIBRATION BAR TUBE WEAR:

Excessive anti-vibration bar (AVB) wear was detected in three Steam Generator 'B' tubes and four Steam Generator 'C' tubes. The largest through wall depth of these indications was 50% with the remaining between 40% and 44%.

LOOSE PARTS AND MECHANICAL TUBE DAMAGE:

Two indications approximately 4 inches above the cold leg tube sheet were detected in Steam Generator 'B'. The through wall depth of these indications was 38% and 45%. The likely failure mechanism is loose parts wear damage since a large foreign object was later removed from Steam Generator 'B'. In addition, one tube in Steam Generator 'C' and one in Steam Generator 'D' were damaged by improper installation of chemical cleaning equipment.

TUBE PLUGGING AND STABILIZATION:

A total of 40 steam generator tubes were removed from service during Refuel 7. Twenty-nine tubes were plugged due to top of tubesheet indications, seven from AVB wear, two from loose parts damage, and two from improper chemical cleaning equipment installation. To mitigate the possibility of tube shear failure and potential damage to adjacent tubes, stabilizers were installed on tubes with circumferential cracking at the top of the tubesheet. Stabilizers were installed on six tubes in Steam Generator 'A', three in Steam Generator 'C', and one in Steam Generator 'D'.

REPAIRS, REPLACEMENTS, AND MODIFICATIONS

Approximately 406 Form NIS-2's were completed for ASME Section XI repairs, replacements, or modifications on ASME Class 1, 2, or 3 components, parts, and appurtenances during the time period beginning with Refuel 6 breaker closure (November 22, 1993) and ending with Refuel 7 breaker closure (May 11, 1995).

Every repair, replacement, or modification completed in accordance with ASME Code requirements at Callaway has been reported on Callaway's Form NIS-2 Report, to document the extent of work performed and to provide traceability of new parts and/or materials. The Form NIS-2 is not required by the governing code, however, this method of reporting is employed to ensure code compliance.

CONCLUSION

Approximately 127 nondestructive examinations, nine visual examinations, and 43 pressure tests were completed on ASME Class 1, 2, and 3 components or welds during Refuel 7 (this total does not include eddy current examinations on steam generator tubes or post repair/replacement examinations). All examinations and inspections required by the Callaway Inservice Inspection Program Plan for the first ten-year interval are complete. As a result of these ASME Section XI examinations and inspections performed and of the conditions observed, there is no general safety concern for the pressure retaining integrity of the safety-related systems at the Callaway Nuclear Plant.