From: "BENNETT, STEVE A" <SBENNE2@entergy.com>
To: "'Tom Alexion'" <twa@nrc.gov>
Date: 10/28/02 2:03PM
Subject: Copies of ANO Procedures 2311.009 and 1032.037

Tom,

Here are copies of the Boric Acid Procedures that you requested for ANO

CC: "DAIBER, BRYAN J" <BDAIBER@entergy.com>

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ENTERGY OPERATIONS INCORPORATED
ARKANSAS NUCLEAR ONE

TITLE: INSPECTION AND EVALUATION OF BORIC ACID LEAKS SET #	DOCUMENT NO. 1032.037	CHANGE NO. 04 000-03-0 Font
	WORK PLAN EXP. DATE N/A Font 10/8/02	TC EXP. DATE 10/8/02 N/A Font 10/4/02
	SAFETY-RELATED ☒YES ☐NO	IPTE ☐YES ☒NO
	TEMP ALT ☐YES ☒NO	

When you see these ***TRAPS***	Get these ***TOOLS***
Time Pressure	Effective Communication
Distraction/Interruption	Questioning Attitude
Multiple Tasks	Placekeeping
Overconfidence	Self Check
Vague or Interpretive Guidance	Peer Check
First Shift/Last Shift	Knowledge
Peer Pressure	Procedures
Change/Off Normal	Job Briefing
Physical Environment	Coaching
Mental Stress (Home or Work)	Turnover

VERIFIED BY	DATE	TIME

FORM TITLE:	FORM NO.	CHANGE NO.
VERIFICATION COVER SHEET	1000.006A	050-00-0

TABLE OF CONTENTS

1.0 PURPOSE

This procedure establishes guidelines for investigating Boric acid leaks, and provides a method for evaluating corrosion associated with Boric acid.

2.0 SCOPE

This procedure applies to all situations in which the potential exists for Boric acid to corrode plant components and piping, particularly the Reactor Coolant systems for both ANO 1 & 2.

3.0 REFERENCES AND COMMITMENTS

3.1 REFERENCES

3.1.1 OE14406, Lessons learned from assessments of the Davis-Besse Boric Acid Control Program. Dated 8/8/2002

3.1.2 NRC I.E. Notice 86-108 "Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion"

3.1.3 NRC Generic Letter 88-05 "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants"

3.1.4 EPRI Report No. RP 2006-18 "A Survey of Boric Acid Corrosion of Carbon and Low-Alloy Steel Pressure Boundary Components in PWR Power Plants"

3.1.5 LER #86-006 "Boric Acid Corrosion of Carbon Steel High Pressure Injection Nozzle and Reactor Coolant System Cold Leg Piping"

3.1.6 LER #89-043 "Boric Acid Corrosion of a Control Rod Drive Mechanism Flange Fastening Assembly"

3.1.7 CR-1-91-0051 Item #4, Reference Form 5120.440A

3.1.8 5000.005, Boric Acid Corrosion Prevention Program Administration

3.2 COMMITMENTS

3.2.1 0CAN058813, Response to NRC Generic Letter 88-05 (Entire procedure)

3.2.2 1CAN019007, Licensee Event Report 50-313/89-043-00, dated January 8, 1990. (Section 9.1 Note)

3.2.3 1CAN128607, Licensee Event Report No. 86-006-00, dated December 9, 1986. (Section 9.2)

4.0 DEFINITIONS

4.1 Reviewer - A person qualified in performing and reviewing boric acid corrosion evaluations per Sections 9.1 and 9.2.

5.0 RESPONSIBILITY AND AUTHORITY

5.1 MANAGER, SYSTEM ENGINEERING (ANO-1/ANO-2)

5.1.1 Ensures that a program exists for investigating and evaluating corrosion associated with boric acid.

5.1.2 Reviews and approves changes to the Boric Acid Corrosion Inspection Program.

5.2 SUPERVISOR, SYSTEM ENGINEERING (ANO-1/ANO-2)

5.2.1 Ensures that the requirements called for in this procedure have been met.

5.2.2 Appoints an individual to serve as Coordinator of boric acid corrosion inspections.

5.2.3 Reviews the work of the Coordinator to ensure that the investigations/evaluations are performed in a correct/timely manner.

5.2.4 Reviews and approves reports prepared to meet the requirements of this procedure and reviews/and approves all changes to the program.

5.3 BORIC ACID CORROSION COORDINATOR (hereafter referred to as the Coordinator)

5.3.1 Provides primary responsibility for the implementation of this procedure, and ensures adherence to all requirements contained in it.

5.3.2 Coordinates the inspection and evaluation (if necessary) of Boric acid leaks, including;

A. Preliminary investigation and determination of severity of the problem.

B. Coordinating and interfacing with all groups involved (i.e., Operations, Health Physics, Decon, MSG, etc.).

C. Determining the cause of the problem and ensuring that corrective actions have been taken.

D. Ensuring that reports required to document the problem and its solution are prepared in a timely manner.

5.3.3 Provides an evaluation number for the boric acid leak evaluation, **Form 1032.037A.**

5.4 BORIC ACID CORROSION EVALUATOR

5.4.1 Performs a boric acid corrosion evaluation per guidance in section 9.2

5.5 BORIC ACID CORROSION EVALUATION REVIEWER

5.5.1 Reviews the boric acid evaluation for completeness, application of engineering knowledge, conclusions and recommendations per Section 9.2.

6.0 TEST EQUIPMENT, SPECIAL TOOLS AND SUPPLIES

6.1 Equipment such as a camera, flashlight, and sample bag may be required to aid in a boric acid leak investigation. In some cases more specilized tools such as a spotting scope, a boroscope or robotics may be used for inspections.

7.0 LIMITS AND PRECAUTIONS

7.1 Because of the high risk of being contaminated by boric acid, all necessary steps should be taken to minimize the possibility of contamination of personnel and equipment.

8.0 PREREQUISITES/INITIAL CONDITIONS

8.1 None

9.0 INSTRUCTIONS

NOTE

Other Engineering groups can perform an evaluation on Boric Acid Leakage but copies of that evaluation shall be sent to System Engineering.

9.1 INVESTIGATION

(1CAN019007)

NOTE

If a Control Rod Drive Mechanism (CRDM) flange leak is identified, an inspection of the CRDM nut rings and associated hardware must be performed per this procedure.

9.1.1 Upon receiving **Form 1032.037A**, the coordinator shall determine the status of the MAI to fix the component. All missing information within Section One of **1032.037A** should be completed to expedite the evaluation.

NOTE

Small amounts of Boric acid have the potential to severely corrode carbon and low alloy steel over a long period of time.

9.1.2 Determine, if possible, the duration of the leak (days, months, years) and the rate at which the component is leaking.

9.1.3 If the component has been repaired/replaced, then the evaluation shall consider the flow path of past leakage and possible related corrosion damage.

9.1.4 If the leaking component cannot be repaired, then actions shall be taken to ensure containment of the leak path if applicable.

9.2 EVALUATION (1CAN128607)

9.2.1 Based on the data gathered in **Section 9.1**, System Engineering shall evaluate the leak using **Section Two** of **Form 1032.037A.**

9.2.2 Include all pertinent data gathered from **Section 9.1**, and attach any MAIs, Condition Reports, photographs, etc., related to the leak.

9.2.3 Determine which parts of the component are suseptible to boric acid corrosion and if necessary, refer to the component drawing to determine which parts are carbon steel.

9.2.4 The evaluation should include, but not limited to, the following information: 1) detail about the staining, buildup, wastage, or corrosion and the overall affect, 2) appropriate recommendations and supporting detail, 3) A time frame for component repair or re-evaluation. All components in the reactor buildings that cannot be repaired shall be evaluated for an 18 month cycle.

9.2.5 A Condition Report may be required to ensure that steps are being taken to correct boric acid leakage. System Engineering shall work with Operations to determine if further evaluation is needed.

9.2.6 If a condition report is written, System Engineering may assist Operations with the 24 hour Operability Determination, as necessary.

9.2.6.1 To assist with the Operability Determination, clean/decontaminate the affected component to visibly determine the extent of material wastage. This will aid in determining component/system operability.

10.0 ATTACHMENTS AND FORMS

10.1 ATTACHMENTS

10.1.1 None

10.2 FORMS

10.2.1 1032.037A, Identification & Evaluation of Boric Acid Leakage

Identification of Boric Acid Leakage

Section One

Eval #: _____
(Provided by Boric Acid Corrosion Coordinator)

Name: _____ Date: _____ Ext.: _____

Leaking Component:

Tag No. _____ Location _____

MAI No. _____ CR Number _____

If known, answer the following questions:

- Method of discovery _____
- Is leak active or inactive? If possible determine leak rate._____
- Was the system in operation at the time of discovery?_____

Evaluation Determination

1. IF there are moist boric acid crystals present on a system with an operating temperature of approximately 150 to 250 degrees F AND visible material wastage, THEN contact System Engineering - NSSS immediately to perform a Boric Acid Leak Evaluation, otherwise N/A. _____

2. Are the boric acid crystals wet? ..... ___Yes ___No

3. Is Boric Acid coming in contact with carbon steel? ..... ___Yes ___No

4. Are the cyrstals red in color? ..... ___Yes ___No

5. Is there any visible wastage of metal present on this component? ..... ___Yes ___No

6. Is there a flow path away from the source of the leak onto components composed of carbon steel? ..... ___Yes ___No

7. Is there a possibility of boric acid accumulating or concentrating within insulation? ..... ___Yes ___No

8. IF any answer to questions 2 - 7 is Yes
THEN contact System Engineering - NSSS within the next business day. _____

9. Forward this form to System Engineering - NSSS. _____

Evaluation Determination performed by _____ Date _____

Boric Acid Leak Evaluation

Evaluation # _____

Component Tag # _____

Section Two (To be completed by Engineering*)

1. Is Boric Acid coming in contact with carbon steel? ..... ___Yes ___No

2. Is there staining of the metal or insulation, or a buildup of Boric Acid Crystals? ..... ___Yes ___No

3. If staining is present, is there significant corrosion present? ..... ___Yes ___No

4. Could this Boric Acid Leak prevent this component or any other component in its leakage path from performing its required safety function until the next refueling outage? ..... ___Yes ___No

5. If yes was checked in any of the above questions, or if further discussion is needed, explain below.

_____

Condition Report Required___Yes___No Condition Report No._____

_____/_____
Evaluation by: Date

* A copy of the evaluation shall be sent to System Engineering.

_____/_____
Review by: Date

FORM TITLE	FORM NO	CHANGE:
IDENTIFICATION & EVALUATION OF BORIC ACID LEAKAGE	1032.037A	000-04-0

ENTERGY OPERATIONS INCORPORATED
ARKANSAS NUCLEAR ONE

TITLE: ANO Unit 1 and Unit 2 ALLOY 600 INSPECTION	DOCUMENT NO. 2311.009	CHANGE NO. 002-00-0
	WORK PLAN EXP. DATE	TC EXP. DATE
SET #	SAFETY-RELATED ☒YES ☐NO	IPTE ☒YES ☐NO
	TEMP ALT ☐YES ☒NO	

When you see these ***TRAPS***	Get these ***TOOLS***
Time Pressure	Effective Communication
Distraction/Interruption	Questioning Attitude
Multiple Tasks	Placekeeping
Overconfidence	Self Check
Vague or Interpretive Guidance	Peer Check
First Shift/Last Shift	Knowledge
Peer Pressure	Procedures
Change/Off Normal	Job Briefing
Physical Environment	Coaching
Mental Stress (Home or Work)	Turnover

VERIFIED BY	DATE	TIME

FORM TITLE: VERIFICATION COVER SHEET	FORM NO. 1000.006A	CHANGE NO. 050-00-0

TABLE OF CONTENTS

1.0 PURPOSE

1.1 This procedure establishes the methods and requirements to be used by inspection personnel in performing examinations of the Reactor Coolant System for leakage indications at ANO-1 and ANO-2.

2.0 SCOPE

2.1 This procedure covers inspections of Alloy 600 penetrations on the Unit 1 and Unit 2 Reactor Coolant Systems. Differences in the design of the units require different inspection approaches. Procedure attachments will be used to direct inspection activities.

2.2 All Alloy 600 nozzles will be inspected as defined within this procedure.

2.3 Attachment 1 and 2 are to be performed during Unit 1 refueling outages. Attachment 3, 4 and 5 are to be perfromed during Unit 2 refueling outages.

2.4 This procedure may be implemented in part or out of sequence to facilitate inspection. Applicable portions of the procedure to be worked shall be indicated below.

_____

_____

_____

_____

Cognizant Supervisor

3.0 DESCRIPTION

3.1 The industry has experienced cracking of Alloy 600 nozzles. Both Unit 1 and Unit 2 have experienced Alloy 600 nozzle cracking. This procedure formalizes the inspection of these nozzles. This procedure provides the documentation of the inspection results.

4.0 REFERENCES

4.1 References:

4.1.1 NRC GL-88-05, BORIC ACID CORROSION OF CARBON STEEL REACTOR PRESSURE BOUNDARY

4.1.2 NRC GL-97-01, Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Head Penetrations

4.1.3 Drawings for Unit 1

- M1B-144-4, Closure Head Sub Assembly
- M1E-3-8, Reactor Coolant Piping Assembly
- M1E-32-2, List of Material Coolant Piping
- M-230 Sht 1, RCS P&ID

4.1.4 Drawings for Unit 2

4.1.4.1 Vessel Head Nozzles

- M-2001-C2-107-3 Closure Head Nozzle Requirements
- M-2001-C2-69 Sheets 1,2,3 Closure Head Assembly
- M-2001-C2-46-10 Reactor Vessel Head Coolant Shroud

4.1.4.2 Pressurizer Heater Nozzles

- M-2001-B6-24-1 Single Line Diagram Pressurizer Heaters
- M-2001-B6-24-2 AN02 Pressurizer Heater Mod detail

4.1.5 CR-ANO-1-2000-97

4.1.6 Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

4.1.7 ASME Section XI, "Rules for In-service Inspection of Nuclear Power Plant Components", 1992 Edition and Portions of 1993 Addenda

4.1.8 ASME Section XI, "Rules for Inservice Inspection of Nuclear Plant Components", 1992 Edition with 1992 Addenda.

4.1.9 ASME Section V, "Non-Destructive Examination" Articles 9, 1992 Edition 1992 Addenda.

4.1.10 NRC Bulletin 2001-01, Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles.

4.1.11 ANO-1 Response to NRC Bulletin 2001-01

4.1.12 ANO-2 Response to NRC Bulletin 2001-01

4.1.13 NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity.

4.1.14 ER-ANO-2002-1134-000, Evaluation of Susceptibility ANO Unit 1 Cold Leg Alloy 600 nozzles.

4.2 Commitments:

4.2.1 CAN090102, 30 Day Response to NRC Bulletin 2001-01 for ANO-1; Circumferential Cracking of VHP Nozzles

4.2.1.1 Perform a qualified visual examination of essentially 100% of the upper surface of the reactor vessel head.

4.2.1.2 Visual inspection to be performed by personnel of multiple site disciplines. These personnel will include a VT-2 inspector who is knowledgeable in the detection and discrimination of leakage evidenced by the accumulation of boron deposits.

4.2.2 2CAN110102, Supplemental Response To NRC Bulletin 2001-01 Regarding ANO-2 Vessel Head Penetration Inspection Scope

4.2.2.1 Perform a 100% inspection of the ANO-2 VHP nozzles during the upcoming 2R15 outage, which is scheduled for the spring of 2002. The 100% inspection scope will consist of an examination of all of the VHP nozzles which will include an examination of essentially 360 degrees around the nozzle.

4.2.3 0CAN040201, 15 Day Response to NRC Bulletin 2002-01, Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity

4.2.3.1 Entergy will perform a qualified visual examination in accordance with procedure 2311.009 during 1R17 (the next refueling outage scheduled for the fall of 2002). The surface of the head will be inspected for degradation (wastage). If throughwall or throughweld cracks are found and a concentration of boron is found protruding through the annulus region of the penetration, an evaluation will be performed to determine if there is a potential for wastage of the adjacent vessel material.

4.2.3.2 For ANO-2, Entergy will perform an inspection in accordance with procedure 2311.009 during 2R15. If throughwall or throughweld cracks are found and a concentration of boron is found protruding through the annulus region of the penetration, an evaluation will be performed to determine if there is a potential for wastage of the adjacent vessel material.

4.2.4 1CAN090202, Perform a volumetric inspection of the ANO-1 CRDM NOZZLES except nozzle 1 which contains the RADCAL MONITOR.

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 Equipment

5.1.1 Equipment, tools, and supplies needed for each inspection will be listed in the appropriate attachment.

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 Limits will be addressed in the appropriate attachment.

6.2 Precautions

6.2.1 Precautions will be addressed in the appropriate attachment.

7.0 PREREQUISITES AND INITIAL CONDITIONS

7.1 Prerequisites

7.1.1 Prerequisites will be addressed in the appropriate attachment.

7.2 Initial Conditions

7.2.1 Initial conditions will be addressed in the appropriate attachment.

8.0 INSTRUCTIONS

8.1 Performing Inspections

8.1.1 Use Attachment 1 to inspect the Unit 1 Reactor Vessel. ☐

8.1.2 Use Attachment 2 to inspect the Unit 1 Reactor vessel small bore nozzles, Core Flood Tanks and Pressurizer heater nozzles. ☐

8.1.3 Use Attachment 3 to inspect the Unit 2 Reactor Vessel Head. ☐

8.1.4 Use Attachment 4 to inspect the Unit 2 Reactor vessel small bore nozzles and Pressurizer nozzles. ☐

8.1.5 Use Attachment 5 to inspect the Unit 2 Reactor Vessel Head from the top of the head. ☐

9.0 RESTORATION AND CHECKOUT

9.1 All material used to perform the reactor head inspection shall be removed upon completion of this work.

_____/_____
Performed By Date

_____/_____
Verified By Date

10.0 ATTACHMENTS AND FORMS

10.1 Attachments

10.1.1 Attachment 1, Inspection of the Unit 1 Reactor Vessel.

10.1.2 Attachment 2, Inspection of the Unit 1 Small Bore, Core Flood Tanks and Pressurizer Nozzles.

10.1.3 Attachment 3, Contractor inspection of the Unit 2 Reactor Vessel Head.

10.1.4 Attachment 4, Inspection of the Unit 2 hot leg small bore and pressurizer nozzles.

10.1.5 Attachment 5, System Engineering visual inspection of the top of the Unit 2 Reactor Vessel Head.

10.2 Forms

10.2.1 Form 1, ANO-1 RPV Penetration Examination Record.

10.2.2 Form 2, ANO-1 Core Flood Tanks and Pressurizer Penetration Examination Record.

10.2.3 Form 3, ANO-1 RCS Hot Leg Penetration Examination Record.

10.2.4 Form 4, ANO-1 RCS Cold Leg Penetration Examination Record.

10.2.5 Form 5, ANO-2 RPV Head Penetration Examination Record.

10.2.6 Form 6, ANO-2 Pressurizer Heater Penetration Examination Record (Zero Degrees).

10.2.7 Form 7, ANO-2 Pressurizer Heater Penetration Examination (Ninety Degrees).

10.2.8 Form 8, ANO-2 Pressurizer Heater Penetration Examination Record (One Hundred Eighty Degrees).

10.2.9 Form 9, ANO-2 Pressurizer Heater Penetration Examination Record (Two Hundred Seventy Degrees).

10.2.10 Form 10, ANO-2 Pressurizer Non-Heater Penetration Examination Record.

10.2.11 Form 11, ANO-2 RCS Hot Leg Penetration Examination Record.

10.2.12 Form 12, ANO-2 RCS Cold Leg Penetration Examination Record.

10.3 Figures

10.3.1 Figure 1, Typical Boric Acid Deposits from a Leaking Penetration.

10.3.2 Figure 2, ANO-2 RPV Head Map from drawing M-2001-C2-107-3.

10.3.3 Figure 3, ANO-1 RPV Head Map from drawing M1B-144-4.

10.3.4 Figure 4, ANO-1 Pressurizer Nozzle locations from drawing M1G-1-7.

10.3.5 Figure 5, ANO-1 RCS Nozzle Locations from drawing M297 Sheet 2.

Attachment 1 **Page 1 of 5 .**
Inspection of the Unit 1 Reactor Vessel .

1.0 PURPOSE

1.1 This attachment provides the necessary steps to perform a remote video inspection of the top of the Unit 1 Reactor Vessel. The inspection is intended to identify and document evidence of boric acid residue that originate at the annulus between the penetration and RV Head that may be indicative of through-wall leaks in the inconnel penetration or attachment weld. The area of interest is essentially 360° around the penetration, including the annulus. This procedure also provides some guidance for evaluating the source of leakage. The Reactor Vessel Incore Instrumentation Nozzle penetrations are located in the bottom head of the reactor vessel. This inspection is performed by the Quality Control department in accordance with Procedure 5120.242 "Unit 1 Post Outage Pressure Test".

2.0 SCOPE

2.1 This document covers remote visual inspection and video taping of the top of the reactor head surface at each of the head penetration locations. Remote inspection equipment, including but not limited to, video probes and a remote manipulator may be utilized depending on the accessibility of each location. All Reactor Vessel Head nozzles will be inspected. This procedure will also document the results of the Unit 1 Post Outage Pressure Test.

3.0 DESCRIPTION

3.1 It is the intent of this procedure to provide guidelines for visual inspection of the Unit 1 Reactor Vessel Head from the top of the head.

3.2 The Systems Engineer will conduct this inspection. Any abnormalities will be identified and additional actions taken as required by condition report actions issued as a result of the findings.

3.3 Active leaks will generally have a light colored or white deposit due to replenishment by leaking borated primary water. Figure 1 shows the "typical" appearance of boric acid deposits, which originated from the annulus.

3.4 Boric acid residues may be visible above or around the annulus that are not necessarily indicative of a failure of the Penetration or the attachment weld. Sufficient resources should be utilzed to conclude the origination of the boric acid residue.

3.5 If deposits appear to originate from above the elevation of the penetration or the surface of the Head, there should be evidence such as boron trails that identify the source of the residue. These areas should be clearly identified for future inspections.

3.6 All indications shall be documented on a condition report in accordance with procedure LI-102.

3.7 Questionable indications should be documented on a condition report to assure that Plant Management appropriately reviews indications.

3.8 This procedure will document, on either videotape or photograph, any residue that appears to originate at the penetration / RV head annulus. Several inspection systems will be utilized, as needed depending on accessibility. It is important that all material used to perform the reactor head inspection be removed upon completion of this work.

3.9 A copy of the respective Post Outage Pressure Test results (Form 5120.0242A) shall be included in the completed documentation of this attachment.

4.0 REFERENCES

4.1 References:

4.1.1 M1B-144-4, ANO-1 RPV Head Map.
4.1.2 Procedure 5120.0242 "Unit 1 Post Outage Pressure Test"

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 The following is a list of equipment that may be used with this procedure. Other items may be required and added by the inspection engineer.

5.1.1 Telescopes

5.1.2 Boroscopes

5.1.3 Cameras

5.1.4 Mirrors

5.1.5 Flashlights

5.1.6 Drop Lights

5.1.7 Binoculars

5.1.8 Robot and Video Equipment

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 None.

6.2 Precautions

6.2.1 Care must be taken to prevent damage to the reactor head, installed insulation, penetrations, instrumentation and piping. Do not use piping, cable trays, instrument lines or supports to hold equipment or personnel.

6.2.2 Only the minimum number of personnel necessary for the inspection should be in the work area to reduce total dose.

6.2.3 Workers must minimize the times spent at or near the Reactor head to minimize their exposure.

7.0 PREREQUISITIES AND INITIAL CONDITIONS.

7.1 PREREQUISITIES

7.1.1 Obtain Shift Manager or Outage Desk permission prior to performing the inspection. ☐

7.1.2 The reactor head is accessible for the inspection (i.e. scaffolding erected and lighting installed). ☐

7.1.3 A RWP has been issued for the work scope. ☐

8.0 INSTRUCTIONS.

NOTE

Steps in this procedure may be performed out of order

8.1 Reactor Head Inspection

8.1.1 Perform an IPTE brief in accordance with 1000.143.

8.1.2 Verify all inspection system compenents are operating properly.

8.1.3 Reference M1B-144-4 for head penetration locations.

4.2.1.1 8.1.4 **Inspect each reactor head nozzle for indication of RCS leakage. Each nozzle should be fully inspected (essentially 360 degrees around the annulus area).** Reposition or replace the inspection equipment as necessary to obtain the best coverage of inspection area. Each nozzle should be photographed or videotaped.

8.1.5 Repeat steps 8.1.1 through 8.1.3 as necessary to complete inspection of all head penetrations.

8.1.6 If any abnormalities are identified, initiate a Condition Report in accordance with Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

4.2.3.1 8.1.7 In the event video equipment fails or is unavailable, the inspection may be conducted by photographing every nozzle. **Inspection includes indications of boric acid build-up or material wastage.** A condition report shall be initiated should this inspection option be exercised.

8.2 INSPECTION EVALUATION

4.2.1.2 8.2.1 **Cognizant members of the following departments shall assemble to review the inspection results for indication of leakage;**

- **Systems Engineering**
- **Quality Control**
- Design Engineering

8.2.2 Using Form 1, document the results of the video review. The SAT column means the nozzle is not leaking. The UNSAT column means the nozzle is or may be leaking.

8.2.3 If only photography was used then make a note in the comments section of the form stating that only photography was used and "N/A" the SAT and UNSAT boxes for each nozzle that was not photographed.

8.2.4 If any abnormalities are identified the review group will initiate a Condition Report in accordance with the Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

CR Number _____

9.0 RESTORATION AND CHECKOUT

9.1 All material used to perform the reactor head inspection shall be removed upon completion of this work.

_____/_____
Performed By Date

_____/_____
Verified By Date

9.2 The videotape and/or photographs are not permanent records. They should be maintained in RCS System Engineering files for information only.

Attachment 2 Page 1 of 4.

Inspection of the Unit 1 Small Bore, Core Flood Tanks and Pressurizer Nozzles.

1.0 PURPOSE

1.1 This attachment provides the necessary steps to perform a visual inspection of the Unit 1 small bore, Core Flood Tanks and pressurizer nozzles. The inspection is intended to identify and document evidence of boric acid residues that originate at the annulus between the penetration and the piping or pressurizer wall that may be indicative of through-wall leaks in the inconnel penetration or attachment weld. The area of interest is essentially 360° around the penetration. This attachment also provides some guidance for evaluating the source of leakage.

2.0 SCOPE

2.1 This document covers visual inspection and, if necessary, videotaping or photographing the small bore, core flood tanks and pressurizer nozzle penetration locations.

3.0 DESCRIPTION

3.1 It is the intent of this procedure to provide guidelines for visual inspection of the Unit 1 small bore, core flood tanks and pressurizer nozzles.

3.2 Active leaks will generally have a light colored or white deposit due to replenishment by leaking borated primary water. Figure 1 shows the "typical" appearance of boric acid deposits.

3.3 The Systems Engineer will conduct this inspection. Any abnormalities will be identified and additional actions taken as required by condition report actions issued as a result of the findings.

4.0 REFERENCES

4.1 References:

4.1.1 M-230 Sht. 1

4.1.2 M1g-1-7

4.1.3 M-297 Sht. 2

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 The following is a list of equipment that may be used with this procedure. Other items may be required and added by the inspection engineer.

5.1.1 Telescopes

5.1.2 Boroscopes

5.1.3 Cameras

5.1.4 Mirrors

5.1.5 Flashlights

5.1.6 Drop Lights

5.1.7 Binoculars

5.1.8 Robot and Video Equipment

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 None.

6.2 Precautions

6.2.1 Care must be taken to prevent damage to vessel, installed insulation, penetrations, instrumentation and piping. Do not use piping, cable trays, instrument lines or supports to hold equipment or personnel.

6.2.2 Only the minimum number of personnel necessary for the Inspection shall be in the work area.

6.2.3 Workers must minimize the times spent at or near the components to minimize their exposure.

7.0 PREREQUISITIES AND INITIAL CONDITIONS.

7.1 PREREQUISITIES

7.1.1 Obtain Shift Manager or Outage Desk permission prior to performing the inspection. ☐

7.1.2 The vessel is accessible for the inspection (i.e. scaffolding erected and lighting installed). ☐

8.0 INSTRUCTIONS.

NOTE

Steps in this procedure may be performed out of order

8.1 INSPECTION

8.1.1 Perform an IPTE brief in accordance with 1000.143.

8.1.2 Visually inspect the Unit 1 pressurizer penetrations and document inspection results on Form 2. Note and photograph abnormalities for evaluations.

8.1.3 Visually inspect the Unit 1 RCS hot leg penetrations and document inspection results on Form 3. Note and photograph abnormalities for evaluation.

8.1.4 Visually inspect the Unit 1 RCS cold leg penetrations and document the results on Form 4. In accordance with engineering evaluation ER-ANO-2002-1134-000 it is acceptable to inspect the ANO Unit 1 Cold leg nozzles from remote locations without visual bare metal examination. The ER documents the acceptability of this evaluation for refueling outage 1R17 only. Note and photograph abnormalities for evaluation.

8.1.5 Visually inspect the Unit 1 Core Flood Tank penetrations and document inspection results on Form 2. Note and photograph abnormalities for evaluations.

8.2 INSPECTION EVALUATION

8.2.1 Cognizant members of the following departments shall assemble and review the inspection results for indication of leakage:

- Systems Engineering
- Quality Control
- Design Engineering

8.2.2 If any abnormalities are identified the review group shall initiate a Condition Report in accordance with Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

Condition Report Number _____

9.0 RESTORATION AND CHECKOUT

9.1 All material used to perform the reactor head inspection shall be removed upon completion of this work.

_____/_____
Performed By Date

_____/_____
Verified By Date

9.2 The videotape and/or photographs are not permanent records. They should be maintained in RCS System Engineering files for information only.

Attachment 3 Page 1 of 2 .

Contractor inspection of the Unit 1 or Unit 2 Reactor Vessel Head.

1.0 PURPOSE

1.1 This attachment provides means to document the contractor inspection of the Unit 1 or Unit 2 Reactor Vessel Head in the area of the CRDM, Head Vent and Instrument Nozzles. The inspection is intended to identify and document evidence of nozzle cracking of the inconnel penetration or attachment weld.

2.0 SCOPE

2.1 This document does not provide instructions or acceptance criteria for inspection methods used by the contractor. This document only provides a means to document the results of that inspection and summarize any repair efforts if needed.

3.0 DESCRIPTION

3.1 Due to the inability to cost effectively perform a visual examination, a volumetric examination will be done from under the head. A vendor, using their procedures and QA program, will do the inspection.

4.0 REFERENCES

4.1 Contractor Inspection Procedures

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 None.

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 None.

6.2 Precautions

6.2.1 None.

7.0 PREREQUISITIES AND INITIAL CONDITIONS.

7.1 PREREQUISITIES

7.1.1 None.

8.0 INSTRUCTIONS

8.1 INSPECTION

4.2.2,4.2.4 **8.1.1 Initate a contract to perform an inspection of the ANO Unit 1 or Unit 2 Reactor Vessel Head (see referenced commitment). The inspection scope will consist of an examination of all the VHP nozzles which will include and examination of essentailly 360 degrees around the nozzle.**

Record Contract Number _____

8.2 INSPECTION EVALUATION

8.2.1 If abnormalities exist then verify a Condition Report has been issued in accordance with Nuclear Management Manual Procedure LI-102, "Corrective Action Process". This condition report will be used to initiate and track corrective actions associated with the inspection.

Condition Report Number _____

8.2.2 Document results of the contractor inspection by giving a brief summary of penetrations that required repair, if any. Attach the summary.

8.2.3 The contractor performing the inspection shall submit all NDE reports and any videotapes or photographs to the System Engineer

Attachment 4 Page 1 of 5 .

Inspection of the Unit 2 Small Bore and Pressurizer Nozzles.

1.0 PURPOSE

1.1 This attachment provides the necessary steps to perform a visual inspection of the Unit 2 small bore and pressurizer nozzles. The inspection is intended to identify and document evidence of boric acid residues that originate at the annulus between the penetration and the piping or pressurizer wall that may be indicative of through-wall leaks in the Alloy 600 penetration or attachment weld. The area of interest is essentially 360° around the penetration. This attachment also provides some guidance for evaluating the source of leakage.

2.0 SCOPE

2.1 This document covers visual inspection and, if necessary, photographing the small bore and pressurizer nozzle penetration locations.

3.0 DESCRIPTION

3.1 It is the intent of this procedure to provide guidelines for visual inspection of the Unit 2 small bore and pressurizer nozzles.

3.2 Active leaks will generally have a light colored or white deposit due to replenishment by leaking borated primary water. Figure 1 shows the "typical" appearance of boric acid deposits.

3.3 The Systems Engineer will conduct this inspection. Any abnormalities will be identified and additional actions taken as required by condition report actions issued as a result of the findings.

4.0 REFERENCES

4.1 References:

4.1.1 M-2230 Sht.1

4.1.2 M-2230 Sht.2

4.1.3 M-2001-B6-24-1

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 The following is a list of equipment that may be used with this procedure. Other items may be required and added by the inspection engineer.

5.1.1 Telescopes

5.1.2 Boroscopes

5.1.3 Cameras

5.1.4 Mirrors

5.1.5 Flashlights

5.1.6 Drop Lights

5.1.7 Binoculars

5.1.8 Robot and Video Equipment

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 None.

6.2 Precautions

6.2.1 Care must be taken to prevent damage to vessel, installed insulation, penetrations, instrumentation and piping. Do not use piping, cable trays, instrument lines or supports to hold equipment or personnel.

6.2.2 Only the minimum number of personnel necessary for the Inspection shall be in the work area.

6.2.3 Workers must minimize the times spent at or near components minimize their exposure.

7.0 PREREQUISITIES AND INITIAL CONDITIONS

7.1 PREREQUISITIES

7.1.1 Obtain Shift Manager or Outage Desk permission prior to performing the inspection. ☐

7.1.2 The vessel is accessible for the inspection (i.e. scaffolding erected and lighting installed). ☐

8.0 INSTRUCTIONS.

NOTE

Steps in this procedure may be performed out of order

8.1 INSPECTION

8.1.1 Perform an IPTE brief in accordance with 1000.143.

8.1.2 Visually inspect the Unit 2 pressurizer penetrations (zero degrees) and document inspection results on Form 6. Note and photograph abnormalities for evaluations.

8.1.3 Visually inspect the Unit 2 pressurizer penetrations (ninety degrees) and document inspection results on Form 7. Note and photograph abnormalities for evaluations.

8.1.4 Visually inspect the Unit 2 pressurizer penetrations (onehundred eighty degrees) and document inspection results on Form 8. Note and photograph abnormalities for evaluations.

8.1.5 Visually inspect the Unit 2 pressurizer penetrations (two hundred seventy degrees) and document inspection results on Form 9. Note and photograph abnormalities for evaluations.

8.1.6 Visually inspect the Unit 2 non-heater pressurizer penetrations and document inspection results on Form 10. Note and photograph abnormalities for evaluations.

8.1.7 Visually inspect the Unit 2 RCS hot leg penetrations and document inspection results on Form 11. Note and photograph abnormalities for evaluation.

8.1.8 Visually inspect the Unit 2 RCS cold leg penetrations and document inspection results on Form 12. Note and photograph abnormalities for evaluation.

8.2 INSPECTION EVALUATION

8.2.1 Cognizant members of the following departments will assemble to review the inspection results for indication of leakage:

- Systems Engineering
- Quality Control
- Design Engineering

8.2.2 If any abnormalities are identified the review group will initiate a Condition Report in accordance with Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

Condition Report Number _____

9.0 RESTORATION AND CHECKOUT

9.1 All material used to perform the reactor head inspection shall be removed upon completion of this work.

_____/_____
Performed By Date

_____/_____
Verified By Date

9.2 The videotape and/or photographs are not permanent records. They should be maintained in RCS System Engineering files for information only.

1.0 PURPOSE

1.1 This attachment provides the necessary steps to perform a visual inspection of the Unit 2 Reactor Vessel Head from the top of the head. The inspection can not identify boric acid residues that originate at the annulus between the penetration and the piping. This inspection can not identify a through-wall leak in the inconnel penetration or attachment weld. This inspection can only determine if large volumes of boric acid exist on the head. The goal of this inspection is to ensure the top of the head gets a visual inspection by Systems Engineering at least once per refueling cycle.

2.0 SCOPE

2.1 This document covers visual inspection and, if necessary, photographing the Unit 2 reactor vessel head from the top of the head.

3.0 DESCRIPTION

3.1 It is the intent of this procedure to provide guidelines for visual inspection of the Unit 2 Reactor Vessel Head from the top of the head.

3.2 The Systems Engineer will conduct this inspection. Any abnormalities will be identified and additional actions taken as required by condition report actions issued as a result of the findings.

3.3 Active leaks will generally have a light colored or white deposit due to replenishment by leaking borated primary water. Figure 1 shows the "typical" appearance of boric acid deposits, which originated from the annulus.

3.4 Boric acid residues may be visible above or around the annulus that are not necessarily indicative of a failure of the Penetration or the attachment weld. Sufficient resources should be utilzed to conclude the origination of the boric acid residue.

4.0 REFERENCES

4.1 References:

4.1.1 M-2001-C2-107-3 Closure Head Nozzle Requirements.

4.1.2 M-2001-C2-69 Sht 1,2,3 Closure head Assembly.

4.1.3 M-2001-C4-1-3 Layout Reactor Dome Insulation.

5.0 TEST EQUIPMENT, SPECIAL TOOLS, AND SUPPLIES

5.1 The following is a list of equipment that may be used with this procedure. Other items may be required and added by the inspection engineer.

5.1.1 Telescopes

5.1.2 Boroscopes

5.1.3 Cameras

5.1.4 Mirrors

5.1.5 Flashlights

5.1.6 Drop Lights

5.1.7 Binoculars

5.1.8 Robot and Video Equipment

6.0 LIMITS AND PRECAUTIONS

6.1 Limits

6.1.1 None.

6.2 Precautions

6.2.1 Care must be taken to prevent damage to vessel, installed insulation, penetrations, instrumentation and piping. Do not use piping, cable trays, instrument lines, CEDM housings, or supports to hold equipment or personnel.

6.2.2 Only the minimum number of personnel necessary for the Inspection shall be in the work area.

6.2.3 Workers must minimize the times spent at or near the Reactor head to minimize their exposure.

7.0 PREREQUISITIES AND INITIAL CONDITIONS.

7.1 PREREQUISITIES

7.1.1 Obtain Shift Manager or Outage Desk permission prior to performing the inspection. ☐

7.1.2 The vessel is accessible for the inspection (i.e. scaffolding erected and lighting installed). ☐

8.0 INSTRUCTIONS.

NOTE

Steps in this procedure may be performed out of order

8.1 INSPECTION

8.1.1 Perform an IPTE brief in accordance with 1000.143.

4.2.3.2 **8.1.2 Visually inspect the Unit 2 Reactor Vessel Head from the top of the head and document results on Form 5. Note and photograph abnormalities including wastage for evaluation.**

8.2 INSPECTION EVALUATION

8.2.1 Cognizant members of the following departments will assemble to review the inspection results for indication of leakage:

- Systems Engineering
- Quality Control
- Design Engineering

8.2.2 If any abnormalities are identified the review group will initiate a Condition Report in accordance with Nuclear Management Manual Procedure LI-102, "Corrective Action Process"

Condition Report Number _____

9.0 RESTORATION AND CHECKOUT

9.1 All material used to perform the reactor head inspection shall be removed upon completion of this work.

_____/_____
Performed By Date

_____/_____
Verified By Date

9.2 The videotape and/or photographs are not permanent records. They should be maintained in RCS System Engineering files for information only.

FORM #1 ANO-1 RPV PENETRATION EXAMINATION RECORD Page 1 of 6

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
1. CRDM Nozzle							
2. CRDM Nozzle							
3. CRDM Nozzle							
4. CRDM Nozzle							
5. CRDM Nozzle							
6. CRDM Nozzle							
7. CRDM Nozzle							
8. CRDM Nozzle							
9. CRDM Nozzle							
10. CRDM Nozzle							
11. CRDM Nozzle							
12. CRDM Nozzle							
13. CRDM Nozzle							

FORM #1 **ANO-1 RPV PENETRATION EXAMINATION RECORD** Page 2 of 6

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
14. CRDM Nozzle							
15. CRDM Nozzle							
16. CRDM Nozzle							
17. CRDM Nozzle							
18. CRDM Nozzle							
19. CRDM Nozzle							
20. CRDM Nozzle							
21. CRDM Nozzle							
22. CRDM Nozzle							
23. CRDM Nozzle							
24. CRDM Nozzle							
25. CRDM Nozzle							
26. CRDM Nozzle							

FORM #1			ANO-1 RPV PENETRATION EXAMINATION RECORD Page 3 of 6				
Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
27. CRDM Nozzle							
28. CRDM Nozzle							
29. CRDM Nozzle							
30. CRDM Nozzle							
31. CRDM Nozzle							
32. CRDM Nozzle							
33. CRDM Nozzle							
34. CRDM Nozzle							
35. CRDM Nozzle							
36. CRDM Nozzle							
37. CRDM Nozzle							
38. CRDM Nozzle							
39. CRDM Nozzle							

FORM #1	ANO-1 RPV PENETRATION EXAMINATION RECORD			Page 4 of 6			
Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
40. CRDM Nozzle							
41. CRDM Nozzle							
42. CRDM Nozzle							
43. CRDM Nozzle							
44. CRDM Nozzle							
45. CRDM Nozzle							
46. CRDM Nozzle							
47. CRDM Nozzle							
48. CRDM Nozzle							
49. CRDM Nozzle							
50. CRDM Nozzle							
51. CRDM Nozzle							
52. CRDM Nozzle							

FORM #1	ANO-1 RPV PENETRATION EXAMINATION RECORD						Page 5 of 6
Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
53. CRDM Nozzle							
54. CRDM Nozzle							
55. CRDM Nozzle							
56. CRDM Nozzle							
57. CRDM Nozzle							
58. CRDM Nozzle							
59. CRDM Nozzle							
60. CRDM Nozzle							
61. CRDM Nozzle							
62. CRDM Nozzle							
63. CRDM Nozzle							
64. CRDM Nozzle							
65. CRDM Nozzle							

FORM #1 ANO-1 RPV PENETRATION EXAMINATION RECORD Page 6 of 6							
Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
66. CRDM Nozzle							
67. CRDM Nozzle							
68. CRDM Nozzle							
69. CRDM Nozzle							
Lower Rx Vessel Head			(For 1R17 only.) Perform an effective 360-degree inspection of the incore nozzles from below the insulation. Report any sign of boric acid or discoloration. For nozzles with indications, inspect the nozzle to head interface for signs of leakage.			Insp	
POPT Complete			Completed Form 5120.242A is attached with added forms (5120.242B, 5120.242C, 5120.242D) if applicable.			SYS Engr	

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #2 ANO-1 PRESSURIZER and Core Flood Tank PENETRATION EXAMINATION RECORD Page 1 of 3

(REF M-230 Sht 1 and M-236 sht 1)

PENETRATION IDENTIFIER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
PSV-1002 Nozzle							
PSV-1001 Nozzle							
CV-1000 Nozzle							
Spray Nozzle							
SS-36 Steam Sample Nozzle							
SS-37 Water Sample Nozzle							
RC-1000A Spare Nozzle							
RC-1001A Upper Level Tap Nozzle							
RC-1002A Upper Level Tap Nozzle							
RC-1001C Lower Level Tap Nozzle							
RC-1002C Lower Level Tap Nozzle							
TE-1001B Nozzle							

FORM #2 ANO-1 PRESSURIZER and Core Flood Tank PENETRATION EXAMINATION RECORD Page 2 of 3

(REF M-230 Sht 1 and M-236 sht 1)

PENETRATION IDENTIFIER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
TE-1002B Nozzle							
RBD-5 Surge Drain Nozzle							
Heater 1004 Nozzle							
Heater 1005 Nozzle							
Heater 1006 Nozzle							
T-2A Sample Nozzle							
T-2A Makeup Nozzle							
T-2B Sample Nozzle							
T-2B Makeup Nozzle							

FORM #2 ANO-1 PRESSURIZER and Core Flood Tank PENETRATION EXAMINATION RECORD Page 3 of 3

(REF M-230 Sht 1 and M-236 sht 1)

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #3 ANO-1 RCS Hot Leg PENETRATION EXAMINATION RECORD Page 1 of 2
(REF M-230 Sht 1)

RCS LOCATION	NOZZLE	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
A HOT LEG	RC-1068 TE/LT-1196 Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
A HOT LEG	RC-1066 TE/LT-1194 Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
A HOT LEG	RC-1030A on FE-1028 Nozzle							
A HOT LEG	RC-1029A on FE1028 Nozzle							
A HOT LEG	TE-1013 & TE-1014 Nozzle							
A HOT LEG	TE-1011 & TE-1012 Nozzle							
A HOT LEG	RC-1021A & RC-1023A Nozzle							
A HOT LEG	TE-1111 & TE-1112 Nozzle							
A HOT LEG	RC-1064 (LT-1190) Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
A HOT LEG	RBV-70A THot Vent Nozzle							
B HOT LEG	RC-1072 TE/LT-1195 Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
B HOT LEG	RC-1074 TE/LT-1195 Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
B HOT LEG	RC-1076 TE/LT-1191 Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				

FORM #3 ANO-1 RCS Hot Leg PENETRATION EXAMINATION RECORD Page 2 of 2
(REF M-230 Sht 1)

RCS LOCATION	NOZZLE	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
B HOT LEG	RC-1035A on FE-1034 Nozzle							
B HOT LEG	RC-1036A on FE1034 Nozzle							
B HOT LEG	TE-1041 & TE-1042 Nozzle							
B HOT LEG	TE-1040 & TE-1099 Nozzle							
B HOT LEG	RC-1039A & RC-1038A Nozzle							
B HOT LEG	TE-1139 & TE-1140 Nozzle							
B HOT LEG	RC-1078 (LT-1189) Nozzle			Reference CR-ANO-1-2000-97, Nozzle replaced with 690 material. Inspection no longer required.				
B HOT LEG	RBV-70B THOT Vent Nozzle							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #4 ANO-1 RCS Cold Leg PENETRATION EXAMINATION RECORD Page 1 of 2
(REF M-230 Sht 1)

RCS LOCATION	Nozzle	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
P-32A Cold Leg	TE-1148 & TE-1147 Nozzle							
P-32A Cold Leg	TE-1047 & TE-1048 Nozzle							
P-32A Cold Leg	RBD-8A & Letdown Nozzle							
P-32B Cold Leg	TE-1144 & TE-1145 Nozzle							
P-32B Cold Leg	TE-1044 & TE-1045 Nozzle							
P-32B Cold Leg	RBD-8B Letdown Nozzle							
P-32C Cold Leg	RC-1 Nozzle							
P-32C Cold Leg	TE-1117 & TE-1118 Nozzle							
P-32C Cold Leg	TE-1017 & TE-1018 Nozzle							
P-32C Cold Leg	RBD-8C Nozzle							

FORM #4 ANO-1 RCS Cold Leg PENETRATION EXAMINATION RECORD Page 2 of 2
(REF M-230 Sht 1)

RCS LOCATION	Nozzle	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
P-32D Cold Leg	TE-1115 & TE-1116 Nozzle							
P-32D Cold Leg	TE-1015 & TE-1016 Nozzle							
P-32D Cold Leg	RBD-8D Nozzle							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 1 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
1 CEDM Nozzle							
2 CEDM Nozzle							
3 CEDM Nozzle							
4 CEDM Nozzle							
5 CEDM Nozzle							
6 CEDM Nozzle							
7 CEDM Nozzle							
8 CEDM Nozzle							
9 CEDM Nozzle							
10 CEDM Nozzle							
11 CEDM Nozzle							
12 CEDM Nozzle							
13 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 2 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
14 CEDM Nozzle							
15 CEDM Nozzle							
16 CEDM Nozzle							
17 CEDM Nozzle							
18 CEDM Nozzle							
19 CEDM Nozzle							
20 CEDM Nozzle							
21 CEDM Nozzle							
22 CEDM Nozzle							
23 CEDM Nozzle							
24 CEDM Nozzle							
25 CEDM Nozzle							
26 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 3 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
27 CEDM Nozzle							
28 CEDM Nozzle							
29 CEDM Nozzle							
30 CEDM Nozzle							
31 CEDM Nozzle							
32 CEDM Nozzle							
33 CEDM Nozzle							
34 CEDM Nozzle							
35 CEDM Nozzle							
36 CEDM Nozzle							
37 CEDM Nozzle							
38 CEDM Nozzle							
39 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 4 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
40 CEDM Nozzle							
41 CEDM Nozzle							
42 CEDM Nozzle							
43 CEDM Nozzle							
44 CEDM Nozzle							
45 CEDM Nozzle							
46 CEDM Nozzle							
47 CEDM Nozzle							
48 CEDM Nozzle							
49 CEDM Nozzle							
50 CEDM Nozzle							
51 CEDM Nozzle							
52 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 5 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
53 CEDM Nozzle							
54 CEDM Nozzle							
55 CEDM Nozzle							
56 CEDM Nozzle							
57 CEDM Nozzle							
58 CEDM Nozzle							
59 CEDM Nozzle							
60 CEDM Nozzle							
61 CEDM Nozzle							
62 CEDM Nozzle							
63 CEDM Nozzle							
64 CEDM Nozzle							
65 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 6 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
66 CEDM Nozzle							
67 CEDM Nozzle							
68 CEDM Nozzle							
69 CEDM Nozzle							
70 CEDM Nozzle							
71 CEDM Nozzle							
72 CEDM Nozzle							
73 CEDM Nozzle							
74 CEDM Nozzle							
75 CEDM Nozzle							
76 CEDM Nozzle							
77 CEDM Nozzle							
78 CEDM Nozzle							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 7 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
79 CEDM Nozzle							
80 CEDM Nozzle							
81 CEDM Nozzle							
Head Vent Nozzle	N/A	N/A	The vent nozzle can not be seen from the top due to insulation.			N/A	N/A
N/A	N/A	N/A	For the instrument nozzles use the head vent piping as a reference. Inspect the instrumnent nozzles clockwise from the vent piping.			N/A	N/A
Instrument Nozzle #1							
Instrument Nozzle #2							
Instrument Nozzle #3							
Instrument Nozzle #4							
Instrument Nozzle #5							
Instrument Nozzle #6							
Instrument Nozzle #7							
Instrument Nozzle #8							

FORM #5 ANO-2 RPV HEAD PENETRATION EXAMINATION RECORD Page 8 of 8
Ref M-2001-C2-107-3

Pen.No.	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #6 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 1 of 3
Zero Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
BB-1							
T-1							
L-1							
F-1							
K-1							
R-1							
Y-1							
X-1							
S-1							
AA-1							
U-1							
N-1							
H-1							

FORM #6 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 2 of 3
Zero Degrees (Ref M-2001-B6-24-2)

HEATER NUMBER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
C-1							
C-4							
H-4							
N-4							
U-4							
AA-4							
S-4							
K-4							
F-4							
L-4							
R-4							
X-4							
Y-4							

FORM #6 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 3 of 3
Zero Degrees (Ref M-2001-B6-24-2)

HEATER NUMBER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
T-4							
BB-4							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #7 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 1 of 2

Ninety Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
D-2							
J-2							
Q-2							
Z-2							
B-2							
G-2							
P-2							
W-2							
A-1							
E-1							
M-1							
V-1							
B-1							

FORM #7 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 2 of 2
Ninety Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
G-1							
P-1							
W-1							
D-1							
J-1							
Q-1							
Z-1							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #8 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 1 of 3
One Hundred Eighty Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
BB-2							
T-2							
L-2							
F-2							
K-2							
R-2							
Y-2							
X-2							
S-2							
AA-2							
U-2							
N-2							

FORM #8 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 2 of 3

One Hundred Eighty Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
H-2							
C-2							
C-3							
H-3							
N-3							
U-3							
AA-3							
S-3							
K-3							
F-3							
L-3							
R-3							
X-3							

FORM #8 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 3 of 3
One Hundred Eighty Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
Y-3							
T-3							
BB-3							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #9 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 1 of 2
Two Hundred Seventy Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
D-3							
J-3							
Q-3							
Z-3							
W-3							
P-3							
G-3							
B-3							
A-2							
E-2							
M-2							
V-2							
W-4							

FORM #9 ANO-2 PZR HEATER PENETRATION EXAMINATION RECORD Page 2 of 2
Two Hundred Seventy Degrees (Ref M-2001-B6-24-2)

Heater Number	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
P-4							
G-4							
B-4							
D-4							
J-4							
Q-4							
Z-4							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #10 ANO-2 PZR NON-HEATER PENETRATION EXAMINATION RECORD Page 1 of 2

PENETRATION IDENTIFIER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
2PSV-4633 NOZZLE							
2PSV-4634 NOZZLE							
LTOP PIPE NOZZLE							
VENT PIPE 2RC-4626A NOZZLE							
PZR SPRAY PIPE NOZZLE							
REFUELING LEVEL/STEAM SAMPLE AT 2RC-13							
PRESSURE TAP AT 2RC-4623A							
UPPER LEVEL TAP AT 2RC-4627A							
UPPER LEVEL TAP AT 2RC-4627E							
LOWER LEVEL TAP AT 2RC-4627C							
LOWER LEVEL TAP AT 2RC-4627G							
WATER PHASE TEMPERATURE 2TE-4627-2							
SURGE LINE SAMPLE AT 2RC-11							

FORM #10 ANO-2 PZR NON-HEATER PENETRATION EXAMINATION RECORD Page 2 of 2

PENETRATION IDENTIFIER	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
SURGE LINE TEMPERATURE 2TE-4609							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FORM #11 ANO-2 RCS Hot Leg PENETRATION EXAMINATION RECORD Page 1 of 2
(REF M-2230 Sht 1)

RCS LOCATION	ELEMENT	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
A HOT LEG	2TE-4610-1							
A HOT LEG	2TE-4610-2							
A HOT LEG	2TE-4610-3							
A HOT LEG	2TE-4610-4							
A HOT LEG	2TE-4614-1							
A HOT LEG	2TE-4635-1							
A HOT LEG	2TE-4635-2							
A HOT LEG	2TE-4635-3							
A HOT LEG	2TE-4635-4							
B HOT LEG	2TE-4710-1							
B HOT LEG	2TE-4710-2							
B HOT LEG	2TE-4710-3							
B HOT LEG	2TE-4710-4							
B HOT LEG	2TE-4714-2							

FORM #11 ANO-2 RCS Hot Leg PENETRATION EXAMINATION RECORD Page 2 of 2
(REF M-2230 Sht 1)

RCS LOCATION	ELEMENT	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
B HOT LEG	2TE-4735-1							
B HOT LEG	2TE-4735-2							
B HOT LEG	2TE-4735-3							
B HOT LEG	2TE-4735-4							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

_____

System Engineering Date

_____

Design Engineering Date

_____

Quality Control Date

_____

System Engineering Supervisor Date

FORM #12 ANO-2 RCS Cold Leg PENETRATION EXAMINATION RECORD Page 1 of 2
(REF M-2230 Sht 1)

RCS LOCATION	ELEMENT	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
2P-32A Cold Leg	2TE-4611-2							
2P-32A Cold Leg	2TE-4611-4							
2P-32A Cold Leg	2TE-4615							
2P-32B Cold Leg	2TE-4611-1							
2P-32B Cold Leg	2TE-4611-3							
2P-32B Cold Leg	2TE-4616							
2P-32C Cold Leg	2TE-4711-1							
2P-32C Cold Leg	2TE-4711-3							
2P-32C Cold Leg	2TE-4715							

FORM #12 ANO-2 RCS Cold Leg PENETRATION EXAMINATION RECORD Page 2 of 2
(REF M-2230 Sht 1)

RCS LOCATION	ELEMENT	SAT	UNSAT	Comments	SYS Engr	D. Engr	QC	Date
2P-32D Cold Leg	2TE-4716							
2P-32D Cold Leg	2TE-4711-2							
2P-32D Cold Leg	2TE-4711-4							

Representatives from Systems Engineering, Design Engineering and Quality Control shall sign below to document concurrence with the above SAT/UNSAT determinations and comments.

System Engineering Date

Design Engineering Date

Quality Control Date

System Engineering Supervisor Date

FIGURE 1

TYPICAL BORIC ACID DEPOSITS .

FROM A LEAKING PENETRATION

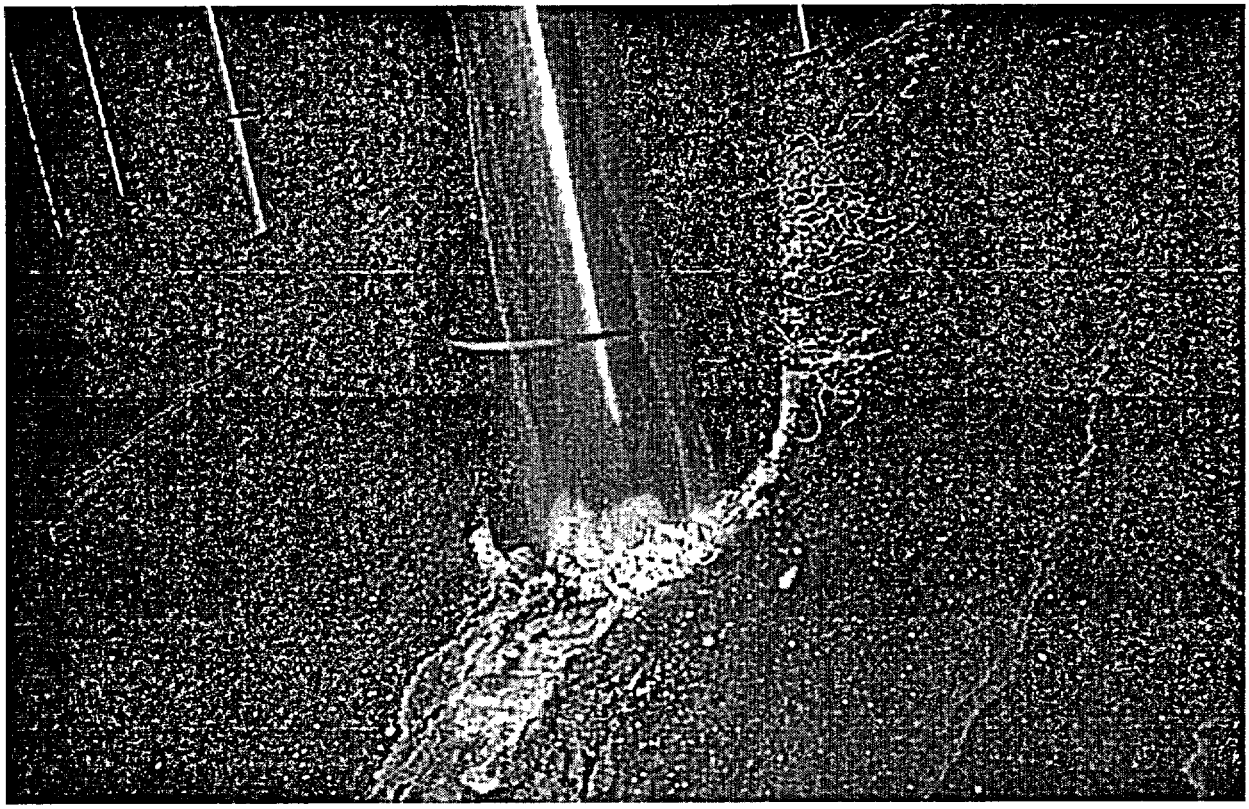


FIGURE 2
AN0-2 RPV Head Map from drawing M-2001-C2-107-3.

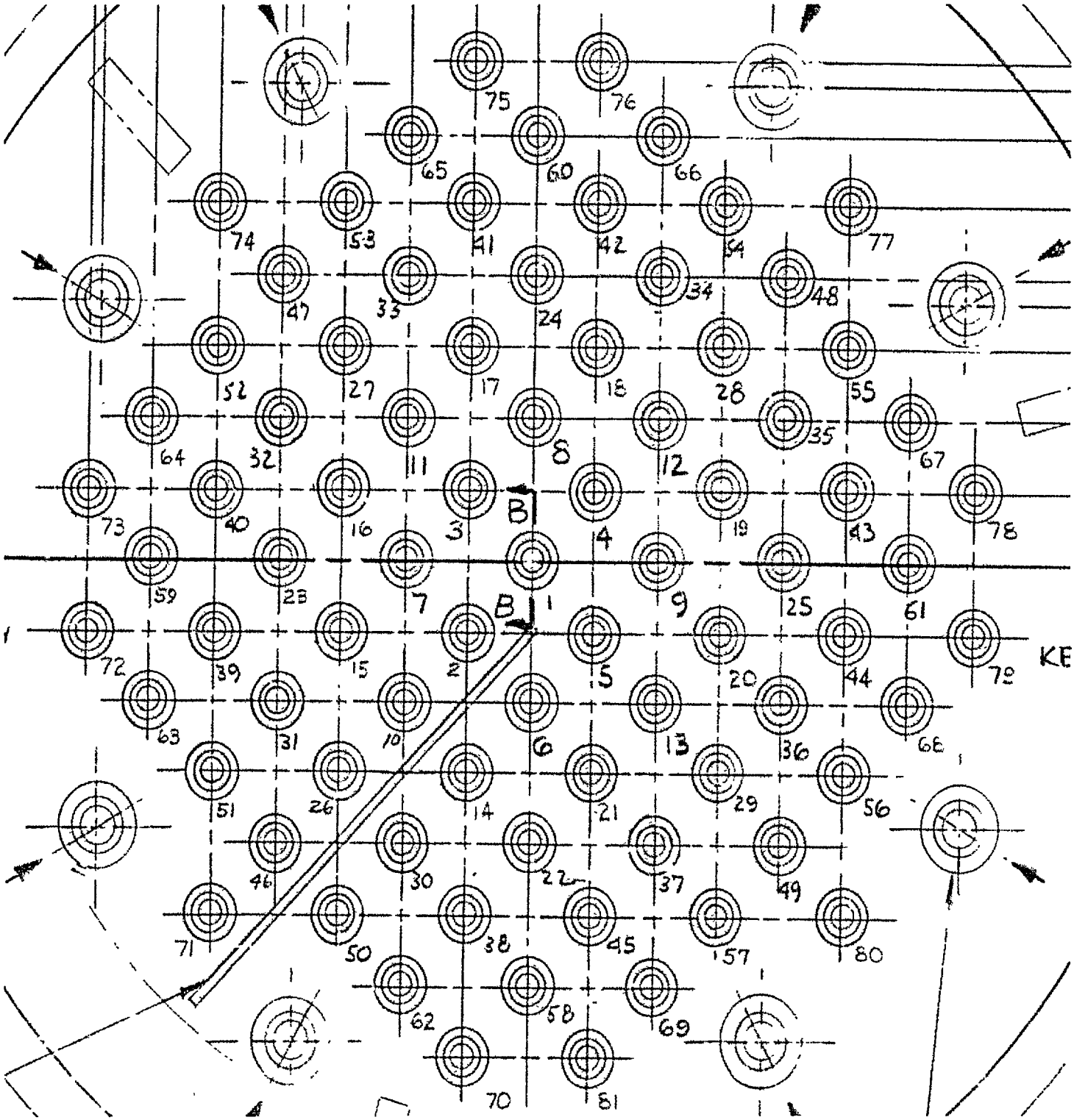
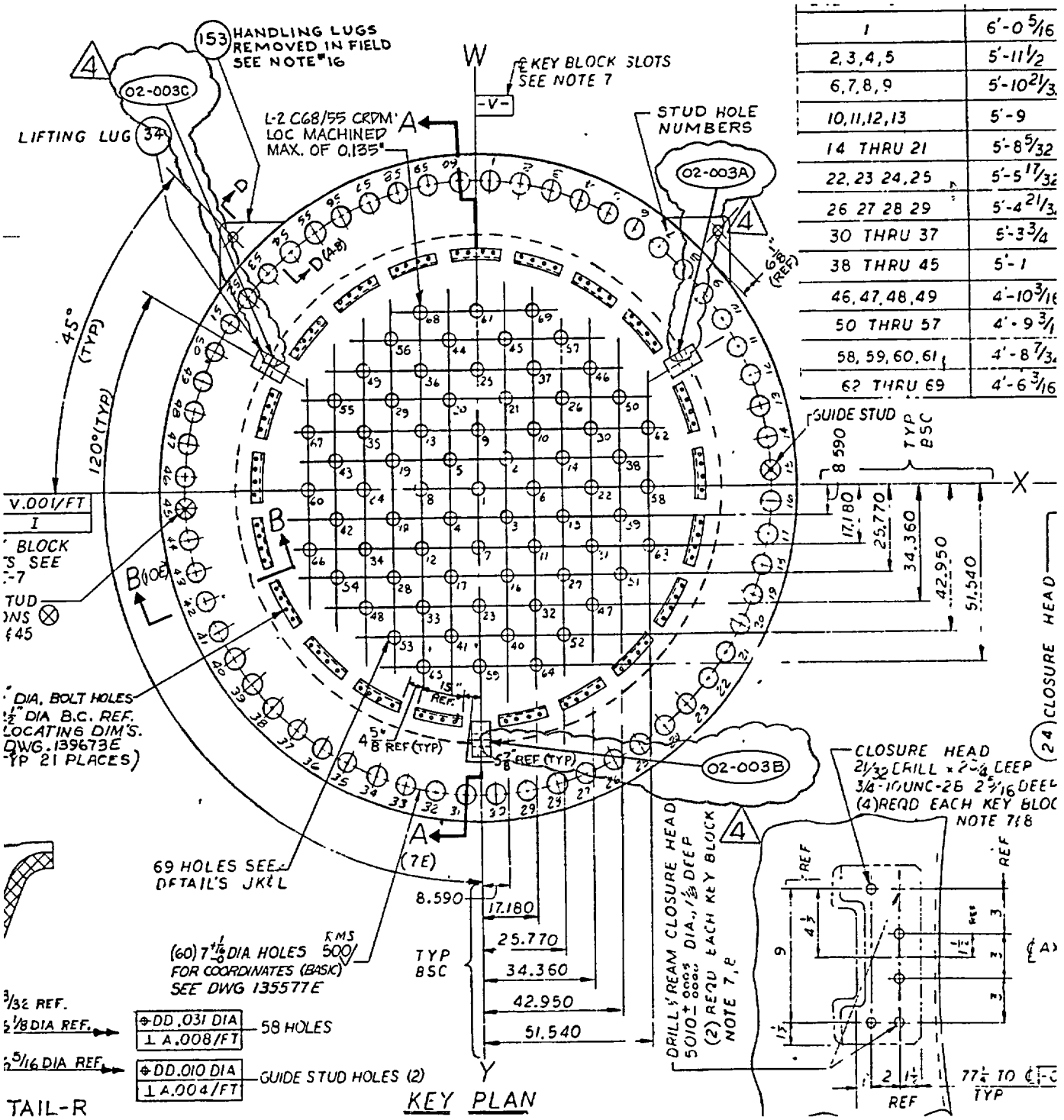


FIGURE 3, ANO-1 RPV HEAD MAP FROM DRAWING M1B-144-4.



1	6'-0 5/16
2,3,4,5	5'-11 1/2
6,7,8,9	5'-10 21/32
10,11,12,13	5'-9
14 THRU 21	5'-8 5/32
22,23,24,25	5'-5 17/32
26,27,28,29	5'-4 21/32
30 THRU 37	5'-3 3/4
38 THRU 45	5'-1
46,47,48,49	4'-10 3/16
50 THRU 57	4'-9 3/16
58,59,60,61	4'-8 7/32
62 THRU 69	4'-6 3/16

Figure 4, ANO-1 Pressurizer Nozzle locations from drawing M1G-1-7.

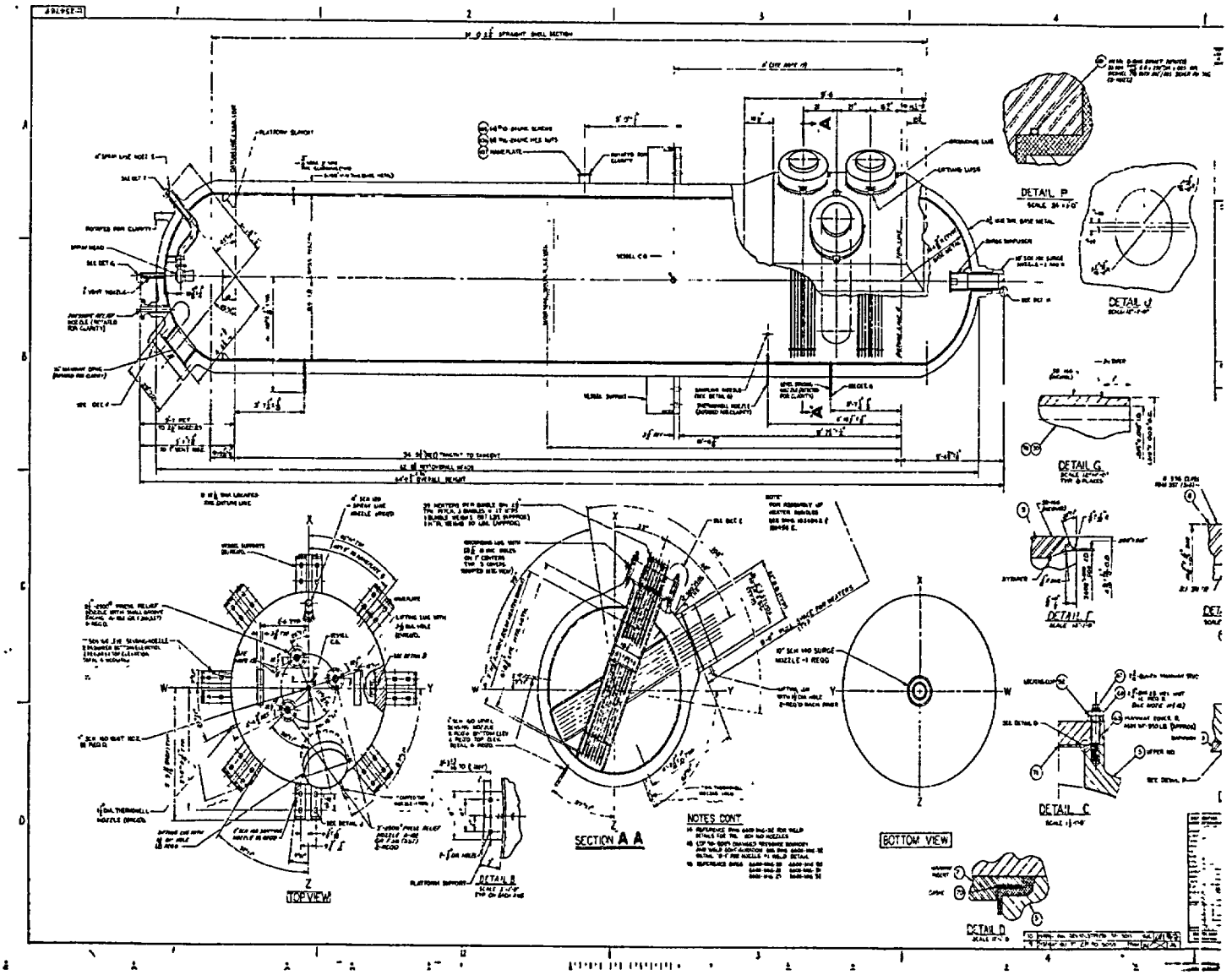


Figure 5, ANO-1 RCS Nozzle Locations from drawing M297 Sheet 2