52-001

**GE Nuclear Energy**

Resent 6/9/92

ABWR

11E28

Date 6/5/92

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Chet Poslusny

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Subject I&C Tech. Spec. for Containment Isolation

Message ATTACHED ARE PROPOSED ABWR TECH SPECS FOR THE PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION. GE HAS NOW SUBMITTED SUCH PROPOSED ABWR T.S FOR RPS, ECCS ACTUATION, AND PCIS ACTUATION WHICH COMPRISE THE BULK OF THE I+C TS IN SECTION 3.3. WE WISH TO RECEIVE FEEDBACK AND PURSUE DIALOGUE ON THESE SPECS SUCH THAT WE MAY FINALIZE THE REMAINING I-C TS USING SIMILAR INSTRUMENTATION AND LOGIC. WE ARE CURRENTLY PREPARING CORRESPONDING BASES CONSISTENT WITH THE FINAL BWR6 ITS THAT ARE NOW COMING OUT



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3.3 INSTRUMENTATION

3.3.6.1 Primary Containment Isolation (PCI) Instrumentation

LCO 3.3.6.1 The Primary Containment Isolation instrumentation, digital trip logic and actuation logic for each Function in Tables 3.3.6.1-1, 3.3.6.1-2 and 3.3.6.1-3 shall be OPERABLE.

APPLICABILITY: According to Tables 3.3.6.1-1, 3.3.6.1-2 and 3.3.6.1-3.

ACTIONS

-----NOTE-----
Seperate Condition entry is allowed for each Primary Containment Isolation Function

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| A. One instrument trip channel inoperable for Primary Containment Isolation functions in Table 3.3.6.1-1. | A.1 | -----NOTE----- LCO 3.0.4 is not applicable.<br>Place instrument trip channel in bypass or trip. | 1 hour |
| | AND | | |
| | A.2 | Restore instrument trip channel to OPERABLE status. | Prior to entering MODE 2 following next MODE 5 entry. |
| B. Two instrument trip channels inoperable for Primary Containment Isolation functions in Table 3.3.6.1-1. | B.1 | Place one instrument trip channel in bypass and the other in trip. | 1 hour |
| | AND | | |
| | B.2 | Restore one instrument trip channel to OPERABLE status. | Prior to completion of the next CHANNEL FUNCTIONAL TEST |

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| | | | |
|---|---|---|---|
| C. Three or more instrument trip channels inoperable for Primary Containment Isolation functions in Table 3.3.6.1-1.<br><br>OR<br><br>One or more instrument trip channels inoperable for Primary Containment Isolation functions in Table 3.3.6.1-2.<br><br>OR<br><br>Required Actions and associated Completion Times of Condition A or B not met. | C.1 | Enter the Condition referenced in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3 for the function. | Immediately |
| D. One actuation logic channel inoperable for any Primary Containment Isolation functions (other than MSIV isolation) in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3. | D.1<br><br>AND | Place (or verify) actuation logic channel in bypass/trip condition. | 1 hour |
| | D.2 | Restore channel to OPERABLE status. | 31 days |

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| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| E. Two actuation logic channels inoperable for any Primary Containment Isolation function (other than MSIV isolation) in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3..<br><br>OR<br><br>Required Actions and associated Completion Times of Condition D not met for any Primary Containment Isolation function (other than MSIV isolation). | E.1 | Enter the Condition referenced in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3 for the function. | Immediately |
| F. One actuation logic channel inoperable for MSIV isolation functions in Table 3.3.6.1-1 or 3.3.6.1-3. | F.1.1 | Place channel in bypass. | 1 hour |
| | AND | | |
| | F.1.2 | Restore channel to OPERABLE status. | 7 days |

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| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| G. Required Actions and associated Completion Times of Condition F not met. | G.1.1 | Place inoperable MSIV isolation actuation logic channel in trip. | 8 hours |
| | <u>OR</u> | | |
| | G.1.2 | Perform SR 3.3.6.1.2 on OPERABLE MSIV isolation actuation logic channels. | 8 hours<br><br><u>AND</u><br><br>Once per 7 days thereafter |
| | <u>AND</u> | | |
| | G.2 | Restore inoperable channel to OPERABLE status. | 31 days from discovery of inoperable actuation logic channel for MSIV isolation function |
| H. Two actuation logic channels inoperable for any MSIV isolation function in Table 3.3.6.1-1 or 3.3.6.1-3. | H.1 | Place one channel in bypass and the other in trip. | 1 hour |
| | <u>AND</u> | | |
| | H.2 | Restore one channel to OPERABLE status. | 24 hours |
| I. Required Actions and associated Completion Times of Condition G or H not met for any MSIV isolation function. | I.1 | Enter the Condition referenced in Table 3.3.6.1-1 or 3.3.6.1-3 for the function. | Immediately |

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| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| J. As required by Required Action C.1 or I.1 and referenced in Table 3.3.6.1-1 or 3.3.6.1-3. | J.1 Isolate associated main steam line(s) (MSL).<br>OR<br>J.2.1 Be in MODE 3.<br>AND<br>J.2.2 Be in MODE 4. | 12 hours<br><br><br>12 hours<br><br>36 hours |
| K. As required by Required Action C.1 or I.1 and referenced in Table 3.3.6.1-1. | K.1 Be in MODE 2. | 6 hours |
| L. As required by Required Action C.1, E.1 or I.1 and referenced in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3. | L.1 Isolate the affected line(s). | 1 hour |
| M. As required by Required Action C.1, E.1 or I.1 and referenced in Table 3.3.6.1-1, 3.3.6.1-2 or 3.3.6.1-3.<br>OR<br>Required Actions and associated Completion Times of Condition K or L not met. | M.1 Be in MODE 3.<br>AND<br>M.2 Be in MODE 4. | 12 hours<br><br>36 hours |

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| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| N. As required by Required Action C.1 or E.1 and referenced in Table 3.3.6.1-2. | N.1 | Declare the associated Standby Liquid Control (SLC) subsystem(s) inoperable. | 1 hour |
| | <u>OR</u> | | |
| | N.2 | Isolate the Reactor Water Cleanup (RWCU) System. | 1 hour |
| O. As required by Required Action C.1 or E.1 and referenced in Table 3.3.6.1-1. | O.1 | Initiate action to restore channel to OPERABLE status. | Immediately |
| | <u>OR</u> | | |
| | O.2 | Initiate action to isolate the RHR shutdown cooling System. | Immediately |

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SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| -------------------NOTES------------------- <br> 1. Refer to Tables 3.3.6.1-1, 3.3.6.1-2 and 3.3.6.1-3 to determine which SRs shall be performed for each Primary Containment Isolation function. <br> 2. A channel may be placed in an inoperable or bypass status for up to 6 hours for required surveillance testing. <br> ------------------------------------------- | | |
| SR 3.3.6.1.1 | Perform CHANNEL CHECK. | 12 hours |
| SR 3.3.6.1.2 | Perform CHANNEL FUNCTIONAL TEST of actuation logic channels. | [31] days |
| SR 3.3.6.1.3 | -------------------NOTE------------------- <br> Radiation detectors may be excluded. <br> ------------------------------------------- <br> Perform CHANNEL FUNCTIONAL TEST of instrument trip logic channels. | [92] days |
| SR 3.3.6.1.4 | Perform CHANNEL CALIBRATION. | [92] days |
| SR 3.3.6.1.5 | Perform CHANNEL CALIBRATION. | [18] months |
| SR 3.3.6.1.6 | Perform LOGIC SYSTEM FUNCTIONAL TEST. | [18] months |
| SR 3.3.6.1.7 | -------------------NOTE------------------- <br> Radiation detectors may be excluded. <br> ------------------------------------------- <br> Demonstrate the ISOLATION SYSTEM RESPONSE TIME is within limits. | [18] months on a STAGGERED TEST BASIS |

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Table 3.3.6.1-1 Primary Containment Isolation Instrumentation, Trip and Actuation Logic
(All Functions in this table have 4 required instrument trip channels configured in 2-out-of-4 logic)

| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 1. Reactor Vessel Water Level--Low Low Low, Level 1 | | | | |
| a. Primary Containment Isolation (RCW/RNCW) | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| 2. Reactor Vessel Water Level--Low Low, Level 1.5 | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| 3. Reactor Vessel Water Level--Low Low, Level 2 | | | | |
| a. Primary Containment Isolation (DW FP Sampling) | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| b. RWCU System Isolation | 1,2,3,4,5 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 4. Reactor Vessel Water Level--Low, Level 3 | | | | |
| a. Primary Containment Isolation (DW Sump Drains/ FCS/ ATIP) | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| b. Shutdown Cooling System Isolation | 3,4,5 | O | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| c. Suppression Pool Cleanup System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [ ] inches |
| 5. Reactor Steam Dome Pressure--High | | | | |
| a. Shutdown Cooling System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [150] psig |
| b. RWCU System Isolation (RPV Head Spray Only) | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [150] psig |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 6. Drywell Pressure--High | | | | |
| a. Primary Containment Isolation (DW FP Sampling/ DW Sump Drains/ RCW/ HNCW/ FCS/ ATIP) | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [ ] psig |
| b. Suppression Pool Cleanup System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] psig |
| 7. Main Steam Line Pressure--Low | | | | |
| a. Main Steam Line Isolation | 1 | K | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.4<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [837] psig |
| 8. Main Steam Line 'A' Flow--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [140] % |
| 9. Main Steam Line 'B' Flow--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [140] % |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 10. Main Steam Line 'C' Flow--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [140] % |
| 11. Main Steam Line 'D' Flow--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [140] % |
| 12. Condenser Vacuum--Low | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≥ [ ] inches Hg vacuum |
| 13. Main Steam Tunnel Ambient Temperature--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| b. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 14. Main Steam Turbine Area Ambient Temperature--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 15. Main Steam Line Radiation--High | | | | |
| a. Main Steam Line Isolation | 1,2,3 | J | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [3x Normal Background] |
| 16. RCIC Steam Line Flow--High | | | | |
| a. RCIC System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [300% Normal Flow] |
| 17. RCIC Steam Supply Line Pressure--Low | | | | |
| a. RCIC System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≥ [60] psig |
| 18. RCIC Room Ambient Temperature--High | | | | |
| a. RCIC System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 19. RHR 'A' Room Ambient Temperature--High | | | | |
| a. Shutdown Cooling System 'A' Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 20. RHR 'B' Room Ambient Temperature--High | | | | |
| a. Shutdown Cooling System 'B' Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 21. RHR 'C' Room Ambient Temperature--High | | | | |
| a. Shutdown Cooling System 'C' Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 22. RWCU System Differential Mass Flow--High | | | | |
| a. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6<br>SR 3.3.6.1.7 | ≤ [ ] gpm |
| 23. RWCU Regenerative Heat Exchanger Area Ambient Temperature--High | | | | |
| a. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |

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| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 24. RWCU Non-Regenerative Heat Exchanger Area Ambient Temperature--High | | | | |
| a. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 25. RWCU Valve Room Temperature--High | | | | |
| a. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |

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## Table 3.3.6.1-2 Primary Containment Isolation Instrumentation, Trip and Actuation Logic
(Other than 4 channel, 2-out-of-4 logic)

| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 1. RCIC Turbine Exhaust Diaphragm Pressure--High (4 channels - 1-out-of-2 Inboard/ 1-out-of-2 Outboard) | | | | |
| a. RCIC System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] psig |
| 2. RWCU Non-Regenerative Heat Exchanger Shell Outlet Temperature--High (1 channel) | | | | |
| a. RWCU System Isolation | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] °F |
| 3. Low Conductivity Waste (LCW) Sump Drain Line Radiation--High (1 channel) | | | | |
| a. LCW System Isolation-Sump Drain Line | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] X normal background |
| 4. High Conductivity Waste (HCW) Sump Drain Line Radiation--High (1 channel) | | | | |
| a. HCW System Isolation-Sump Drain Line | 1,2,3 | L | SR 3.3.6.1.1<br>SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.5<br>SR 3.3.6.1.6 | ≤ [ ] X normal background |
| 5. Standby Liquid Control Subsystem A/B Initiation (2 channels - 1-out-of-1 for each SLC Pump) | | | | |
| a. RWCU System Isolation | 1,2 | N | SR 3.3.6.1.2<br>SR 3.3.6.1.3<br>SR 3.3.6.1.6 | N/A |

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Table 3.3.6.1-3 Primary Containment Isolation
Manual Actuation Logic

| FUNCTION | APPLICABLE MODES | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1, E.1 or I.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 1. Manual Full Isolation (All MSIVs) | | | | |
| a. Division 1 | 1,2,3 | J | SR 3.3.6.1.2 | N/A |
| b. Division 2 | | | SR 3.3.6.1.6 | |
| c. Division 3 | | | | |
| d. Division 4 | | | | |
| 2. Manual Primary Containment Isolation | | | | |
| a. Division 1 | 1,2,3 | L | SR 3.3.6.1.2 | N/A |
| b. Division 2 | | | SR 3.3.6.1.6 | |
| c. Division 3 | | | | |
| 3. Manual RCIC Isolation | | | | |
| a. Division 1 (Inboard) | 1,2,3 | L | SR 3.3.6.1.2 | N/A |
| b. Division 2 (Outboard) | | | SR 3.3.6.1.6 | |

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Abbreviated Discussion of ABWR Bases – Primary Containment Isolation System Instrumentation

The ABWR Primary Containment Isolation System (PCIS) utilizes instrumentation and logic common and/or similar to the RPS and ECCS actuation instrumentation systems. The system uses digitally multiplexed instrument channels and associated digital trip logic to make setpoint exceedence determinations and associated divisional actuation logic to make decisions regarding, and actually affect, appropriate isolation actions. Four separate instrument divisions are used to monitor the required variables for determining the need for isolation of various primary containment penetrations, with some exceptions that must be treated slightly differently. These exceptions are RCIC turbine exhaust pressure, Standby Liquid Control (SLC) pump running status, RWCU nonregenerative heat exchanger (NRHX) shell side outlet temperature, and high and low conductivity waste (HCW/LCW) sump drain line radiation, whose particular treatment is discussed later. The LCO has therefore been written to handle standard four channel instrumentation separately from the noted exceptions.

Four channel instrumentation that functions in the standard two-out-of-four mode utilizes four separate logic channels to perform the required trip determination. This occurs within the divisional Digital Trip Modules (DTMs). Each divisional DTM receives input from the instrumentation in that same division for each variable monitored. For analog variables the DTMs make the trip/no-trip decision by comparing a digitized analog value against a setpoint and initiating a trip condition for that variable if the setpoint is exceeded. In cases where the trip determination is made by the monitoring element itself (e.g. pressure switch) the DTM simply passes on the signal in the form of a trip/no-trip output. The output of the four divisional DTMs (a trip/no-trip condition) for each variable is then routed to the appropriate primary containment isolation actuation logic. For the noted exceptions, the instrument output is routed directly to the individual subsystem logic, as appropriate. Each DTM has a division-of-sensors bypass such that all instruments in that division will be bypassed in the actuation logic at the associated Trip Logic Units (TLUs) or Safety System Logic Units (SLUs). Thus, each TLU or SLU, when a division-of-sensors bypass is in effect, will be making its trip decision on a two out of three logic basis for each variable. It is possible for only one division-of-sensors bypass condition to be in effect at any time.

At the actuation logic stage, the MSIVs are handled uniquely from the remainder of the PCIS. The actuation logic for

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MSIVs is similar to that used by the RPS for initiating reactor scram and is, in fact, handled by the same modules (TLUs). For the MSIVs, the trip decision is made by four divisional TLUs (shared with RPS), each receiving input from all four divisional instrumentation channels. The MSIV actuation logic uses strictly four channel instrument input. The two out of four trip logic decision (or two out of three if a division-of-sensors bypass is in effect) is thus made by each TLU on a per variable basis such that setpoint exceedence in two instrument divisions for the same variable is required to initiate a trip output at the TLU. Since each TLU sees the outputs from all four DTMs, all four divisions of logic should sense and initiate a required trip simultaneously.

A two out of four trip in a TLU causes a trip in its corresponding Output Logic Unit (OLU). It is this trip that then initiates a reactor isolation by tripping load drivers in the power circuits that energize the MSIV solenoids. Each OLU sends output signals to a total of sixteen load drivers, eight each associated with the #2 and #3 MSIV solenoids, respectively (The #1 solenoid is for the test mode). There are a total of 64 load drivers, grouped in a series-parallel arrangement such that each load driver group energizes either the #2 or the #3 MSIV solenoid for one of the eight MSIVs. The overall arrangement of OLU outputs and load driver groupings is such that a trip of any two actuation logic channels (TLUs and associated OLUs) will cause both the #2 and the #3 solenoids of every MSIV to de-energize, and thus cause all eight MSIVs (four inboard, four outboard) to close.

There are also four divisional manual MSIV isolation switches, any two of which will affect a full reactor isolation by closing all eight MSIVs. The four switches each de-energize a separate path such that when individually actuated a half-isolation condition results (one of two solenoids is de-energized for each MSIV), and when any two are actuated together a full isolation results. The manual MSIV isolation function directly interrupts power in the circuits that energize the MSIV solenoids. This occurs upstream of the load driver groups and is completely separate from the associated automatic MSIV actuation logic. They are also hardwired and therefore not reliant on the plant multiplexing system. Each of the four TLUs has a bypass switch so that they can be bypassed, one at a time, such that the MSIV isolation logic reverts to two out of three, i.e., the tripping of any two of the three remaining TLUs will still result in a full isolation. Each OLU has test and trip switches such that the load drivers can be tested both with and without causing a half isolation condition (i.e., de-energizing of one of two MSIV solenoids).

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All other PCIS actuation logic differs from the MSIV actuation logic described above. It is essentially the same as the ECCS actuation logic (LCO 3.3.5.2) and is thus handled in a like fashion. The two out of four trip decision for the remainder of the PCIS is made by the divisional SLUs (some of which are common to ECCS), which are arranged in redundant pairs for each of the three divisions. Each SLU receives the appropriate variable input (tripped/ not-tripped) from each of the four divisions of DTMs and then performs the required two out of four initiation logic determination. For multi-variable inputs the decision to isolate the affected line(s) is made on a per variable basis such that, for the four channel variables, setpoint exceedence in two instrument divisions for the same variable is required to initiate an actuation signal. This trip determination occurs simultaneously in both SLUs in a given division for an affected subsystem or line and at essentially the same time in affected subsystems or lines of other divisions. In all cases, a trip in both of the SLUs of a divisional/subsystem pair is required to cause the desired isolation(s) to take place. Thus, at the output stage, the logic is two out of two on an individual output command basis.

Instrument channel trip inputs from the variables that do not use standard two-out-of-four logic are routed directly to both SLUs in the appropriate divisional pair(s), each of which performs its own trip determination for the associated variable. RCIC turbine exhaust pressure is sensed by four instrument channels, two each in Divisions 1 and 2, respectively. A one-out-of-two trip logic is used in each division to generate a divisional RCIC isolation signal to affect inboard (Div. 1) and/or outboard (Div. 2) valve closure. There are two SLC pump running inputs, one for each SLC pump. Each SLC pump status signal goes to the SLUs of both Divisions 1 and 2, where, respectively, an inboard and outboard RWCU isolation signal is generated. If either SLC pump is sensed as running, both an inboard and an outboard RWCU isolation is affected. RWCU NRHX shell (cooling water side) outlet temperature is sensed by a single instrument channel which is then an input to the SLUs of both Divisions 1 and 2, again generating an inboard and outboard RWCU isolation signal, respectively. On a sensed high temperature in the monitored flow path, both an inboard and an outboard RWCU isolation is effected. Both HCW and LCW sump drain line radiation is sensed by a single instrument channel on each line. Each instrument channel is then an input to the SLUs of both Divisions 1 and 2, again generating both an inboard and outboard isolation signal, respectively, for the associated drain line (LCW or HCW). On sensed high radiation in the monitored flow path, both an inboard and an outboard isolation of that particular flow path is effected.

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The act·al PCIS instrumentation for ABWR is very similar to that in recent BWR designs with ess ntially the same variables providing trip input. A' hough the equipment that performs the actual logic differs rom past BWR designs, the system is effective'y the same in .ow it functions and with regards to technical specifications. However, the LCO is written borrowing to a degree from how digital systems are treated in the CE and B&W ITS products. LCO 3.3.6.1 deals with the actual instrumentation, the associated logic that performs the setpoint exceedence determination at the DTM level ("trip logic"), and the automatic and manual logic performed at the TLU/SLU level ("actuation logic").

*INSTRUMENTATION AND INSTRUMENT TRIP LOGIC*

OPERABILITY of instruments and instrument trip channels, including setpoints, is handled in ABWR in a fashion very similar to how it was done for past BWRs. The LCO uses the familiar instrument table (only now there are actually two tables) where setpoint values, Applicability requirements and Required Surveillances are specified. However, the tables are now arranged by variable, to reflect the fact that the same instrumentation is used to supply isolation signals to multiple lines/subsystems. For those variables that are monitored by four instrument channels, all four are required to be OPERABLE (see Table 3.3.6.1-1). However, with one instrument trip channel out of service, the channel (or division of sensors) can be bypassed and the logic automatically reverts to two out of three in all corresponding subsystem actuation logic. Alternately, the channel could be tripped, which effectively results in a one out of three logic. Either is an acceptable long term condition at the instrument trip channel level as there would still be sufficient redundancy at the automatic actuation logic and manual actuation levels.

The intent of the Required Action is to assure adequate protection but without forcing an unneeded shutdown to repair equipment that might not be readily accessible during operation. Of course, most repairs are likely to be simple card or other electronic subassembly replacements that can be done on-line with the affected division of sensors in bypass. In such cases, restoration should be done as soon as practicable. With two channels out, one is bypassed and the other tripped, resulting effectively in an one out of two configuration for the remaining channels. This situation is acceptable for a shorter duration. With three or more channels out, immediate acti n is required, as either a trip has already been initiated lse the instrumentation and associated logic is no long pable of automatically initiating a trip. For va..ables monitored by other than a standard two-out-of-four instrument channel, all channels

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must be OPERABLE or else more immediate action is required, since such logic is not amenable to having channels out of service for extended period.

Failure to meet Required Actions would generally necessitate manually performing a required iteration that under the degraded conditions would no longer occur automatically (e.g. isolating the affected line(s)), or by placing the plant in an operating mode, or conditions, where the PCIS function is no longer required. Such actions for ABWR mimic very closely those specified in the BWR/6 ITS.

*ACTUATION LOGIC*

OPERABILITY of the actuation logic portion of the PCIS must be handled differently, depending on whether the MSIVs are involved. This is due to the fact that MSIV isolation essentially uses a two-out-of-four logic with all four divisions while all other PCIS functions are essentially two-out-of-two on a per division basis. The actuation logic also includes the manual isolation function (Table 3.3.6.1-3).

MSIVs

If one MSIV actuation logic channel is out of service it can be placed in bypass, such that the MSIV isolation function is operating in two out of three logic, and must then be restored within the next seven days. However, most repairs are expected to be simple replacements and thus restoration would be expected to be made in a much shorter time interval. Should restoration not be made within the allowable time interval, continuation with the channel in bypass (i.e. in two out of three logic) is allowed for up to a cumulative total of 31 days (from time of discovery of inoperability) provided the three remaining OPERABLE MSIV actuation logic channels are surveilled more frequently to assure their continued operability. Alternatively, the inoperable channel could be taken out of bypass and tripped, placing the MSIV isolation function in a one out of three logic, effectively increasing the reliability of the isolation function, if demanded. Thus, continued operation is justified, but only for a limited time as this condition also would be more susceptible to inadvertent isolations. In any case, the inoperable channel would have to be restored to OPERABLE status within 31 days.

With two actuation logic channels (manual or automatic) inoperable redundancy is significantly reduced and restoration to OPERABLE status is required much more expeditiously. Individual MSIV actuation devices, such as load drivers and pilot valve solenoids, are an integral part of the MSIV isolation function and are specifically covered by the required surveillance testing. However, their

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operability was not singled out within the proposed Conditions as they are fail-safe, de-energize to operate devices whose failure would cause a trip, or partial trip, in their respective channel(s). Failures of these devices would be treated by declaring the associated actuation logic channel inoperable and proceeding accordingly.

Other PCIS

With one output logic channel in a given subsystem pair out of service, the channel is put in the trip/bypass state and the logic reverts to one-out-of-one based on the status of the remaining logic channel. In many cases trip/ bypass will occur automatically as a result of system self testing, if a fault is detected. If a logic channel is determined to be inoperable, it must be verified to be in the trip/bypass state (or placed there), resulting in a one-out-of-one logic. This state results in a more reliable logic configuration for isolation, but is also more prone to inadvertent isolations. Therefore, the channel must be returned to OPERABLE status within 31 days. As most repairs are expected to be simple, restoration would be expected to be made as soon as practicable. For plant availability reasons, it would be in the operator's best interest to restore operability and return to a two out of two logic configuration as quickly as possible given the increased probability of inadvertent actuation in a one out of one configuration. With both output logic channels inoperable, corrective action and/or manually affecting the desired automatic function would be required immediately.

Failure to meet Required Actions would generally necessitate manually performing a required iteration that under the degraded conditions would no longer occur automatically (e.g.isolating the affected line(s)), or by placing the plant in an operating mode, or conditions, where the PCIS function is no longer required. Such actions for ABWR mimic very closely those specified in the BWR/6 ITS.

The Surveillance Requirements for PCIS instrumentation are virtually identical to those in the BWR/6 ITS. Minor modifications are made to reflect minor design differences, however, the intent is the same regarding scope and content. On-line testing of the automatic and manual isolation actuation logic, including testing of the final actuators, is required on a monthly basis. LOGIC SYSTEM FUNCTIONAL TESTing of the PCIS (including MSIVs) will be combined testing of both instrumentation and associated trip logic as well as isolation actuation logic.