# Code Case N-504-1

Application to the Palisades Nuclear Plant
Control Rod Drive Upper Housings



ENCLOSURE 2

# Background on the Issue

- CRD Upper Housing Description
- Leak Identification on CRD-21
- Examination Results to Date

# Weld Overlay Repair Option

- Overlay In Accordance With Code Case N-504-1 For Stainless Piping
- CRD Housings Were Supplied As A Sub-component With Reactor Head
- CRD Housing Constructed Of Standard Austenitic Stainless Pipe & Components

# Application Of Code Case N-504-1

## Issues To Be Addressed

- Design Of The Overlay
- Beneficial Effects Of An Overlay
- Applicability To TGSCC

# Palisades Standard Overlay Design

- Applicable To Both Axial And Circumferential Flaws
- Assumes Flaw Is 100% Through Wall, 360° Around
- Overlay Design Utilizes 309L Stainless Material

# Beneficial Effects Of Overlay

- Replaces Base Material With SCC Resistant Material
- Compressive Stress Field Generated
- Over 1000 Overlays Performed With No Indication Of Crack Growth

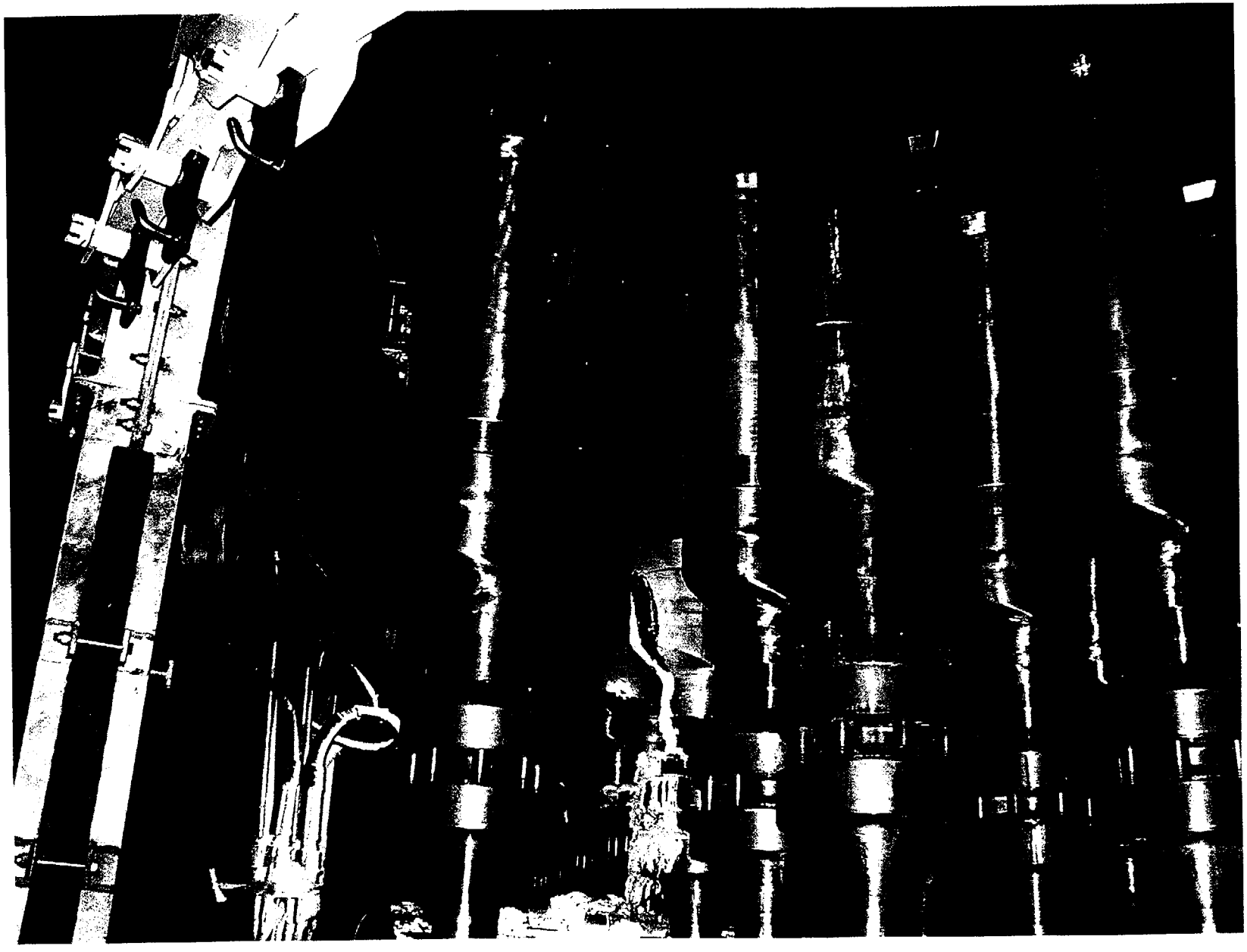
# Applicability To TGSCC

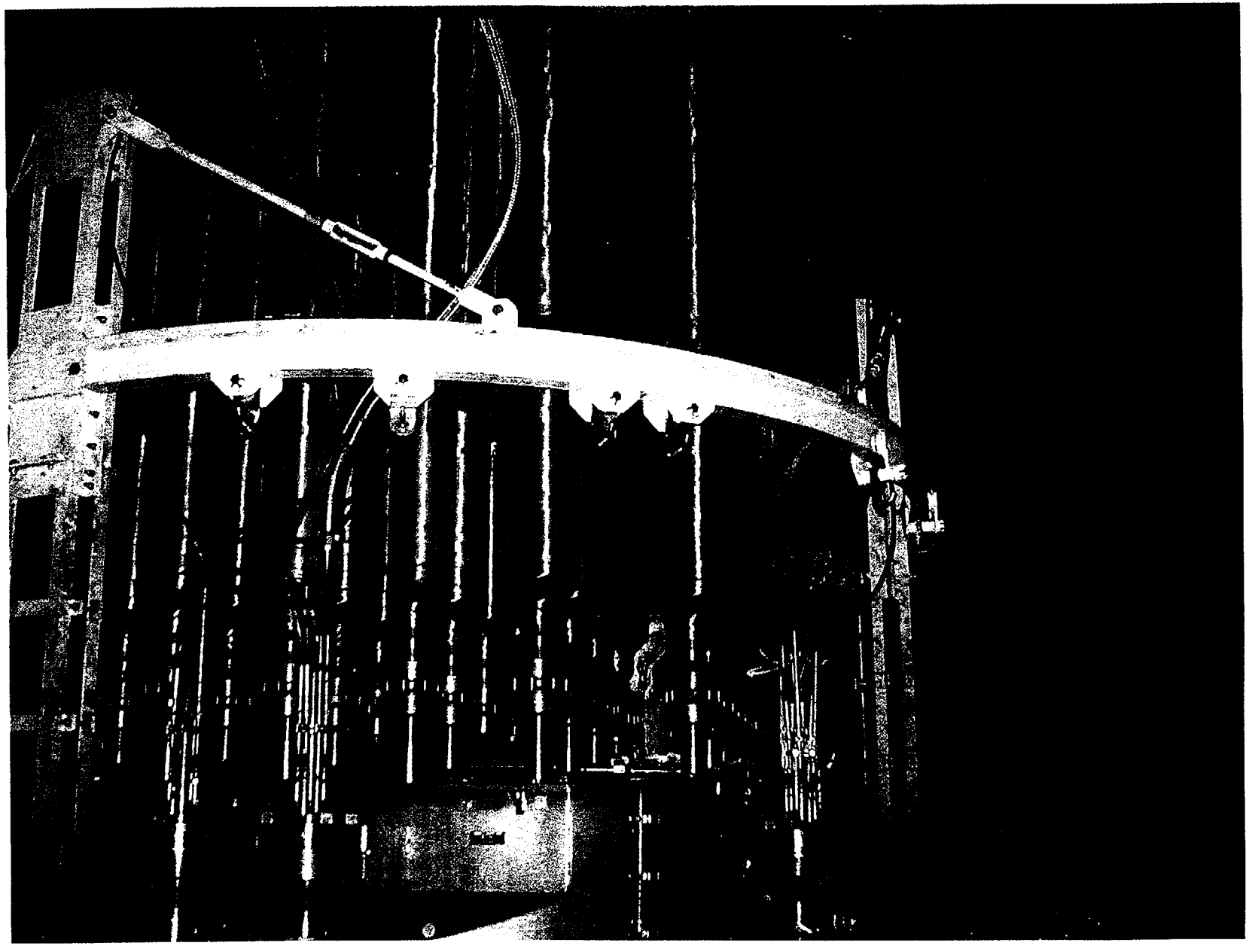
- Code Case Is Not Limited To Any Specific Degradation Mechanism
- Highly Resistant Overlay Material To Be Used (>10% Ferrite)
- Crack Growth Rate Consideration

# Summary

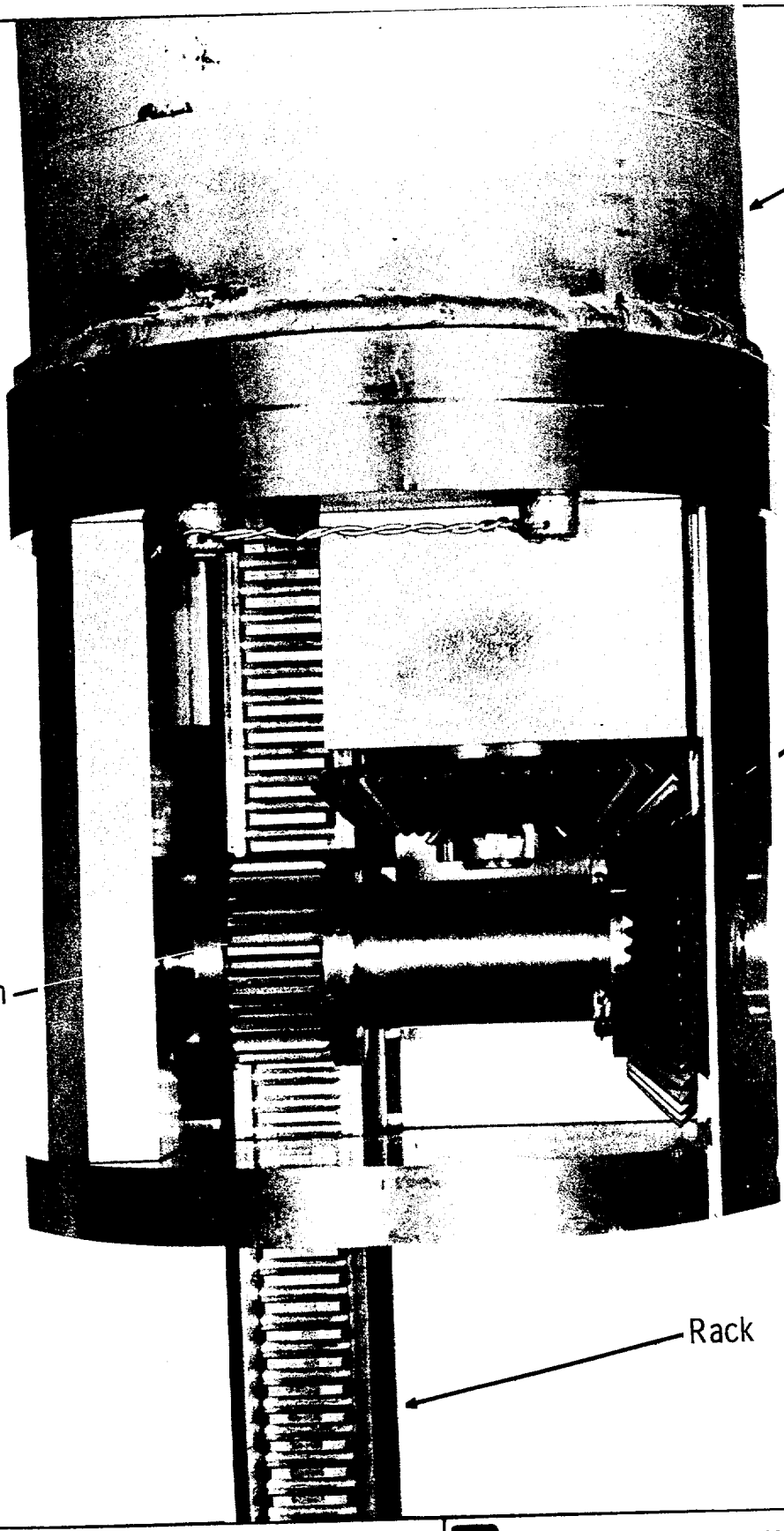
- 309L Material Is Resistant To SCC
- Overlay Mitigates Crack Growth
- Full Structural Overlay Design
- Future Inspections Will Provide Assurance Of Overlay Effectiveness

# Conclusion





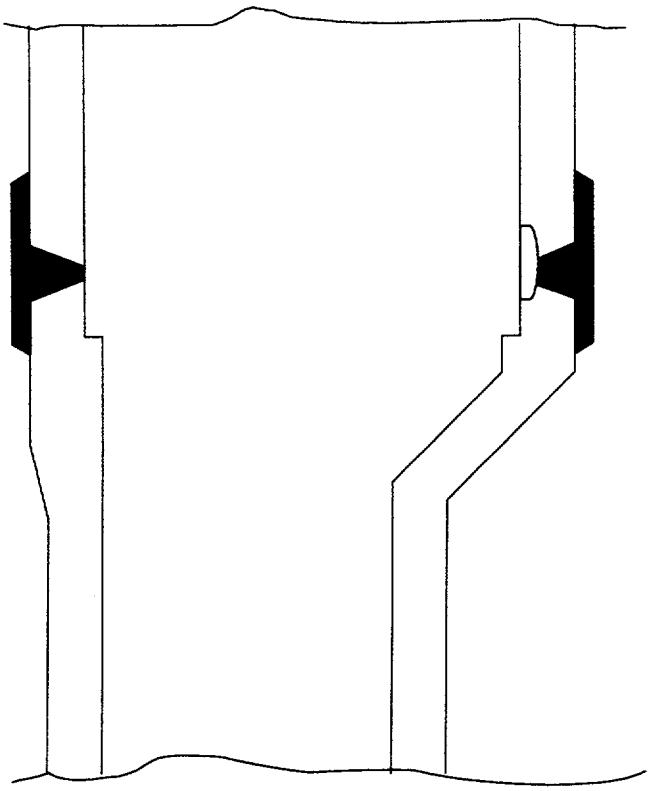
# UPPER HOUSING

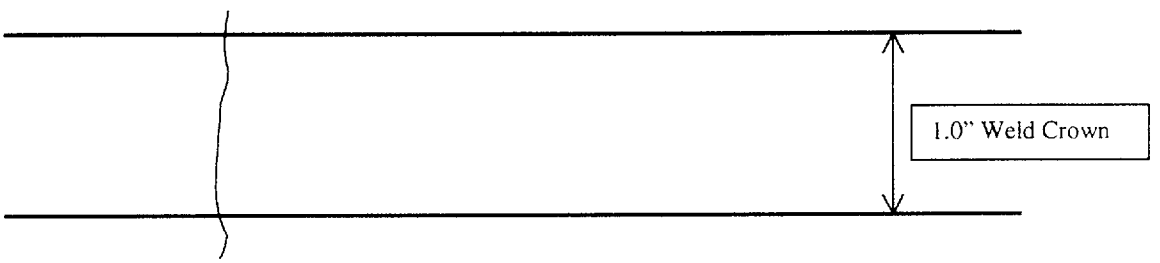



Pinion Housing and Rack Assembly

COMBUSTION ENGINEERING, INC.
WINDSOR, CONNECTICUT

Figure 3




1.0" Weld Crown

Cycle No: End of Cycle 15 (01 Refout beginning)
Date Revised: April 8, 2001
System Engineer: RJ Slakes

REFERENCE ONLY

## CRDM HEAD MAP

NORTH — ||| GATE |||

| | | | | | | |
|---|---|---|---|---|---|---|
| | A 01<br>2966-95<br>93/06 142<br>1/4 41 3/8 | 1 21<br>2966-84<br>95/06 143<br>3/8 33 3/8 | 3 33<br>2966-80<br>00/02 103<br>5/8 28 3/8 | 1 22<br>2966-87<br>93/06 104<br>1/4 34 3/8 | A 02<br>2966-16<br>98/12 105<br>7/16 42 1/4 | |
| A 03<br>2966-107<br>95/06 106<br>5/16 40 3/8 | 4 38<br>2966-90<br>93/06 107<br>1/4 23 3/8 | B 13<br>2966-85<br>93/06 108<br>1/4 17 3/8 | P 42<br>2966-70<br>92/02 205<br>1/4 12 3/8 | B 14<br>2966-104<br>95/06 109<br>5/16 18 3/8 | 4 39<br>2966-73<br>92/02 144<br>5/16 24 3/8 | A 04<br>2966-62<br>99/11 111<br>5/16 43 3/8 |
| 1 23<br>2966-69<br>92/02 112<br>1/4 32 3/8 | B 15<br>2966-81<br>92/02 113<br>1/2 16 3/8 | 2 29<br>2966-89<br>00/02 114<br>5/16 07 3/8 | A 05<br>2966-79<br>92/02 115<br>___ 04 3/8 | 2 30<br>2966-26<br>99/11 116<br>1/4 08 1/4 | B 16<br>2966-97<br>93/06 117<br>1/2 19 3/8 | 1 24<br>2966-86<br>00/02 118<br>9/16 35 3/8 |
| 3 34<br>2966-68<br>92/02 119<br>1/2 27 3/8 | P 43<br>2966-100<br>95/06 202<br>5/16 11 3/8 | A 06<br>2966-66<br>00/02 120<br>5/16 03 3/8 | 3 35<br>2966-71<br>92/02 121<br>3/4 01 3/8 | A 07<br>2966-01<br>99/11 122<br>1/2 05 1/4 | P 44<br>2966-108<br>99/11 203<br>5/16 13 3/8 | 3 36<br>2966-32<br>99/11 123<br>5/16 29 1/4 |
| 1 25<br>2966-93<br>93/06 124<br>9/16 31 3/8 | B 17<br>2966-76<br>93/05 125<br>5/16 15 3/8 | 2 31<br>2966-94<br>95/06 126<br>5/16 06 3/8 | A 08<br>2966-65<br>95/06 127<br>5/16 02 3/8 | 2 32<br>2966-64<br>00/02 128<br>5/16 09 3/8 | B 18<br>2966-63<br>00/02 129<br>5/16 20 3/8 | 1 26<br>2966-110<br>99/11 130<br>5/16 36 3/8 |
| A 09<br>2966-60<br>96/12 131<br>1/4 39 3/8 | 4 40<br>2966-96<br>93/06 132<br>3/8 22 3/8 | B * 19<br>2966-105<br>00/02 110*<br>5/16 14 3/8 | P 45<br>2966-92<br>98/05 204<br>5/16 10 3/8 | B 20<br>2966-34<br>99/11 134<br>1/2 21 1/4 | 4 41<br>2966-98<br>93/06 135<br>5/16 25 3/8 | A 10<br>2966-109<br>99/11 136<br>7/16 44 3/8 |
| | A 11<br>2966-61<br>96/12 137<br>5/8 38 3/8 | 1 27<br>2966-67<br>95/06 138<br>5/16 30 3/8 | 3 37<br>2966-106<br>00/09 139<br>5/16 26 3/8 | 1 28<br>2966-91<br>00/02 140<br>5/16 37 3/8 | A 12<br>2966-99<br>00/02 141<br>3/8 45 3/8 | |

||| GATE ||| — SOUTH

Rod Group — **Location CRD-##**
**Seal Housing Serial Number**
Last Rebuild — Control Rod Serial Number
Collar Hght — Rx Head Bore # — **CCW NPT**

Rod Groups: { A-B shutdown } { 1-4 regulating } { P part-length }

Housing Serial Numbers: <2966-60 are 304 stainless steel with 1/4 NPT CCW ports;
≥ 2966-60 are 347 stainless steel with 3/8 NPT CCW ports.
2966-2xx are Inconel Housings with 3/8 or 1/2 NPT CCW ports.

Broad horizontal lines represent CCW and leakoff piping headers servicing adjacent CRDM rows.
North headers service only the north outer row.
Headers are stacked: Top is CCW in; Middle CCW out; Bottom seal leakoff.

* Location 19 has: Pitted autoclave seating surface and special coupler for Control Rod 110 (ref.SFC-81-092)

ENCLOSURE 3