ATTACHMENT 1 TO BVY 05-068

RESPONSES TO REQUEST FOR ADDITIONAL INFORMATION REGARDING TECHNICAL SPECIFICATIONS PROPOSED CHANGE NO. 259, INSTRUMENTATION TECHNICAL SPECIFICATIONS

ENTERGY NUCLEAR OPERATIONS, INC.
VERMONT YANKEE NUCLEAR POWER STATION
DOCKET NO. 50-271

Technical Specifications Section (IROBA):

RAI G-1

The "Applicable Modes or other Specified Conditions" in Specification Tables are capitalized (e.g., "RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN"). Does capitalization of modes of reactor operation have a definition connotation?

Response to RAI G-1

Capitalization of the entire word does imply that the condition matches a defined mode. It is recognized that no definition of Refuel mode is provided. Therefore, all references to Refuel mode are being changed to initial capitalization. Replacement retyped proposed Technical Specification (TS) pages are provided in Attachment 2. The following proposed pages are affected by this change: 8, 21, 22, 30, 31, 32, 33a, 33b, 33c, 33d, 33e, 33f, 35, 36, 37, 38, 44, 45, 46, 51, 73, 75e, 75j, 75k, 76b, 76e, 76h, 76i, 76p, 76q, 76r, 80a and 80k (now 80l).

RAI G-2

Provide a VYNPS license amendment citation to show that all topical reports listed in the proposed TS Bases for each revised limiting condition for operation (LCO) have been reviewed and approved for VYNPS by the NRC staff, or provide information to show that the topical report is applicable for VYNPS.

Response to RAI G-2

The following topical reports are listed in the proposed TS Bases and have been approved by the NRC in VY License Amendment No. 186 dated April 3, 2000. This is discussed in the *Safety Assessment of Changes sections listed below with each report.*

- NEDC-30851-P-A, Technical Specification Improvement Analyses for BWR Reactor Protection System, March 1988. This is discussed in Section 3.2.B/4.2.B, DOC L.4.
- NEDC-30851P-A Supplement 2, "Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," March 1989. This is discussed in Section 3.2.C/4.2.C, DOC L.3.
- NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," July 1990. This is discussed in Section 3.2.B/4.2.B, DOC L.4.
- NEDC-30936-P-A, BWR Owners' Group Technical Specification Improvement Methodology (With Demonstration for BWR ECCS Actuation Instrumentation), Parts 1 and 2, December 1988. This is discussed in Section 3.2.A/4.2.A, DOC L.5.
- GENE-770-06-1-A, "Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times For Selected Instrumentation Technical Specifications," December 1992. This is discussed in Section 3.2.I/4.2.I, DOC L.1.

- GENE-770-06-2-A, "Addendum to Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications," December 1992. This is discussed in Section 3.2.L/4.2.L, DOC L.1.

NEDC-30851-P-A, Supplement 1, "Technical Specification Improvement Analysis for BWR Control Rod Block Instrumentation," October 1988, is listed in the proposed TS Bases and has been approved by the NRC in VY License Amendment No. 186 dated April 3, 2000.

NEDO-23842, Continuous Control Rod Withdrawal in the Startup Range, April 18, 1978, is listed in the proposed TS Bases and has not been approved by the NRC for VY. This report was adopted by VY in 1999 under the provisions of 10 CFR 50.59. NEDO-23842 supports UFSAR Section 14.5.3.2.

<u>RAI G-3</u>

Reference: Table 3.2.1, ACTION Note Completion Time
The Bases for the Table 3.2.1 ACTIONS Note completion time states:

> it is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This completion time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock."

This completion time discussion is taken from the Improved Standard Technical Specifications (ISTS). Show why this feature of ISTS Section 1.0, Use and Application, Section 1.3, Completion Times is an appropriate application for the VYNPS TSs without incorporating all the features of Section 1.3 of the ISTS. Additionally, explain the meaning of "ACTION Note Completion Time" as referenced to Table 3.2.1.

<u>Response to RAI G-3</u>

The phrase "completion time" is currently in use in the VY TS. Therefore, this feature does not represent a change to the current TS.

The phrases "time zero" and "clock" are included in the proposed Bases in quotation marks because they are not defined in the VY TS. Usage of the above discussion has been evaluated, and it has been determined that the sentence which includes the phrases "time zero" and "clock" can be removed without affecting the meaning of the discussion. Therefore, this sentence is being removed from every proposed Bases section in which it appears. Replacement retyped proposed TS pages are provided in Attachment 2. The following proposed pages are affected by this change: 75p, 75q, 75r, 75s, 75u, 75v, 80l (now 80m), and 80m (now 80n).

The title "ACTION Note" is used to make it clear to the user that these notes are associated with ACTIONS referenced in the associated table. The current VY TS was word searched for other instances of the phrase "ACTION Note" to ensure that it is being used consistently. No other instances of this phrase were found.

RAI G-4

Reference: DOC A.4 (Reactor Protection System [RPS])
Current Technical Specifications (CTS) 3.1.B and 4.1.B, which provided requirements related to the average power range monitors (APRM) gain and power distribution, were deleted from the CTS by Amendment No. 219 after the currently proposed amendment was submitted. The CTS changes made by Amendment Nos. 219 and 220 should be reflected in the revised pages for this amendment to allow for proper review of the revised pages.

Response to RAI G-4

TS pages affected by Amendment Nos. 219, 220, 221 and 223 have been marked up to reflect the changes of Proposed Change No. 259. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup pages are affected by this change: i, 5, 20, 21, 22, 24, 27, 28, 52, 54, 71, 84, 85, 90, 226, and 228. The following proposed pages are affected by this change: i, 5, 21, 24, 27, 33, 33a, 33n, 33p, 61, 62, 63, 77, 77a, 79c, 79d, 79e, 84, 85, 90, 226, and 228. Replacement markup and retyped proposed pages are not provided for Pages 84, 85, 90, 226 and 228 since the proposed changes to these pages have already been implemented by Amendment 219.

DOC A.4 for CTS 3.1/4.1 is concerned with CTS 3.1.B and 4.1.B, which were deleted by Amendment 219. Therefore, DOC A.4 is being deleted.

RAI G-5

Reference: Instrumentation Definitions
CTS definitions for channel functional tests are credited in 3.1/4.1 Discussion of Change (DOC) LA.10 as ensuring the RPS instrumentation is maintained operable; therefore, the CTS details for performing instrument functional tests of the RPS functions can be relocated to the Bases. However, the emergency core cooling systems (ECCS) instrumentation has a logic system functional test (4.2.A.2), while the proposed RPS instrumentation section does not. Note 7 to CTS Table 4.1.1 describes a logic system functional test of the RPS. Please add this requirement to the proposed TS (perhaps as 4.1.A.4) or justify its removal. Describe how logic system functional tests are handled for each instrumentation section.

Response to RAI G-5

A specific RPS logic system functional test (LSFT) surveillance requirement is being added as SR 4.1.A.4. Details of LSFT performance are controlled by Definition 1.0.H. Therefore, CTS Table 4.1.1 Note 7 is unnecessary and is being deleted. Revised DOC LA.10 is provided below. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup page is affected by this change: 20. The following proposed pages are affected by this change: 20, 20a, 33k and 33m.

Proposed replacement to DOC LA.10:
Proposed Surveillance Requirement 4.1.A.4 requires a Logic System Functional Test (LSFT) of the Reactor Protection System once every Operating Cycle. CTS Table 4.1.1 and associated

Note 7 describe details of the performance of Logic System Functional Tests of the RPS. These details are being deleted since they are not necessary to ensure the operability of the RPS. The VYNPS TS definition of LSFT, Definition 1.0.H, provides the required details for performance of an LSFT and is adequate to ensure RPS is maintained operable. As such, these details are not required to be in the VYNPS TS to provide adequate protection of the public health and safety. Not including these details in TS is consistent with the ISTS.

Emergency Core Cooling System (ECCS): CTS Table 4.2.1 requires a Functional Test of the ECCS Trip System Logic once per operating cycle. This requirement is included in proposed SR 4.2.A.2 which specifically requires performance of a logic system functional test of ECCS instrumentation trip functions once every operating cycle.

Primary Containment Isolation System (PCIS): CTS Table 4.2.2 requires a Functional Test of the PCIS Trip System Logic once per operating cycle. This requirement is included in proposed SR 4.2.B.2 which specifically requires performance of a logic system functional test of PCIS instrumentation trip functions once every operating cycle.

Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation (RBVISGTS): CTS Table 4.2.3 requires a Functional Test of the RBVISGTS Trip System Logic once per operating cycle. This requirement is included in proposed SR 4.2.C.2 which specifically requires performance of a logic system functional test of RBVISGTS instrumentation trip functions once every operating cycle.

Off-Gas System Isolation, 3.2.D/4.2.D, is being relocated to the TRM.

Control Rod Block Actuation: 3.2.E/4.2.E does not specifically require performance of a logic system functional test. As discussed in the proposed Bases for Section 3.2.E/4.2.E, control rod block instrumentation inputs into two Reactor Manual Control System (RMCS) circuits. A rod block in either RMCS circuit will provide a control rod block to all control rods. Therefore, performance of the individual instrument channel functional tests is equivalent to the performance of a logic system functional test for the subject trip function.

Mechanical Vacuum Pump (MVP) Isolation Instrumentation: CTS SR 4.2.F.5 specifically requires performance of a logic system functional test once every operating cycle. This section is being reformatted such that the new SR number is 4.2.F.1.e.

Post-Accident Monitoring Instrumentation: 3.2.G/4.2.G does not require performance of a logic system functional test since this instrumentation is indication only and does not include any trip functions.

Drywell to Torus ΔP Instrumentation, 3.2.H/4.2.H, is being relocated to the TRM.

Recirculation Pump Trip (RPT) Instrumentation: CTS Table 4.2.1 requires a Functional Test of the Recirculation Pump Trip Actuation System Trip System Logic once per operating cycle. This requirement is included in proposed SR 4.2.I.2 which specifically requires performance of a logic system functional test of RPT instrumentation trip functions once every operating cycle.

Degraded Grid Protective System, 3.2.K/4.2.K: CTS Table 4.2.8 Note 10 states that all functional testing requirements are satisfied by performance of the calibration and integrated ECCS tests. This note is being retained in proposed Table 4.2.8 as Footnote 1.

Reactor Core Isolation Cooling (RCIC): CTS Table 4.2.9 requires a Functional Test of the RCIC Trip System Logic once per operating cycle. This requirement is included in proposed SR 4.2.L.2 which specifically requires performance of a logic system functional test of RCIC instrumentation trip functions once every operating cycle.

SECTION 1
CTS 3.1/4.1, REACTOR PROTECTION SYSTEM

RAI 1.0-3

Reference: A.17
CTS Table 4.1.1 Note 4 and CTS Table 4.1.2 Note 2 state that tests are not required when systems are not required to be operable or are tripped and that if tests are missed, they shall be performed prior to returning the system to an operable status. The basic requirements of these notes are also in the CTS definition 1.0.Z, "Surveillance Interval," which states that these tests, unless otherwise stated in these specifications, may be waived when the instrument, component, or system is not required to be operable, but that these tests shall be performed on the instrument, component, or system prior to being required to be operable. However, the CTS also discusses requirements if the channel is tripped and if tests are missed. These deletions of CTS are not evaluated in DOC A.17. Provide additional analysis and discussion of change.

Response to RAI 1.0-3

Amendment 221 relocated the contents of Definition 1.0.Z, "Surveillance Interval" to new Specification 4.0.1. Therefore, DOC A.17 is being revised to discuss the requirements of CTS Table 4.1.1 Note 4 and CTS Table 4.1.2 Note 2 in comparison to those of Specification 4.0.1. Revised DOC A.17 is provided below.

Proposed replacement to DOC A.17:
CTS Table 4.1.1 Note 4 and CTS Table 4.1.2 Note 2 state that tests are not required when systems are not required to be operable or are tripped and that if tests are missed, they shall be performed prior to returning the system to an operable status. The requirements of these Notes are addressed in CTS Specification 4.0.1, which states that surveillances do not have to be performed on inoperable equipment. In addition, the Bases for Specification 4.0.1 state that surveillances have to be met and performed in accordance with SR 4.0.2, prior to returning equipment to OPERABLE status. Since tests cannot be performed on a channel when it is tripped, those portions of the Notes are meaningless. CTS Specification 4.0.1, like the Notes, requires tests to be performed prior to the channel being required to be operable. Therefore, the requirements of Specification 4.0.1 are equivalent to those of CTS Table 4.1.1 Note 4 and CTS Table 4.1.2 Note 2, and these two Notes can be deleted.

RAI 1.0-4

Reference: LA.3, LA.4 and M.6
CTS Table 3.1.1 Note 2 becomes proposed Table 3.1.1 Note 1. These notes provide the actions to be taken when inoperable channels are discovered. From the NRC staff review of the documentation, there is a mismatch between the proposed TS Actions and the changes to CTS in that all TS changes are not identified and discussed. Revise the markup of CTS and the discussion of changes (DOCs) as necessary to cite the changes needed to CTS for adopting Table 3.1.1 Actions Note 1 requirements for one or more protection channels inoperable, Action Note 1.a requirements for one or more trip functions with one or more required channels inoperable, Action Note 1.b requirements for one or more Trip Functions with one or more required channels inoperable in both trip systems, and Action Note 1.c requirements for one or more trip functions with RPS trip capability not maintained.

Response to RAI 1.0-4

In order to more clearly identify the proposed changes to Table 3.1.1 notes, the markup of CTS Page 23 has been revised and new DOC A.21 has been developed to replace DOC LA.3. The replacement markup to TS Page 23 is provided in Attachment 2.

Proposed DOC A.21:
With the exception of changes described in Discussions of Changes (DOC) A.8, LA.4 and M.6, the conversion of CTS Table 3.1.1 Note 2 to proposed Table 3.1.1 Note 1 results in no changes to actions taken by the user in response to a given plant condition. A comparison of the different sections of the two notes is provided below.

- The first sentence of CTS Note 2 states that "there shall be two operable or tripped trip systems for each Trip Function." The requirement for two operable trip systems has the same meaning as the condition in proposed Note 1 of "one or more required Reactor Protection System channels inoperable." The option in CTS Note 2 for the trip systems to be tripped matches the actions specified in proposed Notes 1.a, 1.b, and 1.c. The requirement in proposed Note 1 to "take all of the applicable Actions in Notes 1.a, 1.b, and 1.c" ensures that a loss of trip capability is addressed for all situations. This results in the proposed note being more restrictive for the case of the manual RPS trips as described in DOC M.6.
- The last sentences of CTS Notes 2.a and 2.b require the appropriate action in Note 3 to be performed as specified in Table 3.1.1. The last sentence of proposed Note 1 directs the identical action. CTS Note 3 is being converted to proposed Note 2.
- The first sentence of CTS Note 2.a is being reworded to become proposed Note 1.a with no change in meaning. The phrase "one less than the required minimum number of operable instrument channels" in CTS Note 2.a has the same meaning as the phrase "one or more required channels inoperable" in proposed Note 1.a.
- CTS Note 2.b.1 addresses a loss of trip capability by requiring that trip capability is verified within one hour. This note is being replaced by proposed Note 1.c which states that if trip capability is not maintained then it must be restored within one hour. These two requirements are equivalent since they both result in the same actions being taken. This

change, along with the requirement in the first sentence of Note 1 to "take all of the applicable Actions in Notes 1.a, 1.b, and 1.c" ensures that a loss of trip capability is addressed for all situations, as described in DOC M.6.

- CTS Note 2.b.2 is being reworded to become proposed Note 1.b with no change in meaning.
- CTS Note 2.b.3 is being deleted. This action is addressed by proposed Note 1.a for cases involving any number of inoperable channels due to the requirement in the first sentence of Note 1 to "take all of the applicable Actions in Notes 1.a, 1.b, and 1.c".

Therefore, the conversion of CTS Table 3.1.1 Note 2 to proposed Table 3.1.1 Note 1 is considered administrative.

RAI 1.0-7

Reference: Bases Retype page 30
The RPS is required to be operable in RUN, STARTUP/HOT STANDBY and REFUEL with reactor coolant temperature > 212 °F. The REFUEL applicability with reactor coolant temperatures >212 °F is a departure from the ISTS. Explain the safety analysis that this applicability requirement is derived from. Revise the proposed TS Bases in sufficient detail to ensure adequate basis is provided as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36.

Response to RAI 1.0-7

CTS Table 3.1.1 includes, under "Modes in Which Functions Must be Operable", a column labeled Refuel and modified by a reference to Note 1. Note 1 is worded as follows:

1. When the reactor is subcritical and the reactor water temperature is less than 212 °F, only the following trip functions need to be operable:

    a) mode switch in shutdown
    b) manual scram
    c) high flux IRM or high flux SRM in coincidence
    d) scram discharge volume high water level

Therefore, all of the trip functions listed under Refuel in CTS Table 3.1.1 are required to be operable in Refuel with reactor coolant temperature >212 °F, but only the trip functions listed in Note 1 are required to be operable in Refuel with reactor coolant temperature <212 °F. Therefore, the applicability of Refuel with reactor coolant temperature <212 °F is an existing feature of the current VY TS. This applicability is being retained and applied to the same trip functions in proposed Table 3.1.1, with the following exceptions. The option of maintaining the SRM High Flux in coincidence trip function operable instead of the IRM High Flux trip function is being deleted since the SRM trip function is no longer used. Also, the IRM Inop trip function is being added to the list of trip functions that are required in Refuel with reactor coolant temperature <212 °F because it is a design feature that supports the IRM High Flux trip function, which is required under these conditions. Both of these changes are described in DOC M.5.

The four trip functions listed in CTS Note 1 are required in all conditions when control rods can be withdrawn. This includes Refuel with reactor coolant temperature <212 °F or >212 °F. This is stated in the Bases under "Applicable Safety Analyses, LCO and Applicability" for proposed Trip Functions 1, 2, 3.a and 8.

The following trip functions are not required in Refuel with reactor coolant temperature <212 °F because sufficient energy does not exist in the RCS to result in limiting transients or accidents: High Reactor Pressure, High Drywell Pressure, and Reactor Low Water Level. This is stated in the Bases under "Applicable Safety Analyses, LCO and Applicability" for proposed Trip Functions 5, 6 and 7.

The IRM Inop trip function supports the IRM High Flux trip function and therefore is required to be operable whenever that trip function is required to be operable. This is stated in the Bases under "Applicable Safety Analyses, LCO and Applicability" for proposed Trip Function 3.b.

Like the IRM Inop, the APRM Inop trip function supports the other APRM trip functions and therefore is required to be operable whenever any other APRM trip function is required to be operable. This is stated in the Bases under "Applicable Safety Analyses, LCO and Applicability" for proposed Trip Function 4.c.

The only inconsistent requirement is the applicability of the APRM High Flux (Reduced) trip function. This trip function provides a backup to the IRM High Flux trip function, however IRM High Flux is required in Refuel with reactor coolant temperature <212 °F and APRM High Flux (Reduced) is not. In Startup/Hot Standby, the APRM High Flux (Reduced) trip function provides a practical backup to the IRM High Flux trip function. In this mode, the IRMs may be set on the higher ranges, so the trip setpoints of the APRM High Flux (Reduced) trip function may be comparable to those of the IRM High Flux trip function. In Refuel, the APRM High Flux (Reduced) trip function does not provide a practical backup to the IRM High Flux trip function because the IRMs will always be set on Range 1. The IRM High Flux trip setpoint on Range 1 is on the order of 10^{-2} percent rated thermal power (RTP), as compared to the APRM High Flux (Reduced) trip setpoint of 15 percent RTP. Therefore, the APRM High Flux (Reduced) trip function does not need to be operable in Refuel with reactor coolant temperature <212 °F or >212 °F. However, the current requirement for this trip function to be operable in Refuel with reactor coolant temperature >212 °F is being retained. This requirement does not represent a significant operational burden since the reactor is rarely operated in this condition.

The trip functions listed in Note 1 are Mode Switch in Shutdown, Manual Scram, IRM or SRM High Flux, and SDV High Level. Change M.5 is removing the option of having the SRM High Flux scram operable instead of the IRM High Flux Scram, and it's adding the IRM Inop scram. The proposed bases already have some safety analysis info on these trips.
Neither the Mode Switch in Shutdown nor the Manual scram are credited in any accident analysis, but are included for overall redundancy and diversity. They're required in all modes when control rods can be withdrawn.

The IRM High Flux scram is credited with mitigating the control rod withdrawal event in Startup. In Refuel this scram can mitigate other reactivity excursions and is required since control rods can be withdrawn in Refuel.
The IRM Inop scram is not credited in any accident analysis. Since it ensures the IRM High Flux scram is available, it is required whenever that scram is required.
The SDV High Level scram is required to ensure the other scrams remain operable. It's required in all modes when control rods can be withdrawn.

RAI 1.0-8

Reference: Bases Retype page 33, 4.a. APRM High Flux (Flow Bias)
Clarify the Bases statement that the APRM flow bias trip monitors neutron flux "relative" to the reactor coolant. What design basis is implied by "relative to reactor coolant"? Should this say "reactor coolant flow"?

Response to RAI 1.0-8

This statement was a typographical error. The APRM flow bias trip monitors neutron flux relative to reactor coolant flow as measured by recirculation pump drive flow. The Bases have been revised to reflect this correction and a replacement retyped Bases Page 33 is provided in Attachment 2.

RAI 1.0-9

Reference: Bases Retype page 33, 4.a. APRM High Flux (Flow Biased)
Bases Retype page 33b, 4.b. APRM High Flux
CTS allow an exception to having at least two local power range monitors (LPRM) inputs from each of the levels at which the LPRMs are located, which is "except that Channels A, C, D and F may lose all APRM inputs from the companion APRM cabinets plus one additional LPRM input and still be considered operable." This is proposed to be moved to the Bases. To relocate details such as this to the Bases, a Bases Control Program must be established in TS Section 6.

Response to RAI 1.0-9

TS Amendment 221 added Specification 6.7.E, Technical Specification (TS) Bases Control Program to the VY Technical Specifications. This administrative specification provides a means for processing changes to the Bases of the VY Technical Specifications.

SECTION 2
CTS 3.2.A/4.2.A, EMERGENCY CORE COOLING SYSTEM

RAI 2.0-1

DOC Reference: A.2
The proposed CTS applicability is to use table entries containing a reference to an "Applicable Mode or other specified conditions" for each ECCS required TS trip function as a replacement for "When the system(s) it initiates or controls is required in accordance with Specification 3.5." The level of detail provided in discussion of change A.2 is insufficient for the NRC staff to discern what, if any, changes are being made to the CTS applicability for trip functions contained in Table 3.2.1. Show by a markup of the CTS applicability how the applicability requirements are changing for each Table 3.2.1 trip function. Justify changes as appropriate.

Response to RAI 2.0-1

The applicability requirements for Table 3.2.1 trip functions are not being changed, except as provided and justified in changes L.1 and L.4. It was determined to be impractical to illustrate this fact using a markup of CTS applicability. Therefore, DOC A.2 has been rewritten to provide a more detailed explanation of the equivalence of the CTS and proposed applicabilities.

Proposed Replacement to DOC A.2:
CTS 3.2.A specifies an Applicability for Emergency Core Cooling System (ECCS) instrumentation of "When the system(s) it initiates or controls is required in accordance with Specification 3.5." Specification 3.5 includes the requirements for the ECCS. This change provides an explicit Applicability, in proposed Table 3.2.1 for each ECCS instrumentation trip function. The specified Applicabilities, in proposed Table 3.2.1, are consistent with the Modes and conditions when the associated ECCS are required to be operable by Specification 3.5, except as provided and justified in changes L.1 and L.4. This is detailed for each ECCS below:

- Per CTS 3.5.A, Core Spray is required to be operable whenever irradiated fuel is in the reactor vessel. Therefore, most Core Spray Trip Functions are required by proposed Table 3.2.1 to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212 °F. In addition, CTS 3.5.H specifies limited operability requirements for shutdown conditions. Therefore, in order to address the requirements of CTS 3.5.H, proposed Table 3.2.1 includes a requirement of "when associated ECCS subsystem is required to be operable" for most Core Spray Trip Functions. There are two exceptions to these proposed requirements. Trip Function 1.a, High Drywell Pressure, is only required to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212 °F, as discussed in DOC L.1. Trip Function 1.f, Pump Discharge Pressure, is only required to be operable in Run and in Startup/Hot Standby, Hot Shutdown and Refuel with reactor steam pressure > 150 psig. Trip Function 1.f feeds the Automatic Depressurization System (ADS) logic rather than the Core Spray logic. Therefore, the applicability of this trip matches the ADS applicability of "any time the reactor pressure is above 150 psig and irradiated fuel is in the reactor vessel" as specified in CTS 3.5.F.

- Per CTS 3.5.A, Low Pressure Coolant Injection (LPCI) is required to be operable whenever irradiated fuel is in the reactor vessel. Therefore, most LPCI Trip Functions are required by proposed Table 3.2.1 to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212 °F. In addition, CTS 3.5.H specifies limited operability requirements for shutdown conditions. Therefore, in order to address the requirements of CTS 3.5.H, proposed Table 3.2.1 includes a requirement of "when associated ECCS subsystem is required to be operable" for most LPCI Trip Functions. There are four exceptions to these proposed requirements. Trip Function 2.b, High Drywell Pressure (Initiation), Trip Function 2.d, Reactor Vessel Shroud Level, and Trip Function 2.g, High Drywell Pressure (Containment Spray Permissive), are only required to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212 °F, as discussed in DOCs L.1 and L.4. Trip Function 2.f, Pump Discharge Pressure, is only required to be operable in Run and in Startup/Hot Standby, Hot Shutdown and Refuel with reactor steam pressure > 150 psig. Trip Function 2.f feeds the Automatic Depressurization System (ADS) logic rather than the LPCI logic. Therefore, the applicability of this trip matches the ADS applicability of "any time the reactor pressure is above 150 psig and irradiated fuel is in the reactor vessel" as specified in CTS 3.5.F.
- Per CTS 3.5.E, High Pressure Coolant Injection (HPCI) is required to be operable whenever irradiated fuel is in the reactor vessel and reactor steam pressure is greater than 150 psig. Therefore, all HPCI Trip Functions are required by proposed Table 3.2.1 to be operable in Run and in Startup/Hot Standby, Hot Shutdown and Refuel with reactor steam pressure > 150 psig.
- Per CTS 3.5.F, Automatic Depressurization System (ADS) is required to be operable whenever irradiated fuel is in the reactor vessel and reactor steam pressure is greater than 150 psig. Therefore, all ADS Trip Functions are required by proposed Table 3.2.1 to be operable in Run and in Startup/Hot Standby, Hot Shutdown and Refuel with reactor steam pressure > 150 psig.

Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. The change, providing explicit Mode or conditions of Applicability for each trip function, is consistent with the ISTS.

<u>RAI 2.0-3</u>

DOC Reference: L.1 and L.4
Show by marking up the CTS that, when compared to proposed Table 3.2.1 Applicability Requirements, the resulting applicability based on Modes is a less restrictive change to the current TS as derived from the Updated Final Safety Analysis Report (UFSAR).

<u>Response to RAI 2.0-3</u>

It was determined to be impractical to illustrate the comparison of the CTS and proposed applicabilities using a markup of CTS applicability. Therefore, DOCs L.1 and L.4 have been rewritten to provide a more detailed explanation.

Proposed Replacement to DOC L.1:
CTS 3.2.A requires the Core Spray and LPCI High Drywell Pressure Trip Functions (proposed Table 3.2.1 Trip Functions 1.a, 2.b, and 2.g) to be operable whenever the Core Spray and LPCI subsystems are required to be operable. Per CTS 3.5.A, Core Spray and LPCI are required to be operable whenever irradiated fuel is in the reactor vessel. In addition, CTS 3.5.H specifies limited operability requirements for shutdown conditions. The result is that Core Spray and LPCI are currently required to be operable in Run, Startup/Hot Standby, Hot Shutdown, Cold Shutdown, Refuel with reactor coolant temperature > 212 °F, and Refuel with reactor coolant temperature ≤ 212 °F. Proposed Table 3.2.1 only requires these Trip Functions to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212°F. In Cold Shutdown and Refuel with reactor coolant temperature ≤ 212 °F, the High Drywell Pressure initiation of the ECCS is not assumed since the primary containment is not required to be operable. In these other Modes or conditions, other Core Spray and LPCI Trip Functions are required to be operable to generate an ECCS initiation signal if required. As such, proposed Table 3.2.1 Trip Functions 1.a, 2.b, and 2.g are not required in Modes other than Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212°F. This change is consistent with the ISTS.

Proposed Replacement to DOC L.4:
CTS 3.2.A requires the LPCI Reactor Vessel Shroud Level Trip Function to be operable whenever the LPCI subsystems are required to be operable. Per CTS 3.5.A, Core Spray and LPCI are required to be operable whenever irradiated fuel is in the reactor vessel. In addition, CTS 3.5.H specifies limited operability requirements for shutdown conditions. The result is that Core Spray and LPCI are currently required to be operable in Run, Startup/Hot Standby, Hot Shutdown, Cold Shutdown, Refuel with reactor coolant temperature > 212 °F, and Refuel with reactor coolant temperature ≤ 212 °F. Proposed Table 3.2.1 only requires this Trip Function (Trip Function 2.d) to be operable in Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212°F. In Cold Shutdown and Refuel with reactor coolant temperature ≤ 212 °F, the specific initiation time of the ECCS is not assumed and the Trip Function only serves as a backup to administrative controls to ensure operators do not divert LPCI flow during a LOCA. In addition, in these other Modes or conditions, the modes of the RHR System (drywell and suppression pool spray) that utilize this Trip Function are not required to be operable since primary containment is not required to be operable. As such, proposed Table 3.2.1 Trip Function 2.d is not required in Modes other than Run, Startup/Hot Standby, Hot Shutdown and Refuel with reactor coolant temperature > 212°F. This change is consistent with the ISTS.

<u>RAI 2.0-4</u>

Reference: Table 3.2.1, Trip Function 1.c, Low Reactor Pressure (Initiation)
For this function, the required channels per trip system entry is "1." On Bases page 75a, the discussion explains the low pressure signals are initiated for two pressure transmitters that sense reactor pressure. Each of the transmitters provide an input to both low pressure ECCS logic trains with the contacts arranged in one-out-of-two logic. With two inputs to each train logic, it appears Table 3.2.1 should specify "2" required channels of low reactor pressure. (The staff notes that Table 3.2.1 Trip Function 1.d, "Low Reactor Pressure (System Ready and Valve

Permissive)" requires two channels per trip system and has identical trip settings, 300 psig and 350 psig.)

Response to RAI 2.0-4

The design for Trip Function 1.c, "Low Reactor Pressure (Initiation)" is unusual in that two transmitters provide inputs to both of the trip systems. However, there are a total of two channels available and there are a total of two trip systems available. Therefore, there must be only one channel per trip system available. Stating that there are two channels per trip system would imply that there are a total of four channels, which is not true. The design for Trip Function 1.d, "Low Reactor Pressure (System Ready and Valve Permissive)" is more conventional in that four transmitters are installed, with two providing inputs to one trip system and two providing inputs to the other trip system. Therefore, for Trip Function 1.d it is clear that there are two available channels per trip system.

Since there are only two channels available for Trip Function 1.c and both of them are required, listing two required channels per trip system will not change the operability requirements. CTS Table 3.2.1 requires one channel per trip system, which complies with the current VY design convention. The most important aspect of the specification is ensuring that the operating crew correctly determines when actions are required, i.e. when a required channel is inoperable or when loss of initiation capability has occurred. Therefore, the associated Bases are being changed to clarify the design and operability requirements for these trip functions. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup pages are affected by this change: 38 and 39. The following proposed pages are affected by this change: 35, 36, 75f and 75p.

RAI 2.0-5

Reference: Table 3.2.1, Trip Function 1.f, Pump Discharge Pressure
For the required channels per trip system trip function 1.f specifies "2 per pump." The "per pump" requirement represents a difference from current TSs, but was not evaluated. Provide an appropriate discussion of change.

Response to RAI 2.0-5

New DOC M.7 is provided below. Replacement markup Page 38 is provided in Attachment 2.

Proposed New DOC M.7:
CTS Table 3.2.1 requires 2 channels per trip system for Core Spray Pump Discharge Pressure (proposed Trip Function 1.f). As described in the proposed Bases, the 2 Core Spray Pump A discharge pressure channels feed ADS trip system A, and the 2 Core Spray Pump B discharge pressure channels feed ADS trip system B. Therefore, in order to provide redundancy, both channels for each pump must be operable. So the number of required channels per trip system for Trip Function 1.f is being changed from "2" to "2 per pump." This matches the current requirement for LPCI Pump Discharge Pressure (proposed Trip Function 2.f). This change is consistent with the ISTS.

RAI 2.0-6

Reference: Bases Table 3.2.1 ACTIONS Note 3 (page 75r, 3rd paragraph)
The proposed Bases state that the basis for an allowed out-of-service time of 24 hours to restore an inoperable channel of reactor vessel shroud level (trip function 2.d) or high drywell pressure (containment spray permissive; trip function 2.g) is the redundancy of the ECCS design as justified in topical report NEDC-30936-P-A (Bases reference 3). Thus, the current VYNPS license basis is NEDC-30936 and this is not proposed to be changed. However, the proposed "restore" action is a change to the CTS "place the channel in trip" action for trip function 2.g. Thus, if the current licensing basis document (NEDC-30936) has not changed, then a discussion is needed to show how NEDC-30936 addresses both the trip and repair options for the same 24-hour period. Otherwise, provide a discussion to justify the change to the trip function 2.g action requirement. Revise the Bases on page 75r accordingly and change to a less restrictive DOC writeup.

Response to RAI 2.0-6

This proposed change is discussed in DOC M.4. CTS Table 3.2.1 Note 13 requires an inoperable LPCI High Drywell Pressure containment spray permissive channel to be tripped. The proposed change would require the channel to be restored to operable status.

The purpose of this permissive is to ensure that the Residual Heat Removal (RHR) system is not inadvertently aligned to the containment spray mode when it should be aligned for the LPCI mode. If this instrument channel were to become inoperable and the action of CTS Table 3.2.1 Note 13 were taken (i.e., tripping the channel), an additional operator error would have to occur in order for the LPCI subsystem to be placed in an incorrect alignment and thus be made inoperable. Such an occurrence is extremely unlikely since LPCI system alignment is performed per procedure, is subject to peer checking by a second operator, and is verified (also per procedure) once per shift.

If one channel of the LPCI High Drywell Pressure containment spray permissive were to become inoperable and it was not tripped, then the failure of one additional channel would prevent operation of containment spray in the associated RHR loop.

Since the potential consequences of not tripping an inoperable channel are more safety significant than the potential consequences of tripping the channel, the required action of tripping the channel will remain in effect. Therefore, Entergy is withdrawing this proposed change. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup page is affected by this change: 44a. The following proposed pages are affected by this change: 39, 75j and 75r.

SECTION 3
CTS 3.2.B/4.2.B, PRIMARY CONTAINMENT ISOLATION

RAI 3.0-1

DOC Reference: A.9
The discussion of change A.9 does not discuss Table 4.2.2 Notes 10 and 11 that are shown to be changed by DOC A.9 in the CTS markup.
Response to RAI 3.0-1

Revised DOC A.9 is provided below.

Proposed Replacement to DOC A.9:
CTS 3.2.1 and 4.2.1 and associated Notes provide requirements related to Recirculation Pump Trip instrumentation. The requirements applicable to the Recirculation Pump Trip instrumentation are physically moved and changes addressed in proposed Specifications 3.2.I and 4.2.I. Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. CTS 3.2.1 and 4.2.1 and associated Notes also provide requirements for ECCS Instrumentation. The ECCS instrumentation requirements are included in proposed Tables 3.2.1 and 4.2.1. Changes to the ECCS instrumentation requirements are addressed in the safety assessment of changes for TS 3.2.A/4.2.A, ECCS Instrumentation. Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. CTS Table 4.2 Notes 4, 12, and 13 provides requirements that apply to control rod block instrumentation. The control rod block instrumentation is located in proposed Specifications 3.2.E and 4.2.E. Therefore, the requirements of CTS Table 4.2 Note 4 are physically moved and changes addressed in proposed Specifications 3.2.E and 4.2.E. Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. CTS Table 4.2 Note 9 provides requirements that apply to post-accident monitoring instrumentation. The post-accident monitoring instrumentation is located in proposed Specifications 3.2.G and 4.2.G. Therefore, the requirements of CTS Table 4.2 Note 9 are physically moved and changes addressed in proposed Specifications 3.2.G and 4.2.G. Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. CTS Table 4.2 Note 10 provides requirements that apply to degraded grid protective system instrumentation. The degraded grid protective system instrumentation is located in proposed Specifications 3.2.K and 4.2.K. Therefore, the requirements of CTS Table 4.2 Note 10 are physically moved and changes addressed in proposed Specifications 3.2.K and 4.2.K. Therefore, this change does not involve a technical change, but is only a difference of presentation preference and is considered administrative. CTS Table 4.2 Note 11 describes details of the performance of the Functional Test of the ADS Trip System Logic. These details are being relocated to Bases as discussed in the safety assessment of change LA.5 for TS 3.2.A/4.2.A, ECCS Instrumentation.

RAI 3.0-3

The proposed TS Bases page 76m has a list of functions requiring an instrument check which does not match the proposed TS page 48. Correct the discrepancy.

Response to RAI 3.0-3

There is an error in the proposed Bases 4.2.2 on new page 76m. As noted in revised TS Table 4.2.2 (new page 48), an instrument check shall be performed once/day for Trip Functions 1.a, 1.c, 1.e, and 2.b. No instrument check is specified for Trip Function 1.b and there is no Trip Function 1.h. Replacement retyped proposed Page 76m is provided in Attachment 2.

SECTION 4
CTS 3.2.C/4.2.C, REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION INSTRUMENTATION

RAI 4.0-1

DOC Reference: A.5
Note 3 to CTS Table 3.2.3 provides actions when the minimum number of channels per trip system requirement is not met. The proposed TS adds a column, "ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE" to Table 3.2.3 which provides actions for inoperable channels. The new table column refers to actions listed in the table notes, which are located on the page following the table. Table 3.2.3 also includes footnotes for specifying applicability requirements. Having applicability footnotes and table action notes which are only differentiated by (1) for footnotes vice "1" for actions may lead to a misunderstanding during control room operations. Clarify the use of table notes and footnotes. The NRC staff recommends annotating the actions note with "Table 3.2.3" to read "Table 3.2.3 Note 1." Consider using lowercase letters for footnotes.

Response to RAI 4.0-1

In order to ensure that footnotes are easily distinguishable from action notes, the footnote designators are being changed from numbers to lowercase letters. This convention is consistent with ISTS. In all cases, existing numbers are being changed to letters in matching sequence, i.e. "1" becomes "a", "2" becomes "b", etc. Replacement retyped proposed TS pages are provided in Attachment 2. The following proposed pages are affected by this change: 21, 22, 24, 25, 33l, 33m, 33n, 33o, 35, 36, 37, 38, 41, 42, 44, 45, 46, 48, 51, 53, 55, 57, 67, 69, 71, 73, 74a, 75d, 75x, 76e, 76h, 76n, 76u, 77d, 80e, 80i, 80p (now 80q). Existing DOCs are not being changed to reflect this new convention.

RAI 4.0-2

DOC Reference: L.1
The applicability of the low reactor vessel water level trip function of CTS Table 3.2.3 is revised to delete requirements for "during movement of irradiated fuel assemblies or the fuel cask in secondary containment, and during alteration of the reactor core." These changes to the applicability are not evaluated. Additionally, the proposed applicabilities are not, as stated, consistent with the ISTS. Provide a safety analysis discussion of all changes with a conclusion as to why the change is acceptable.

Editorial comment: The correct reference in the 2nd to last sentence of DOC L.1 is "Function 1."

Response to RAI 4.0-2

Revised DOC L.1 is provided below.

Proposed Replacement to DOC L.1:
The Applicability of the Low Reactor Vessel Water Level Trip Function of CTS Table 3.2.3 is "When Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation are required by Specification 3.7.B and 3.7.C." The requirements of Specifications 3.7.B and 3.7.C, and as a result the requirements for this Trip Function, are applicable in Run, Startup/Hot Standby, Hot Shutdown, and Refuel (with reactor coolant water temperature > 212°F) and during operations with a potential for draining the reactor vessel, during movement of irradiated fuel assemblies or fuel cask in secondary containment, and during alteration of the reactor core. The Low Reactor Vessel Water Level Trip Function is required to support the operability of the Secondary Containment System and the Standby Gas Treatment System to ensure fission products entrapped within secondary containment are treated prior to discharge to the environment. When the plant is in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), the probability and consequences of a design basis accident that is postulated to leak fission products into secondary containment are reduced due to the temperature and pressure limitations in these Modes and conditions. However, in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), activities are conducted for which significant releases of radioactivity are postulated due to reductions in reactor vessel water level. As a result, the Low Reactor Vessel Water Level Trip Function is required to be operable in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), when activities are in progress which could result in reactor vessel water level reductions (i.e., during operations with the potential for draining the reactor vessel (OPDRVs)). Low Reactor Vessel Water Level actuation of the reactor building ventilation isolation and the Standby Gas Treatment System initiation is not assumed to mitigate the consequences of postulated events in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F) when OPDRVs are not being conducted. In Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), when other activities are conducted for which significant releases of radioactivity are postulated (i.e., movement of irradiated fuel assemblies or fuel cask in secondary containment and alteration of the reactor core) and OPDRVs are not being conducted, other reactor building ventilation isolation and the Standby Gas Treatment System initiation Trip Functions are required to be operable to generate the required isolation and initiation signals if required. Therefore, the Low Reactor Vessel Water Level Trip Function is not required to be operable during movement of irradiated fuel assemblies or fuel cask in secondary containment, and during alteration of the reactor core. As such, proposed Table 3.2.3 Trip Function 2 is revised to only be required in Run, Startup/Hot Standby, Hot Shutdown and Refuel (with reactor coolant temperature > 212°F) and during OPDRVs. This change is consistent with the ISTS in that ISTS Table 3.3.6.2-1 does not require the Low Reactor Vessel Water Level Trip Function to be operable during movement of irradiated fuel assemblies or fuel cask in secondary containment, or during alteration of the reactor core.

RAI 4.0-3

DOC Reference: L.2
The applicability of the high drywell trip function of CTS Table 3.2.3 is revised to delete requirements for "during movement of irradiated fuel assemblies or fuel cask in secondary containment, and during alteration of the reactor core." These changes to the applicability are not evaluated. Provide a safety analysis discussion of all changes. Additionally, the proposed applicabilities are not, as stated, consistent with the ISTS. Add a conclusion statement to explain why the change is acceptable.

Response to RAI 4.0-3

Revised DOC L.2 is provided below.

Proposed Replacement to DOC L.2:
The Applicability of the High Drywell Pressure Trip Function of CTS Table 3.2.3 is "When Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation are required by Specification 3.7.B and 3.7.C." The requirements of Specifications 3.7.B and 3.7.C, and as a result the requirements for this Trip Function, are applicable in Run, Startup/Hot Standby, Hot Shutdown, and Refuel (with reactor coolant water temperature > 212°F) and during operations with a potential for draining the reactor vessel, during movement of irradiated fuel assemblies or fuel cask in secondary containment, and during alteration of the reactor core. The High Drywell Pressure Trip Function is required to support the operability of the Secondary Containment System and the Standby Gas Treatment System to ensure fission products entrapped within secondary containment are treated prior to discharge to the environment. When the plant is in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), the probability and consequences of a design basis accident that is postulated to leak fission products into secondary containment are reduced due to the temperature and pressure limitations in these Modes and conditions. In addition, in these Modes or conditions, there is insufficient energy in the reactor vessel to pressurize the primary containment and the primary containment is not required to be operable. As a result, High Drywell Pressure actuation of the reactor building ventilation isolation and the Standby Gas Treatment System initiation is not assumed to mitigate the consequences of postulated events in Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F). In Cold Shutdown or Refuel (with reactor coolant water temperature ≤ 212°F), when other activities are conducted for which significant releases of radioactivity are postulated (i.e., operations with a potential for draining the reactor vessel, movement of irradiated fuel assemblies or fuel cask in secondary containment and alteration of the reactor core), other reactor building ventilation isolation and the Standby Gas Treatment System initiation Trip Functions are required to be operable to generate the required isolation and initiation signals if required. Therefore, the High Drywell Pressure Trip Function is not required to be operable during operations with a potential for draining the reactor vessel, movement of irradiated fuel assemblies or fuel cask in secondary containment, or alteration of the reactor core. As such, proposed Table 3.2.3 Trip Function 2 is revised to only be required in the Run, Startup/Hot Standby, Hot Shutdown and Refuel (with reactor coolant temperature > 212°F) Modes. This change is consistent with the ISTS in that ISTS Table 3.3.6.2-1 does not require the High Drywell Pressure Trip Function to be operable during operations with a potential for

draining the reactor vessel, during movement of irradiated fuel assemblies or fuel cask in secondary containment, or during alteration of the reactor core.

SECTION 5
CTS 3.2.D/4.2.D, OFF-GAS SYSTEM ISOLATION INSTRUMENTATION

RAI 5.0-1

DOC References: A.1 and A.2
Revise the submittal to delete both DOCs A.1 and A.2. These changes are not applicable to off-gas system isolation TS relocations which are evaluated using DOC R.1.

Response to RAI 5.0-1

For Section 3.2.D/4.2.D, DOCS A.1 and A.2 can be considered deleted.

SECTION 6
CTS 3.2.E/4.2.E, CONTROL ROD BLOCK ACTUATION INSTRUMENTATION

RAI 6.0-4

DOC Reference: LA.4
CTS Table 4.2.5 and associated Note 13, describing details of the performance of instrument calibrations of the rod block monitor (RBM) upscale (flow biased) trip function, are proposed to be relocated to the Bases. The calibration note states: "Includes calibration of the RBM Reference Downscale Function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power)." This surveillance requirement (SR) is equivalent to NUREG-1433 SR 3.3.2.1.4.a to verify RBM is not bypassed for the upscale function. The calibration can not check the bypass function, so the bypass function must be a separate surveillance. Revise the proposed TS SRs to include the current TS Table 4.2.5 Note 13 testing requirements.

Response to RAI 6.0-4

CTS Table 4.2.5 Note 13 is being included in proposed Table 4.2.5 as Footnote (c). DOC LA.4 can be considered deleted. Replacement markup and retyped proposed TS pages are provided in Attachment 2. Markup Page 74 is affected by this change. The following proposed pages are affected by this change: 57 and 77d.

RAI 6.0-5

DOC Reference: L.1
CTS requirements such as CTS 3.3.B.6, CTS 4.3.B.6, and CTS 4.11.C were deleted or modified in amendment 219. As noted in RAI G-4 previously, please revise the new TS pages to reflect the effect of Amendment No. 219.

Response to RAI 6.0-5

As stated in the response to RAI G-4, all TS and Bases pages affected by Amendment Nos. 219 and 220 have been marked up to reflect the changes of Proposed Change No. 259. Replacement markup and retyped proposed TS pages are provided in Attachment 2.

RAI 6.0-6

Reference Table 3.2.5 Action Note 2
The editorial change to capitalize "action" is incorrect. The intent of this usage in ISTS is to instruct the operator to "take" the specified action, i.e., to do something.

Response to RAI 6.0-6

The word "action" in proposed Table 3.2.5 Action Note 2 is being changed to lower case. Replacement markup of CTS Page 52 and retyped proposed TS Page 56 are provided in Attachment 2.

SECTION 8
CTS 3.2.G/4.2.G, POST-ACCIDENT MONITORING INSTRUMENTATION

RAI 8.0-1

DOC Reference: NA
CTS 3.2.G is revised by deleting descriptive information regarding the design, location and analysis assumptions of post accident monitoring parameters. This change is not evaluated by any safety analysis discussion of change. Provide appropriate documentation for this change.

Response to RAI 8.0-1

New DOC A.7 is provided below. Replacement markup of CTS Page 36 is provided in Attachment 2.

Proposed New DOC A.7:
CTS 3.2.G includes descriptive information regarding the design, location and analysis assumptions of post accident monitoring parameters. Similar information is included in the Bases for CTS 3.2 (CTS Page 79) and is being retained in the Background section of the proposed Bases for TS Section 3.2.G/4.2.G (proposed Page 79). Such information is not necessary for determination of the requirements of the specification. Therefore, this change does not involve a technical change, and is considered administrative.

RAI 8.0-2

DOC Reference: NA
CTS Table 3.2.6 parameter nomenclature for containment pressure (item 2 in the table) is revised by replacing "Containment" with "Drywell." This change is not evaluated by any safety analysis discussion of change. Provide appropriate documentation for this change.

Response to RAI 8.0-2

New DOC A.8 is provided below. Replacement markup of CTS Page 53 is provided in Attachment 2.

Proposed New DOC A.8
The parameter labeled "Containment Pressure" in CTS Table 3.2.6 is designated as Function 2 and is being renamed "Drywell Pressure" in proposed Table 3.2.6. The VY Primary Containment is comprised of two sections, the Drywell and the Suppression Chamber (also referred to as the Torus). These two sections have separate airspaces that normally do not communicate. The Post-Accident Monitoring Instrumentation required by proposed Table 3.2.6 as Function 2 is only capable of monitoring the pressure in the Drywell portion of the Primary Containment. This change in designation provides a more accurate description of the monitoring function of the subject instrumentation. Therefore, this change does not involve a technical change, and is considered administrative.

RAI 8.0-3

DOC Reference: R.1
Evaluate CTS 3.2.G/4.2.G relocating requirements (LCOs, actions and surveillances) for the safety relief valve position indication (both pressure transmitter and acoustic monitor) and for stack noble gas effluent monitors to the Technical Requirements Manual (TRM) by performing an analysis using 10 CFR 50.36.(c)(2)(ii), or add a L-DOC justification for removal from CTS if the 10 CFR 50.36 criteria do not apply.

Response to RAI 8.0-3

DOC R.1 provides a comparison to the deterministic screening criteria for post-accident monitoring which concludes that only Regulatory Guide (RG) 1.97 Type A instruments specified in the plant's Safety Evaluation Report on RG 1.97, and all RG 1.97 Category 1 instruments, need to be included in the Technical Specifications (TS) as post-accident monitoring instrumentation. Based on this comparison, the operability requirements for the following instrumentation can be relocated to the TRM:

- Safety/Relief Valve Position from Pressure Switches
- Safety Valve Position from Acoustic Monitors
- Stack Noble Gas Effluent

The requirement specified in 10 CFR 50.36(c)(2)(ii) for inclusion of a limiting condition for operation in the TS is that one or more of the following criteria are met:

Criterion 1: Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
Criterion 2: A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

Criterion 3: A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
Criterion 4: A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.
ISTS (NUREG-1433) Bases Section B.3.3.3.1, PAM Instrumentation, discusses the criteria for retaining post-accident monitoring instrumentation in TS. ISTS states that instrumentation that satisfies the definition of Type A in RG 1.97 meets Criterion 3 above. ISTS also states that instrumentation that satisfies the definition of Category I, non-Type A in RG 1.97 is retained in TS because it assists operators in minimizing the consequences of accidents, and is therefore important for reducing public risk. Therefore, Category I, non-Type A instrumentation meets Criterion 4 above.

As discussed in DOC R.1, the three instrument functions listed above did not satisfy the screening criteria for Type A or non-Type A, Category I instrumentation, and therefore do not meet either Criterion 3 or 4 above. None of these three parameters are indicative of a degradation of the reactor coolant pressure boundary, so these instrument functions do not meet Criterion 1 above. Also, none of these three instrument functions are design features associated with any initial condition of a design basis accident or transient analysis, so these instrument functions do not meet Criterion 2 above. Since none of these three instrument functions meet any of the criteria specified in 10 CFR 50.36(c)(2)(ii), they do not need to be included as a limiting condition for operation in the TS.

SECTION 9
CTS 3.2.H/4.2.H, DRYWELL TO TORUS DELTA-PRESSURE INSTRUMENTATION

RAI 9.0-1

DOC Reference: LC.1
Evaluate CTS 3.2.H/4.2.H relocating requirements (LCOs, actions and surveillances) for the drywell to torus delta-pressure instrumentation to the TRM by performing an analysis using 10 CFR 50.36.(c)(2)(ii). This must be an R-DOC discussion since CTS 3.7 (p.151) currently has an LCO on the delta-pressure.

Response to RAI 9.0-1

New DOC R.1 is provided below to replace DOC LC.1. Replacement markups of CTS Pages 36 and 37 are provided in Attachment 2.

Proposed New DOC R.1
CTS 3.2.H and 4.2.H specify requirements for the drywell to torus Δp instrumentation. This monitoring instrumentation does not necessarily relate directly to maintaining the monitored parameter (drywell to torus Δp) within limits. The ISTS do not specify indication-only equipment to be operable to support operability of a system or component or maintaining variables within limits. Control of the availability of, and necessary compensatory activities if not available, for indication and monitoring instruments are addressed by plant procedures and policies. Therefore, these requirements are to be relocated to the Technical Requirements Manual.

The requirement specified in 10 CFR 50.36(c)(2)(ii) for inclusion of a limiting condition for operation in the TS that one or more of the following criteria are met:

Criterion 1: Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
Criterion 2: A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
Criterion 3: A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
Criterion 4: A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The monitored parameter (drywell to torus Δp) is an initial condition of a design basis accident analysis that assumes the failure of a fission product barrier. Therefore, the limits on this parameter required by TS 3.7.A.9/4.7.A.9 meet Criterion 2 above. However, the instrumentation used to verify compliance with these limits does not meet Criterion 2. Since drywell to torus Δp is not indicative of a degradation of the reactor coolant pressure boundary, the drywell to torus Δp instrumentation does not meet Criterion 1. As stated above, drywell to torus Δp is an initial condition of a design basis accident and is not involved with the mitigation of any accident or transient. Therefore, the drywell to torus Δp instrumentation does not meet Criterion 3. TS 3.7.A.9/4.7.A.9, Drywell/Suppression Chamber d/p, provides regulatory control over the requirement to maintain drywell to torus Δp within limits. Therefore, CTS 3.2.H/4.2.H serves no purpose and is not significant to public health and safety. Therefore, the drywell to torus Δp instrumentation does not meet Criterion 4.

Changes to the Technical Requirements Manual are controlled using 10 CFR 50.59. Not including these requirements in the TS is consistent with the ISTS.

SECTION 10
CTS 3.2.I/4.2.I, RECIRCULATION PUMP TRIP INSTRUMENTATION

RAI 10.0-2

DOC Reference: M.2 (editorial)
Insert "or" after "channels" and before "if" in the 3rd sentence.

Response to RAI 10.0-2

New DOC M.2 is provided below.

Proposed New DOC M.2
CTS Table 3.2.1 Note 19.B requires inoperable recirculation pump trip instrumentation channels to be restored or placed in the tripped condition. Proposed Table 3.2.7 Action Note 1.a provides

the same alternative actions as CTS Table 3.2.1 Note 19.B but includes a limitation on the use of the action to place the inoperable channels in trip. Proposed Table 3.2.7 Action Note 1.a precludes the use of the action to trip the inoperable channel if the inoperability is associated with Trip Function 2 (i.e., Time Delay) channels or if the inoperability is the result of an inoperable recirculation pump trip breaker. These restrictions are added since (1) placing the Time Delay Trip Function channels in trip (as allowed by CTS Table 3.2.1 Note 19.B) does not perform the intended function (providing a time delay for actuation after certain conditions are satisfied) and could make the consequences of a postulated LOCA more severe, and (2) with the channels inoperable due to an inoperable breaker, tripping the affected channels may not adequately compensate for the inoperable breaker (e.g., the breaker may be inoperable such that it will not open). This change represents an additional restriction on plant operation by requiring the channels in these conditions to be restored to operable status rather than tripped. The change is consistent with the ISTS.

SECTION 11
CTS 3.2.K/4.2.K, DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

RAI 11.0-2

DOC Reference: LC.1
CTS Table 3.2.8, Degraded Bus Voltage - Time Delay requires two operable instruments per bus. The proposed TS requires only one operable instrument channel per bus. DOC LC.1 does not evaluate this proposed change. Provide safety analysis justification to support the change or retain CTS requirements. Also see Tech Branch RAI 11.0-5.

Response to RAI 11.0-2

As stated in RAI 11.0-5 below, proposed change LC.1 deletes the alarm function from CTS Table 3.2.8, Degraded Bus Voltage. Since one of the Degraded Bus Voltage - Time Delay channels for each emergency bus is associated with this alarm function, proposed change LC.1 reduces the number of required channels per bus from two to one. However, Entergy agrees that the alarm function is required for operator action for emergency bus realignment and should therefore remain in the TSs, as stated in RAI 11.0-5. Therefore, proposed change LC.1 is being withdrawn.

Based on discussions with the NRC reviewers, the alarm function is being retained in the TS. However, Entergy and the NRC reviewers agreed that the current LCO actions are inappropriate for loss of the alarm function. The current actions require declaring the associated diesel generator inoperable when the alarm function cannot be restored within the allowable outage time. Instead, proposed change L.3 is provided to separate the actuation and alarm trip functions in Table 3.2.8 and provide different actions for inoperability of the different trip functions. Proposed DOC L.3 below provides an explanation and justification for the change. In addition to the proposed action of increased bus voltage monitoring, VY design includes a voltage signal feed from the emergency buses to the Emergency Response Facilities Information System (ERFIS) computer. The occurrence of high or low voltage on either emergency bus will, after a time delay, cause an alarm message to be printed out on the alarm typer in the control room. Therefore, the operator is provided with multiple indications of

degraded emergency bus voltage to provide a high assurance that manual action for degraded grid protection will be taken. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup pages are affected by this change: 56. The following proposed pages are affected by this change: 69, 70, 80f, 80g, 80h, 80i and 80j.
Proposed DOC L.3
CTS Table 3.2.8 includes two Degraded Bus Voltage - Voltage channels per bus and two Degraded Bus Voltage - Time Delay channels per bus. One of the time delay relays for each bus feeds the actuation circuitry and the other one feeds the alarm circuitry. Both of the low voltage relays for each bus feed both the actuation and alarm circuitry. CTS Table 3.2.8 does not distinguish between the actuation and alarm circuits, and the required LCO actions are the same for each. Proposed Table 3.2.8 includes two new Trip Functions to account for the alarm circuitry: Degraded Bus Voltage - Voltage Alarm and Degraded Bus Voltage - Alarm Time Delay. Since the alarm circuitry is arranged in a one-out-of-two logic configuration, alarm capability for a bus can be maintained with one Degraded Bus Voltage - Voltage Alarm inoperable. Therefore, since this Trip Function is not common to RPS, 24 hours is allowed to restore the inoperable channel to operable status (proposed Table 3.2.8 ACTION Note 3.b). If alarm capability is not maintained for a bus, either due to both Degraded Bus Voltage - Voltage Alarm channels or the one Degraded Bus Voltage - Alarm Time Delay channel being inoperable, only 1 hour is allowed to restore alarm capability (proposed Table 3.2.8 ACTION Note 3.a). Since the Degraded Bus Voltage - Voltage Alarm and Alarm Time Delay channels do not provide an automatic protective function, but rather provide a control room annunciator function from which manual action is taken for degraded grid protection, it is appropriate to compensate for the loss of this alarm function rather than potentially require a reactor shutdown. Therefore, if the Action and associated completion time of proposed ACTION Note 3.a or 3.b are not met, rather than declare the associated diesel generator inoperable, proposed ACTION Note 3 will require increased voltage monitoring of the associated 4.16 kV emergency bus(es) in accordance with plant procedures. This change is acceptable since the control room operator will still be alerted of a degraded voltage condition so that manual action for degraded grid protection can be taken in accordance with plant procedures.

<u>RAI 11.0-4</u>

DOC Reference: None
Bases for applicable safety analyses, LCO and applicability states that the degraded grid protective system instrumentation is required for engineered safety features to function in any accident with a "degradation or loss of offsite power." From this basis, it is clear that the VYNPS licensing basis should require the loss of power instrumentation to be operable. Provide the appropriate loss of power TS instrumentation in Table 3.2.8.

<u>Response to RAI 11.0-4</u>

The referenced statement provided in the Applicable Safety Analyses, LCO, and Applicability section of the proposed Bases for Section 3.2.K/4.2.K specifically addresses the degraded grid protective system instrumentation and not the loss of power instrumentation. This statement simply indicates that the degraded grid instrument channels will actuate at any voltage level below the trip setting, including a value of 0 volts or a "loss of offsite power."

The loss of power instrumentation is addressed in CTS 3.10.A.1 since this instrumentation is required to be operable in order to support operability of the emergency diesel generators. This support requirement is specifically called out in surveillance requirements (SRs) for the emergency diesel generators. SRs 4.10.A.1.a.1 and 4.10.A.1.a.3 both state that the diesel generators shall be "started using the undervoltage automatic starting circuit." SR 4.10.A.1.b states that the "actual conditions under which the diesel generators are required to start automatically will be simulated." The bases for SR 4.10.A.1.b state that during this test "a loss of normal power condition will be imposed to simulate a loss of off-site power." Therefore, since these diesel generator SRs include a functional test of the loss of power instrumentation, it's clear that the operability of this instrumentation is required to support operability of the diesel generators.

The loss of power instrumentation is functionally tested at least once per month per SR 4.10.A.1.a.1, however no calibration of the instrument setpoints is required by the current Technical Specifications. The current setpoint of the loss of power relays is 1925 volts. Since this instrumentation is designed to detect a complete loss of power to the emergency buses (i.e., 0 volts), and the relay setpoint is significantly higher, precise instrument calibration is not necessary to ensure its operability. This instrumentation is calibrated periodically as controlled by plant procedures. Therefore, the current emergency diesel generator LCO and SRs are adequate to ensure that the loss of power instrumentation remains operable.

10 CFR 50.36(c)(2)(iii) is worded as follows: "A licensee is not required to propose to modify technical specifications that are included in any license issued before August 18, 1995, to satisfy the criteria in paragraph (c)(2)(ii) of this section." Therefore, even though the loss of power instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii), the regulations specifically state that the Technical Specifications do not need to be modified to include operability and surveillance requirements for this instrumentation. In addition, based on the above discussion, Entergy believes that the current Technical Specifications provide adequate controls to ensure the loss of power instrumentation remains operable and capable of performing its intended function.

SECTION 12
CTS 3.2.L/4.2.L, REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ACTUATION

<u>RAI 12.0-2</u>

DOC Reference: LA.2
CTS 3.2.L Table 3.2.9 includes column "Minimum Number of Operable Instrument Channels per Trip System" with notes to each function that describe the trip system arrangements including the number of channels per trip system. The trip system design requirements are relocated to the Bases. The proposed Table 3.2.9 specifies "Required Channels per Trip System." The ISTS specifies the "Total Channels per Function." Revise Table 3.2.9 to adopt the ISTS column "Total Channels per Function" and revise Function 1 to specify four required channels.

Response to RAI 12.0-2

The current version of ISTS, NUREG-1433, Revision 3, specifies the "Required Channels per Function." This designation is more accurate than "Total Channels per Function" as it specifies the number of channels required to be operable rather than the number of channels available. Table 3.2.9 is being revised to specify the "Required Channels per Function" and Function 1 is being revised to specify four required channels. In addition, the Bases are being revised to reflect the trip system design. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup pages are affected by this change: 57. The following proposed pages are affected by this change: 73 and 80j (now 80k).

RAI 12.0-4

DOC Reference: LCO Retype
Proposed TS Table 3.2.9, Action Notes 1.b, 2.b and 3.a refers to "Place [Restore] inoperable channel....." Revise these statements to "Place [Restore] inoperable channels..."

Response to RAI 12.0-4

In order to avoid ambiguity and still provide appropriate instructions for both single and multiple failures, the phrase "any inoperable channel" is being used. For proposed Table 3.2.9 Action Notes 1.b and 2.b the action phrases become: "Place any inoperable channel in trip..." For proposed Table 3.2.9 Action Note 3.a the action phrase becomes: "Restore any inoperable channel to operable status..." Similar issues were found to exist in other instrumentation sections. The following sections were changed to adopt the above convention:

- Table 3.2.1: ACTION Notes 1.b, 2.b, 3.b, 4.b, 5.b, 6.a, 7.b, 8.b and 8.c
- Table 3.2.2: ACTION Notes 1.a.1, 1.a.2 and 1.a.3
- Table 3.2.3: ACTION Notes 1.a.1 and 1.a.2
- Section 3.2.F.2.a.1 and 3.2.F.2.a.2
- Table 3.2.7: ACTION Notes 1.a.1 and 1.a.2
- Table 3.2.8: ACTION Notes 1.a and 2.a

Replacement retyped proposed TS pages are provided in Attachment 2. The following proposed pages are affected by this change: 39, 40, 47, 52, 59, 66, 70 and 74.

RAI 12.0-5

DOC Reference: Bases Retype pages 80l and 80m
The Actions basis for Table 3.2.9, Action Note 1 and Action Note 2 refer to the completion time as allowing an exception to the normal "time zero" for beginning the allowed outage time "clock." Show that the current TSs contain a "Use and Application Completion Times" discussion equivalent to NUREG-1433, Section 1.3. If not, discuss how "time zero" clocks can be interpreted with respect to the format and content of current TS. Also, on page 80m, correct the reference in the middle of the "Table 3.2.9 ACTION Note 2" paragraph to 2.a from 1.a.

Response to RAI 12.0-5

Use of "time zero" and "clock" are addressed in RAI G-3 above. As stated in the response to RAI G-3, all sentences containing "time zero" and "clock" are being deleted. The reference in the "Table 3.2.9 ACTION Note 2" paragraph is being changed to 2.a from 1.a. Replacement retyped proposed TS pages are provided in Attachment 2. The following proposed page is affected by this change: 80m (now 80n).

Technical Branch RAIs

CTS 3.1/4.1, REACTOR PROTECTION SYSTEM

RAI 1.0-12

DOC Reference: M.12

The trip setting for the turbine control valve fast closure trip function is specified in CTS Table 3.1.1 Note 9 as "Channel signals for the turbine control valve fast closure scram shall be derived from the same event or events that cause the control valve fast closure," and CTS 2.1.F as, "Turbine control valve fast closure scram shall ... trip upon actuation of the turbine control valve fast closure relay." In proposed Table 3.1.1 (trip function 10) and TS 2.1.F, the trip setting is specified as > 150 psig acceleration relay oil pressure. Provide a technical basis to justify this change. In particular, verify this will comply with the statement in UFSAR 14.5.1.1.1 that control rod motion starts within 0.28 seconds after turbine control valves start to close. The NRC staff believes it is incorrect to state (in M.12 or the Bases, p. 33f) that "the actual operating point for the associated trip function is not assumed in any transient or accident analysis," as the analysis in UFSAR 14.5.1.1.1 obviously assumes an operating point that will allow control rod insertion at the stated time.

Response to RAI 1.0-12

Change M.12 is being withdrawn and the DOC for Change M.12 should be considered deleted. Replacement markup and retyped proposed TS pages are provided in Attachment 2. The following markup pages are affected by this change: 10, 22 and 24. The following proposed pages are affected by this change: 10, 22 and 33f.

SECTION 2

CTS 3.2.A/4.2.A, EMERGENCY CORE COOLING SYSTEM

RAI 2.0-7

DOC Reference: M.6

CTS Table 3.2.1 specifies for the low condensate storage tank water level trip function that the Trip Setting be 3%. In proposed Table 3.2.1, the trip setting for the low condensate storage tank water level trip function (trip function 3.b) has been increased to 4.24% to account for the additional water level needed to preclude vortex formation. Provide the calculations for staff review of the setpoint methodology for this TS change.

Response to RAI 2.0-7

A copy of the setpoint calculation for the HPCI System Low Condensate Storage Tank Water Level trip function, along with a copy of a table from a supporting technical evaluation, are provided as Attachment 3 to this letter.

SECTION 3
CTS 3.2.B/4.2.B, PRIMARY CONTAINMENT ISOLATION

RAI 3.0-4

DOC Reference: M.7
Proposed TS Table 3.2.2, Function 1.b, 3.a, 3.d, 4.a, and 4.c, have trip setting changes from current TS which are justified by DOC M.7. Provide the setpoint calculations for staff review of the setpoint methodology for these TS changes.

Response to RAI 3.0-4

A copy of the setpoint calculation for proposed TS Table 3.2.2, Trip Function 1.b, Main Steam Line Isolation High Main Steam Line Area Temperature, is provided as Attachment 4 to this letter.

A copy of the setpoint calculation for proposed TS Table 3.2.2, Trip Functions 3.a and 3.d, HPCI System Isolation High Steam Line Space Temperature and High Main Steam Line Tunnel Temperature, is provided as Attachment 5 to this letter.

A copy of the setpoint calculation for proposed TS Table 3.2.2, Trip Functions 4.a and 4.c, RCIC System Isolation High Main Steam Line Tunnel Temperature and High Steam Line Space Temperature, is provided as Attachment 6 to this letter.

SECTION 11
CTS 3.2.K/4.2.K, DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

RAI 11.0-5

DOC Reference: LC.1
The proposed change to Table 3.2.8 Degraded Bus Voltage - Time Delay trip function deletes the alarm function from TSs. The alarm function is necessary to alert operators to a degraded grid bus voltage condition in order for operators to take timely actions to mitigate a degraded bus voltage situation. VYNPS's licensing and design basis does not provide for automatic disconnect of a degraded bus, absent a loss-of-coolant-accident signal, which differs from NRC Branch Technical Position 1 (PSB-1). VYNPS committed, in a letter dated July 24, 1980, that operator action will be credited for the protection of safety equipment under these circumstances. Therefore, the alarm function is required for operator action for emergency bus realignment and should remain in the TSs. Table 3.2.8 should have an alarm function with an appropriate action for an inoperable instrument.

Response to RAI 11.0-5

See Response to RAI 11.0-2 above.

SECTION 12
CTS 3.2.L/4.2.L, REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM ACTUATION
RAI 12.0-3

DOC Reference: M.2
The CTS trip setting for low condensate storage tank water level trip function is revised from "3%" to "3.81%" to account for the additional water level needed to preclude the potential for vortex formation which corresponds to the process limit used in the associated setpoint calculation. Provide the calculations for NRC staff review of the setpoint methodology for this TS change.

Response to RAI 12.0-3

A copy of the setpoint calculation for the RCIC System Low Condensate Storage Tank Water Level trip function, along with a copy of a table from a supporting technical evaluation, are provided as Attachment 7 to this letter.

ATTACHMENT 2 TO BVY 05-068

REPLACEMENT PAGES FOR RETYPED
PROPOSED TS AND BASES
AND MARKUPS OF CTS

ENTERGY NUCLEAR OPERATIONS, INC.
VERMONT YANKEE NUCLEAR POWER STATION
DOCKET NO. 50-271

Listing of Affected Technical Specifications Pages

Replace the Vermont Yankee Nuclear Power Station Technical Specifications pages listed below with the revised pages included herein. The revised pages contain vertical lines in the margin indicating the areas of change. This list supersedes the list of affected pages included in Reference 2.

Remove	Insert	Remove	Insert	Remove	Insert	Remove	Insert
i	i	-	33f	49a	-	-	75a
5	5	-	33g	50	50	-	75b
8	8	-	33h	51	51	-	75c
10	10	-	33i	52	52	-	75d
14	14	-	33j	53	53	-	75e
14a	-	-	33k	54	54	-	75f
15	15	-	33l	55	55	-	75g
16	16	-	33m	55a	-	-	75h
17	17	-	33n	56	56	-	75i
20	20	-	33o	57	57	-	75j
-	20a	-	33p	58	58	-	75k
21	21	34	34	59	59	-	75l
-	21a	35	35	60	60	-	75m
22	22	36	36	61	61	-	75n
23	23	37	37	62	62	-	75o
24	24	38	38	63	63	-	75p
25	25	39	39	64	64	-	75q
26	26	40	40	65	65	-	75r
27	27	41	41	66	66	-	75s
28	28	42	42	67	67	-	75t
29	29	43	43	68	68	-	75u
30	30	44	44	69	69	-	75v
31	31	44a	-	70	70	-	75w
32	32	44b	-	71	71	-	75x
33	33	45	45	71a	-	76	76
33a	33a	46	46	72	72	-	76a
-	33b	47	47	73	73	-	76b
-	33c	48	48	74	74	-	76c
-	33d	48a	-	-	74a	-	76d
-	33e	49	49	75	75	-	76e

Listing of Affected Technical Specifications Pages
(continued)

Remove	Insert	Remove	Insert	Remove	Insert	Remove	Insert
-	76f	-	76s	-	78d	-	80e
-	76g	-	76t	79	79	-	80f
-	76h	-	76u	79a	79a	-	80g
-	76i	77	77	-	79b	-	80h
-	76j	-	77a	-	79c	-	80i
-	76k	-	77b	-	79d	-	80j
-	76l	-	77c	-	79e	-	80k
-	76m	-	77d	-	79f	-	80l
-	76n	-	77e	80	80	-	80m
-	76o	78	78	80a	80a	-	80n
-	76p	-	78a	-	80b	-	80o
-	76q	-	78b	-	80c	-	80p
-	76r	-	78c	-	80d	-	80q

Proposed

Technical Specifications

3.1 and 4.1 – Reactor Protection System

And related Technical Specifications:

Table of Contents

3.1 LIMITING CONDITIONS FOR OPERATION

3.1 REACTOR PROTECTION SYSTEM (RPS)

Applicability:

Applies to the operability of plant instrumentation and control systems required for reactor safety.

Objective:

To specify the limits imposed on plant operation by those instrument and control systems required for reactor safety.

Specification:

A. The RPS instrumentation for each Trip Function in Table 3.1.1 shall be operable in accordance with Table 3.1.1.

4.1 SURVEILLANCE REQUIREMENTS

4.1 REACTOR PROTECTION SYSTEM (RPS)

Applicability:

Applies to the surveillance of the plant instrumentation and control systems required for reactor safety.

Objective:

To specify the type and frequency of surveillance to be applied to those instrument and control systems required for reactor safety.

Specification:

A.1 RPS instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.1.1. RPS testing shall also be performed as indicated in Surveillance Requirements 4.1.A.2 and 4.1.A.3.

When an RPS channel is placed in an inoperable status solely for the performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains RPS trip capability.

2. Exercise each automatic scram contactor once every week using the RPS channel test switches or by performing a Functional Test of any automatic RPS Trip Function.

3. Verify RPS Response Time is $\leq$ 50 milliseconds for each automatic RPS Trip Function once every Operating Cycle.

3.1 LIMITING CONDITIONS FOR OPERATION

4.1 SURVEILLANCE REQUIREMENTS

4. Perform a Logic System Functional Test of RPS instrumentation Trip Functions once every Operating Cycle.

Table 3.1.1 (page 1 of 3)
Reactor Protection System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
1. Reactor Mode Switch in Shutdown	RUN, STARTUP/HOT STANDBY, Refuel[a]	1	Note 1	Note 2.a	NA
	Refuel[b]	1	Note 1	Note 2.d	NA
2. Manual Scram	RUN, STARTUP/HOT STANDBY, Refuel[a]	1	Note 1	Note 2.a	NA
	Refuel[b]	1	Note 1	Note 2.d	NA
3. Intermediate Range Monitors (IRMs)					
a. High Flux	STARTUP/HOT STANDBY, Refuel[a]	2	Note 1	Note 2.a	≤ 120/125
	Refuel[b]	2	Note 1	Note 2.d	≤ 120/125
b. Inop	STARTUP/HOT STANDBY, Refuel[a]	2	Note 1	Note 2.a	NA
	Refuel[b]	2	Note 1	Note 2.d	NA

(a) With reactor coolant temperature > 212°F.

(b) With reactor coolant temperature ≤ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies.

Table 3.1.1 (page 2 of 3)
Reactor Protection System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
4. Average Power Range Monitors (APRMs)					
a. High Flux (Flow Bias)	RUN	2	Note 1	Note 2.b	(c)
b. High Flux (Reduced)	STARTUP/HOT STANDBY, Refuel[a]	2	Note 1	Note 2.a	≤ 15%
c. Inop	RUN, STARTUP/HOT STANDBY, Refuel[a]	2	Note 1	Note 2.a	NA

(a) With reactor coolant temperature > 212°F.

(c) <u>Two loop operation:</u>
$S \leq 0.4W + 61.10\%$ for $0\% < W \leq 31.1\%$
$S \leq 1.28W + 33.31\%$ for $31.1\% < W \leq 54.0\%$
$S \leq 0.66W + 67.28\%$ for $54.0\% < W \leq 75.0\%$
With a maximum of 117.0% power
for $W > 75.0\%$

<u>Single loop operation:</u>
$S \leq 0.4W + 58.09\%$ for $0\% < W \leq 39.1\%$
$S \leq 1.28W + 23.56\%$ for $39.1\% < W \leq 61.9\%$
$S \leq 0.66W + 62.10\%$ for $61.9\% < W \leq 83.0\%$
With a maximum of 117.0% power
for $W > 83.0\%$

Table 3.1.1 (page 3 of 3)
Reactor Protection System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
5. High Reactor Pressure	RUN, STARTUP/HOT STANDBY, Refuel[(a)]	2	Note 1	Note 2.a	≤ 1055 psig
6. High Drywell Pressure	RUN, STARTUP/HOT STANDBY, Refuel[(a)]	2	Note 1	Note 2.a	≤ 2.5 psig
7. Reactor Low Water Level	RUN, STARTUP/HOT STANDBY, Refuel[(a)]	2	Note 1	Note 2.a	≥ 127.0 inches
8. Scram Discharge Volume High Level	RUN, STARTUP/HOT STANDBY, Refuel[(a)]	2 per volume	Note 1	Note 2.a	≤ 21.0 gallons
	Refuel[(b)]	2 per volume	Note 1	Note 2.d	≤ 21.0 gallons
9. Main Steam Line Isolation Valve Closure	RUN	8	Note 1	Note 2.b	≤ 10% valve closure
10. Turbine Control Valve Fast Closure	> 30% RATED THERMAL POWER	2	Note 1	Note 2.c	(d)
11. Turbine Stop Valve Closure	> 30% RATED THERMAL POWER	4	Note 1	Note 2.c	≤ 10% valve closure

(a) With reactor coolant temperature > 212°F.

(b) With reactor coolant temperature ≤ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies.

(d) Channel signals for the turbine control valve fast closure trip shall be derived from the same event or events which cause the control valve fast closure.

Table 3.1.1 ACTION Notes

1. With one or more required Reactor Protection System channels inoperable, take all of the applicable Actions in Notes 1.a, 1.b, and 1.c below.

   a. With one or more Trip Functions with one or more required channels inoperable:

      1) Place an inoperable channel for each Trip Function in trip within 12 hours; or

      2) Place the associated trip system in trip within 12 hours.

   b. With one or more Trip Functions with one or more required channels inoperable in both trip systems:

      1) Place an inoperable channel in one trip system in trip within 6 hours; or

      2) Place one trip system in trip within 6 hours.

   c. With one or more Trip Functions with Reactor Protection System trip capability not maintained:

      1) Restore Reactor Protection System trip capability within 1 hour.

   If any applicable Action and associated completion time of Notes 1.a, 1.b, or 1.c is not met, take the applicable Action of Note 2 below referenced in Table 3.1.1 for the channel.

2. a. Place the reactor in HOT SHUTDOWN within 12 hours.

   b. Place the reactor in STARTUP/HOT STANDBY within 8 hours.

   c. Reduce reactor power to ≤ 30% Rated Thermal Power within 8 hours.

   d. Immediately initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.

Table 4.1.1 (page 1 of 3)
Reactor Protection System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Reactor Mode Switch in Shutdown	NA	Each Refueling Outage	NA
2. Manual Scram	NA	Every 3 Months	NA
3. Intermediate Range Monitors (IRMs)			
a. High Flux	Once/Day, (a)	Within 7 Days Before entering STARTUP/HOT STANDBY[(b)] and Every 7 Days During STARTUP/HOT STANDBY, Every 7 Days During Refueling	Once/Operating Cycle[(b),(c)]
b. Inop	NA	Within 7 Days Before entering STARTUP/HOT STANDBY[(b)] and Every 7 Days During STARTUP/HOT STANDBY, Every 7 Days During Refueling	NA
4. Average Power Range Monitors (APRMs)			
a. High Flux (Flow Bias)	NA	Every 3 Months	Every 7 Days for Output Signal by Heat Balance[(d)], Every 3 Months[(e)], Each Refueling Outage for Flow Bias, Every 2000 MWD/T Average Core Exposure for LPRMs using TIP System

(a) IRM and Source Range Monitor channels shall be determined to overlap during each startup after entering STARTUP/HOT STANDBY MODE and IRM and APRM channels shall be determined to overlap during each controlled shutdown, if not performed in the previous 7 days.

(b) Not required to be performed when entering STARTUP/HOT STANDBY MODE from RUN MODE until 12 hours after entering STARTUP/HOT STANDBY MODE.

(c) Neutron detectors are excluded.

(d) Not required to be performed until 12 hours after reactor power is $\geq$ 25% Rated Thermal Power.

(e) Trip unit calibration only.

Table 4.1.1 (page 2 of 3)
Reactor Protection System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
4. APRMs (continued)			
b. High Flux (Reduced)	(a)	Within 7 Days Before entering STARTUP/HOT STANDBY[b] and Every 7 Days During STARTUP/HOT STANDBY, Every 7 Days During Refueling	Every 7 Days[b],[c]
c. Inop	NA	Every 3 Months	NA
5. High Reactor Pressure	Once/Day	Every 3 Months	Every 3 Months[e], Once/Operating Cycle
6. High Drywell Pressure	NA	Every 3 Months	Every 3 Months[e], Once/Operating Cycle
7. Reactor Low Water Level	Once/Day	Every 3 Months	Every 3 Months[e], Once/Operating Cycle
8. Scram Discharge Volume High Level	NA	Every 3 Months	Every 3 Months[e], Once/Operating Cycle
9. Main Steam Line Isolation Valve Closure	NA	Every 3 Months	Each Refueling Outage
10. Turbine Control Valve Fast Closure	NA	Every 3 Months	Every 3 Months
a. First Stage Turbine Pressure Permissive	NA	Every 6 Months	Every 6 Months and prior to entering STARTUP/HOT STANDBY for plant startup after Refueling

(a) IRM and Source Range Monitor channels shall be determined to overlap during each startup after entering STARTUP/HOT STANDBY MODE and IRM and APRM channels shall be determined to overlap during each controlled shutdown, if not performed in the previous 7 days.

(b) Not required to be performed when entering STARTUP/HOT STANDBY MODE from RUN MODE until 12 hours after entering STARTUP/HOT STANDBY MODE.

(c) Neutron detectors are excluded.

(e) Trip unit calibration only.

Table 4.1.1 (page 3 of 3)
Reactor Protection System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
11. Turbine Stop Valve Closure	NA	Every 3 Months	Each Refueling Outage
a. First Stage Turbine Pressure Permissive	NA	Every 6 Months	Every 6 Months and prior to entering STARTUP/HOT STANDBY for plant startup after Refueling

3.1 LIMITING CONDITIONS FOR OPERATION

4.1 SURVEILLANCE REQUIREMENTS

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TABLE OF CONTENTS

1.0 DEFINITIONS

Z. Surveillance Interval - Relocated to Specification 4.0.1.

AA. Deleted

BB. Source Check - The qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

CC. Dose Equivalent I-131 - The dose equivalent I-131 shall be that concentration of I-131 (microcurie/gram) which alone would produce the same dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. The Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1988; FGR 12, "External Exposure to Radionuclides In Air, Water, and Soil," 1993; or dose conversion factors used for this calculation shall be those listed in NRC Regulatory Guide 1.109, Revision 1, October 1977.

DD. Deleted

EE. Deleted

FF. Deleted

GG. Deleted

HH. Deleted

II. Deleted

JJ. Deleted

KK. Deleted

LL. Deleted

MM. Deleted

NN. Core Operating Limits Report - The Core Operating Limits Report is the unit-specific document that provides core operating limits for the current operating reload cycle. These cycle-specific core operating limits shall be determined for each reload cycle in accordance with Specification 6.6.C. Plant operation within these operating limits is addressed in individual specifications.

OO. Reactor Protection System (RPS) Response Time - RPS Response Time shall be the time from the opening of the sensor contact up to and including the opening of the scram solenoid relay.

1.1 SAFETY LIMIT

2.1 LIMITING SAFETY SYSTEM SETTING

For no combination of loop recirculation flow rate and core thermal power shall the APRM flux scram trip setting be allowed to exceed 120% of rated thermal power.

b. Flux Scram Trip Setting (Refuel or Startup/ Hot Standby Mode)

When the reactor mode switch is in the Refuel position with reactor coolant temperature > 212 °F or the STARTUP/HOT STANDBY position, average power range monitor (APRM) scram shall be set down to less than or equal to 15% of rated neutron flux. The IRM flux scram setting shall be set at less than or equal to 120/125 of full scale.

B. Deleted

C. Reactor low water level scram setting shall be at least 127 inches above the top of the enriched fuel.

1.1 SAFETY LIMIT

2.1 LIMITING SAFETY SYSTEM SETTING

D. Reactor low-low water level Emergency Core Cooling System (ECCS) initiation shall be ≥ 82.5 inches above the top of the enriched fuel.

E. When operating at > 30% of Rated Thermal Power, turbine stop valve scram shall be ≤ 10% valve closure from full open.

F. When operating at > 30% of Rated Thermal Power, turbine control valve fast closure scram shall be actuation of the turbine control valve fast closure relay.

G. Main steam line isolation valve closure scram shall be ≤ 10% valve closure from full open.

H. Main steam line low pressure initiation of main steam line isolation valve closure shall be ≥ 800 psig.

Proposed

Bases

3.1 and 4.1 – Reactor Protection System

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

BACKGROUND

The Reactor Protection System (RPS) initiates a reactor scram when one or more monitored parameters exceed their specified limits, to preserve the integrity of the fuel cladding and the reactor coolant pressure boundary (RCPB) and minimize the energy that must be absorbed following a loss of coolant accident (LOCA). This can be accomplished either automatically or manually.

The protection and monitoring functions of the RPS have been designed to ensure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as LCOs on other reactor system parameters and equipment performance. The LSSS are defined in this Specification as the Allowable Values, which, in conjunction with the LCOs, establish the threshold for protective system action to prevent exceeding acceptable limits, including Safety Limits (SLs) during Design Basis Accidents (DBAs)and transients.

The RPS, as described in the UFSAR, Section 7.2 (Ref. 1), includes sensors, relays, bypass circuits, and switches that are necessary to cause initiation of a reactor scram. Functional diversity is provided by monitoring a wide range of dependent and independent parameters. The input parameters to the scram logic are from instrumentation that monitors reactor vessel water level, reactor vessel pressure, neutron flux, main steam line isolation valve position, turbine control valve (TCV) fast closure, turbine stop valve (TSV) position, drywell pressure, and scram discharge volume (SDV) water level, as well as reactor mode switch in shutdown position and manual scram signals. There are at least four redundant sensor input signals from each of these parameters (with the exception of the reactor mode switch in shutdown scram signal and the manual scram signal). Most channels include instrumentation that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs an RPS trip signal to the trip logic.

The RPS is comprised of two independent trip systems (A and B) with three logic channels in each trip system (logic channels A1, A2, and A3; B1, B2, and B3) as shown in Reference 1 figures. Logic channels A1, A2, B1, and B2 contain automatic logic for which the above monitored parameters each have at least one input to each of these logic channels. The outputs of the logic channels in a trip system are combined in a one-out-of-two logic so that either channel can trip the associated trip system. The tripping of both trip systems will produce a reactor scram. This logic arrangement is referred to as a one-out-of-two taken twice logic. In addition to the automatic logic channels, logic channels A3 and B3 (one logic channel per trip system) are manual scram channels. Both must be deenergized in order to initiate the manual trip function. Each trip system can be reset by use of a reset switch. If a full scram occurs (both trip systems trip), a relay prevents reset of the trip systems for 10 seconds after the full scram signal is received. This 10 second delay on reset ensures that the scram function will be completed.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

BACKGROUND (continued)

One scram pilot valve with two scram valves are located in the hydraulic control unit for each control rod drive (CRD). Each scram pilot valve has two solenoids with the solenoids normally energized. The scram pilot valves control the air supply to the scram inlet and outlet valves for the associated CRD. When either scram pilot valve solenoid is energized, air pressure holds the scram valves closed and, therefore, both scram pilot valve solenoids must be de-energized to cause a control rod to scram. The scram valves control the supply and discharge paths for the CRD water during a scram. One of the scram pilot valve solenoids for each CRD is controlled by trip system A, and the other solenoid is controlled by trip system B. Any trip of trip system A in conjunction with any trip in trip system B results in de-energizing both solenoids, air bleeding off, scram valves opening, and control rod scram.

The backup scram valves, which energize on a scram signal to depressurize the scram air header, are also controlled by the RPS. Additionally, the RPS System controls the SDV vent and drain valves such that when both trip systems trip, the SDV vent and drain valves close to isolate the SDV.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The actions of the RPS are assumed in the safety analyses of References 1, 2, and 3. The RPS initiates a reactor scram when monitored parameter values exceed the trip values, specified by the setpoint methodology and listed in Table 3.1.1 to preserve the integrity of the fuel cladding, the RCPB, and the containment by minimizing the energy that must be absorbed following a LOCA.

RPS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). Trip Functions not specifically credited in the accident analysis are retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

The operability of the RPS is dependent on the operability of the individual instrumentation channel Trip Functions specified in Table 3.1.1. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.1.1. As a result, for most Trip Functions, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. Since the APRM flow biased flux scram Trip Setting is an Allowable Value, it is only considered inoperable if its actual trip setpoint is not within the Trip Setting specified in Table 3.1.1 The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions. Each channel must also respond within its assumed response time, where applicable.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The operability of scram pilot valves and associated solenoids, backup scram valves, and SDV valves, described in the Background section, are not addressed by this LCO.

The individual Trip Functions are required to be operable in the MODES or other specified conditions indicated in Table 3.1.1, which may require an RPS trip to mitigate the consequences of a design basis accident or transient. To ensure a reliable scram function, a combination of Trip Functions is required in each MODE to provide primary and diverse initiation signals.

The RPS is required to be operable in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, and in Refuel with reactor coolant temperature $\leq$ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies. Control rods withdrawn from a core cell containing no fuel assemblies do not affect the reactivity of the core and, therefore, are not required to have the capability to scram. Provided all other control rods remain inserted, the RPS function is not required. In this condition, the required Shutdown Margin and refuel position one-rod-out interlock ensure that no event requiring RPS will occur. During normal operation in HOT SHUTDOWN and COLD SHUTDOWN, all control rods are fully inserted and the Reactor Mode Switch Shutdown Position control rod withdrawal block does not allow any control rod to be withdrawn. Under these conditions, the RPS function is not required to be operable.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

1. Reactor Mode Switch in Shutdown

The Reactor Mode Switch in Shutdown Trip Function provides signals, via the manual scram logic channels, to two RPS logic channels, which are redundant to the automatic protective instrumentation channels and provide manual reactor trip capability. This Trip Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

The reactor mode switch is a single switch with two channels, each of which provides input into one of the manual RPS logic channels (A3 and B3). The reactor mode switch is capable of scramming the reactor if the mode switch is placed in the shutdown position.

There is no Trip Setting for this Trip Function, since the channels are mechanically actuated based solely on reactor mode switch position.

Two channels of Reactor Mode Switch in Shutdown, with one channel in trip channel A3 and one channel in trip channel B3 are available and required to be operable. The Reactor Mode Switch in Shutdown Trip Function is required to be

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

operable in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, and in Refuel with reactor coolant temperature ≤ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies, since these are the MODES and other specified conditions when control rods are withdrawn.

2. Manual Scram

The Manual Scram push button channels provide signals to the manual scram logic channels (A3 and B3), which are redundant to the automatic protective instrumentation channels and provide manual reactor trip capability. This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

There is one Manual Scram push button channel for each RPS trip system. In order to cause a scram it is necessary for each trip system to be actuated.

There is no Trip Setting for this Trip Function since the channels are mechanically actuated based solely on the position of the push buttons.

Two channels of Manual Scram with one channel in trip channel A3 and one channel in trip channel B3 are available and required to be operable in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, and in Refuel with reactor coolant temperature ≤ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies, since these are the MODES and other specified conditions when control rods are withdrawn.

3.a. Intermediate Range Monitor High Flux

The IRMs monitor neutron flux levels from the upper range of the source range monitor (SRM) to the lower range of the average power range monitors (APRMs). The IRMs are capable of generating trip signals that can be used to prevent fuel damage resulting from abnormal operating transients in the intermediate power range. In this power range, the most significant source of reactivity change is due to control rod withdrawal. The IRMs provide diverse protection from the rod worth minimizer (RWM), which monitors and controls the movement of control rods at low power. The RWM prevents the withdrawal of an out of sequence control rod during startup that could result in an unacceptable neutron flux excursion. The IRMs provide mitigation of the neutron flux excursion. To demonstrate the capability of the IRM System to mitigate control rod withdrawal events, a generic analysis has been performed (Ref. 3) to evaluate the consequences of control rod withdrawal events during startup. This analysis, which assumes that one IRM channel in each trip system

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

is bypassed, demonstrates that the IRMs provide protection against local control rod withdrawal errors and results in peak fuel enthalpy below the 170 cal/gm fuel failure threshold criterion (Ref. 4).

The IRMs are also capable of limiting other reactivity excursions during startup, such as cold water injection events, although no credit is specifically assumed.

The IRM System is divided into two groups of IRM channels, with three IRM channels inputting to each trip system. The analysis of Reference 3 assumes that one channel in each trip system is bypassed. Therefore, four channels with two channels in each trip system are required for IRM operability to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal. This trip is active in each of the 10 ranges of the IRM, which must be selected by the operator to maintain the neutron flux within the monitored level of an IRM range.

The analysis of Reference 3 has adequate conservatism to permit the IRM Trip Setting of 120 divisions of a 125 division scale.

The Intermediate Range Monitor High Flux Trip Function must be operable during STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F when control rods may be withdrawn and the potential for criticality exists. In Refuel with reactor coolant temperature ≤ 212°F, when a cell with fuel has its control rod withdrawn, the IRMs provide monitoring for and protection against unexpected reactivity excursions. In RUN, the APRM System, the RWM, and the Rod Block Monitor provide protection against control rod withdrawal error events and the IRMs are not required.

3.b. Intermediate Range Monitor Inop

This trip signal provides assurance that a minimum number of IRMs are operable. Anytime an IRM mode switch is moved to any position other than "Operate," the detector voltage drops below a preset level, or when a module is not plugged in, an inoperative trip signal will be received by the RPS unless the IRM is bypassed. Since only one IRM in each trip system may be bypassed, only one IRM in each RPS trip system may be inoperable without resulting in an RPS trip signal.

This Trip Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

Four channels of Intermediate Range Monitor Inop with two channels in each trip system are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Since this Trip Function is not assumed in the safety analysis, there is no Trip Setting for this Trip Function.

This Trip Function is required to be operable when the Intermediate Range Monitor High Flux Trip Function is required.

4.a. Average Power Range Monitor High Flux (Flow Bias)

The Average Power Range Monitor (APRM) channels receive input from the Local Power Range Monitors (LPRMs) within the reactor core, which provide indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide continuous indication of average reactor power from a few percent to greater than Rated Thermal Power. The Average Power Range Monitor High Flux (Flow Bias) Trip Function monitors neutron flux relative to the reactor coolant flow. The trip level is varied as a function of recirculation drive flow (i.e., at lower core flows, the setpoint is reduced proportional to the reduction in power experienced as core flow is reduced with a fixed control rod pattern) and is clamped at an upper limit. The relationship between recirculation drive flow and reactor core flow is non-linear at low core flows. Due to stability concerns, separate APRM flow biased scram trip setting equations are provided for low core flows. The flow bias portion of the Average Power Range Monitor High Flux (Flow Bias) Trip Function is not specifically credited in the accident or transient analyses, but is included to provide protection against transients where Thermal Power increases slowly and to provide protection against power oscillations which may result from reactor thermal hydraulic instabilities. However, the clamp portion of the Average Power Range Monitor High Flux (Flow Bias) Trip Function is assumed to terminate the main steam isolation valve closure event and along with the safety/relief valves (S/RVs) limits the RPV pressure to less than the ASME Code limits. The control rod drop accident (CRDA) analysis also takes credit for the clamp portion of this Trip Function to terminate the CRDA.

The APRM System is divided into two groups of channels with three APRM channels inputting into each trip system. The system is designed to allow one channel in each trip system to be bypassed. Any one APRM channel in a trip system can cause the associated trip system to trip. Four channels of Average Power Range Monitor High Flux (Flow Bias) with two channels in each trip system arranged in a one-out-of-two logic are required to be operable to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least 13 LPRM inputs are required for each APRM channel, with at least two LPRM inputs from each of the levels at which the LPRMs are located, except that channels A, C, D and F may lose all APRM inputs from the companion APRM cabinet plus one additional LPRM input and still be considered operable. The LPRMs, themselves, do not provide a scram signal. Each APRM channel receives one total drive flow signal representative of total core flow. The total drive flow signals are generated by two flow converters, one

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

of which supplies signals to the trip system A APRMs, while the other supplies signals to the trip system B APRMs. Each flow converter signal is provided by summing up a flow signal from the two recirculation loops. Each required Average Power Range Monitor High Flux (Flow Bias) channel requires an input from one operable flow converter (e.g., if a converter unit is inoperable, the associated Average Power Range Monitor High Flux (Flow Bias) channels must be considered inoperable). An APRM flow converter is considered inoperable whenever it cannot deliver a flow signal less than or equal to actual recirculation flow conditions for all steady state and transient reactor conditions while in RUN.

The APRM flow biased flux scram Trip Setting is an Allowable Value, which is the limiting value that the trip setpoint may have when tested periodically, beyond which appropriate action shall be taken. For Vermont Yankee, the periodic testing is defined as the calibration. The actual scram trip is conservatively set in relation to the Allowable Value to ensure operability between periodic testing. The Trip Setting is derived from the Analytical Limit assumed in the CRDA analyses. W is percent of rated two loop drive flow where 100% rated drive flow is that flow equivalent to 48 X 10^6 lbs/hr core flow.

The Average Power Range Monitor High Flux (Flow Bias) Trip Function is required to be operable in RUN where there is a possibility of generating excessive Thermal Power and potentially exceeding the SL applicable to high pressure and core flow conditions (SL 1.1.A) and where there is the possibility of neutronic/thermal hydraulic instability. During STARTUP/HOT STANDBY and Refuel, other IRM and APRM Trip Functions provide protection for fuel cladding integrity. Although the Average Power Range Monitor High Flux (Flow Bias) Trip Function is assumed in the CRDA analysis, which is applicable in STARTUP/HOT STANDBY, the Average Power Range Monitor High Flux (Reduced) Trip Function conservatively bounds the assumed trip and, together with the assumed IRM trips, provides adequate protection. Therefore, the Average Power Range Monitor High Flux (Flow Bias) Trip Function is not required in STARTUP/HOT STANDBY.

4.b. Average Power Range Monitor High Flux (Reduced)

The APRM channels receive input signals from the LPRMs within the reactor core, which provide an indication of the power distribution and local power changes. The APRM channels average these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than Rated Thermal Power. For operation at low power (i.e., STARTUP/HOT STANDBY), the Average Power Range Monitor High Flux (Reduced) Trip Function is capable of generating a trip signal that prevents fuel damage resulting from abnormal operating transients in this power range. For most operation at low power levels, the Average Power Range Monitor High Flux (Reduced) Trip Function will provide a secondary scram to the Intermediate Range Monitor High Flux Trip Function because of the relative setpoints. With the IRMs at Range 9 or 10, it is possible that the Average Power Range Monitor High Flux (Reduced) Trip

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Function will provide the primary trip signal for a core-wide increase in power.

No specific safety analyses take direct credit for the Average Power Range Monitor High Flux (Reduced) Trip Function. However, the Average Power Range Monitor High Flux (Reduced) Trip Function indirectly ensures that before the reactor mode switch is placed in the run position, reactor power does not exceed 25% RTP (SL 1.1.B) when operating at low reactor pressure and low core flow. Therefore, it indirectly prevents fuel damage during significant reactivity increases with reactor power < 25% Rated Thermal Power.

The APRM System is divided into two groups of channels with three APRM channel inputs to each trip system. The system is designed to allow one channel in each trip system to be bypassed. Any one APRM channel in a trip system can cause the associated trip system to trip. Four channels of Average Power Range Monitor High Flux (Reduced) with two channels in each trip system are required to be operable to ensure that no single failure will preclude a scram from this Trip Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least 13 LPRM inputs are required for each APRM channel, with at least two LPRM inputs from each of the levels at which the LPRMs are located, except that channels A, C, D and F may lose all APRM inputs from the companion APRM cabinet plus one additional LPRM input and still be considered operable. The LPRMs, themselves, do not provide a scram signal.

The Trip Setting is based on preventing significant increases in power when reactor power is < 25% Rated Thermal Power.

The Average Power Range Monitor High Flux (Reduced) Trip Function must be operable during STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F when control rods may be withdrawn since the potential for criticality exists. In RUN, the Average Power Range Monitor High Flux (Flow Bias) Trip Functions provide protection against reactivity transients and the RWM and Rod Block Monitor protect against control rod withdrawal error events.

4.c. Average Power Range Monitor Inop

This signal provides assurance that a minimum number of APRMs are operable. Anytime an APRM mode switch is moved to any position other than "Operate," an APRM module is unplugged, or the APRM has too few LPRM inputs (< 13 for channels B and E; < 9 for channels A, C, D and F), an inoperative trip signal will be received by the RPS, unless the APRM is bypassed. Since only one APRM in each trip system may be bypassed, only one APRM in each trip system may be inoperable without resulting in an RPS trip signal. This Trip Function was not specifically credited in the accident analysis, but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Four channels of Average Power Range Monitor Inop with two channels in each trip system are required to be operable to ensure that no single failure will preclude a scram from this Trip Function on a valid signal.

There is no Trip Setting for this Trip Function.

This Trip Function is required to be operable in the MODES where the APRM Trip Functions are required.

5. High Reactor Pressure

An increase in RPV pressure during reactor operation compresses the steam voids and results in a positive reactivity insertion. This causes the neutron flux and Thermal Power transferred to the reactor coolant to increase, which could challenge the integrity of the fuel cladding and the RCPB. The High Reactor Pressure Trip Function initiates a scram for transients that result in a pressure increase, counteracting the pressure increase by rapidly reducing core power. For the overpressurization protection analyses of Reference 5, reactor scram (the analyses conservatively assume scram from the APRM High Flux (Flow Bias) signal, not the High Reactor Pressure signal), along with the S/RVs, limits the peak RPV pressure to less than the ASME Section III Code limits.

High reactor pressure signals are initiated from four pressure transmitters that sense reactor pressure. The High Reactor Pressure Trip Setting is chosen to provide a sufficient margin to the ASME Section III Code limits during the event.

Four channels of High Reactor Pressure Trip Function, with two channels in each trip system arranged in a one-out-of-two logic, are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal. The Function is required to be operable in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F since the Reactor Coolant System (RCS) is pressurized and the potential for pressure increase exists.

6. High Drywell Pressure

High pressure in the drywell could indicate a break in the RCPB. A reactor scram is initiated to minimize the possibility of fuel damage and to reduce the amount of energy being added to the coolant and the drywell. The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the ECCS, ensures that the requirements of 10 CFR 50.46 are met.

High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Trip Setting was selected to be as low as possible and indicative of a LOCA inside primary containment.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Four channels of High Drywell Pressure, with two channels in each trip system arranged in a one-out-of-two logic, are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal. The Trip Function is required in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, where considerable energy exists in the RCS, resulting in the limiting transients and accidents.

7. Reactor Low Water Level

Low RPV water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, a reactor scram is initiated at low water level to substantially reduce the heat generated in the fuel from fission. The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the Emergency Core Cooling Systems (ECCS), ensures that requirements of 10 CFR 50.46 are met.

Reactor Low Water Level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

Four channels of Reactor Low Water Level Trip Function, with two channels in each trip system arranged in a one-out-of-two logic, are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal.

The Reactor Low Water Level Trip Setting is selected to ensure that during normal operation spurious scrams are avoided and that enough water is available above the top of enriched fuel to account for evaporative losses and displacements of coolant following the most severe abnormal operational transient involving a reactor water level decrease. The Trip Setting is referenced from top of enriched fuel. The top of enriched fuel has been designated as 0 inches and provides a common reference point for all reactor vessel water level instrumentation.

The Trip Function is required in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F where considerable energy exists in the RCS resulting in the limiting transients and accidents. ECCS initiations at low water levels provide sufficient protection for level transients in all other MODES.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

8. Scram Discharge Volume High Level

The SDV receives the water displaced by the motion of the CRD pistons during a reactor scram. Should this volume fill to a point where there is insufficient volume to accept the displaced water, control rod insertion would be hindered. Therefore, a reactor scram is initiated while the remaining free volume is still sufficient to accommodate the water from a full core scram. No credit is taken for a scram initiated from these Trip Functions for any of the design basis accidents or transients analyzed in the UFSAR. However, they are retained to ensure the RPS remains operable.

There are four level transmitters and trip units associated with each instrument volume. Four trip units (two for each instrument volume) are provided for each RPS trip system. On a per instrument volume basis, these trip units are arranged in pairs so that no single event will prevent a scram from this Trip Function on a valid signal.

The Trip Setting is chosen low enough to ensure that there is sufficient volume in the SDVs to accommodate the water from a full scram.

Eight channels of the Scram Discharge Volume High Level Trip Function, with two channels per volume in each trip system, are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal. These Trip Functions are required in RUN, STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, and in Refuel with reactor coolant temperature $\leq$ 212°F and any control rod withdrawn from a core cell containing one or more fuel assemblies, since these are the MODES and other specified conditions when control rods are withdrawn. At all other times, this Trip Function may be bypassed.

9. Main Steamline Isolation Valve Closure

Main steamline isolation valve (MSIV) closure results in loss of the main turbine and the condenser as a heat sink for the nuclear steam supply system and indicates a need to shut down the reactor to reduce heat generation. Therefore, a reactor scram is initiated on a Main Steamline Isolation Valve Closure signal before the MSIVs are completely closed in anticipation of the complete loss of the normal heat sink and subsequent overpressurization transient. However, for the overpressurization protection analyses of Reference 5, the Average Power Range Monitor High Flux (Flow Bias) Trip Function, along with the S/RVs, limits the peak RPV pressure to less than the ASME Code limits. That is, the direct scram on position switches for MSIV closure events is not assumed in the overpressurization analysis.

The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the ECCS, ensures that the requirements of 10 CFR 50.46 are met.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MSIV closure signals are initiated from position switches located on each of the eight MSIVs. Each MSIV has two position switches; one switch inputs to RPS trip system A while the other switch inputs to RPS trip system B. Thus, each RPS trip system receives an input from eight Main Steamline Isolation Valve Closure channels, each consisting of one position switch. The logic for the Main Steam Isolation Valve Closure Trip Function is arranged such that either the inboard or outboard valve on three or more of the main steam lines must close in order for a scram to occur. In addition, certain combinations of valves closed in two lines will result in a half-scram.

The Main Steam Isolation Valve Closure Trip Setting is specified to ensure that a scram occurs prior to a significant reduction in steam flow, thereby reducing the severity of the subsequent pressure transient.

Sixteen channels of the Main Steam Isolation Valve Closure Trip Function, with eight channels in each trip system, are required to be operable to ensure that no single instrument failure will preclude the scram from this Trip Function on a valid signal. This Trip Function is only required in RUN since, with the MSIVs open and the heat generation rate high, a pressurization transient can occur if the MSIVs close. In STARTUP/HOT STANDBY and Refuel with reactor coolant temperature > 212°F, the heat generation rate is low enough so that the other diverse RPS functions provide sufficient protection.

10. Turbine Control Valve Fast Closure

Fast closure of the TCVs results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated on TCV fast closure in anticipation of the transients that would result from the closure of these valves. The Turbine Control Valve Fast Closure Trip Function is the primary scram signal for the generator load rejection event analyzed in Reference 6. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the MCPR SL (SL 1.1.A) is not exceeded.

Turbine Control Valve Fast Closure signals are initiated by the four pressure switches that sense acceleration relay oil pressure. Each pressure switch provides a signal to a separate RPS logic channel. This Trip Function must be enabled at Thermal Power > 30% Rated Thermal Power. This is accomplished automatically by pressure switches sensing turbine first stage pressure; therefore, opening of the turbine bypass valves may affect this Trip Function.

The Turbine Control Valve Fast Closure Trip Setting is selected to detect imminent TCV fast closure.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Four channels of Turbine Control Valve Fast Closure with two channels in each trip system arranged in a one-out-of-two logic are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal. This Trip Function is required, consistent with the analysis assumptions, whenever Thermal Power is > 30% Rated Thermal Power. This Trip Function is not required when Thermal Power is ≤ 30% Rated Thermal Power, since the High Reactor Pressure and the Average Power Range Monitor High Flux (Flow Bias) Trip Functions are adequate to maintain the necessary safety margins.

11. Turbine Stop Valve Closure

Closure of the TSVs results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated at the start of TSV closure in anticipation of the transients that would result from the closure of these valves. The Turbine Stop Valve Closure Trip Function is the primary scram signal for the turbine trip event analyzed in Reference 7. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the MCPR SL (SL 1.1.A) is not exceeded.

Turbine Stop Valve Closure signals are initiated from limit switches located on each of the four TSVs. Each TSV has one limit switch with two contacts; one contact inputs to RPS trip system A; the other contact inputs to RPS trip system B. Thus, each RPS trip system receives an input from four Turbine Stop Valve Closure channels, each consisting of one limit switch contact. The logic for the Turbine Stop Valve Closure Trip Function is such that three or more TSVs must be closed to produce a scram. In addition, certain combinations of two valves closed will result in a half-scram. This Function must be enabled at Thermal Power > 30% Rated Thermal Power. This is accomplished automatically by pressure switches sensing turbine first stage pressure; therefore, opening of the turbine bypass valves may affect this Trip Function.

The Turbine Stop Valve Closure Trip Setting is selected to be high enough to detect imminent TSV closure, thereby reducing the severity of the subsequent pressure transient.

Eight channels of Turbine Stop Valve Closure, with four channels in each trip system, are required to be operable to ensure that no single instrument failure will preclude a scram from this Trip Function on a valid signal if any three TSVs should close. This Trip Function is required, consistent with analysis assumptions, whenever Thermal Power is > 30% Rated Thermal Power. This Trip Function is not required when Thermal Power is ≤ 30% Rated Thermal Power since the High Reactor Pressure and the Average Power Range Monitor High Flux (Flow Bias) Trip Functions are adequate to maintain the necessary safety margins.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

ACTIONS

Table 3.1.1 ACTION Notes 1.a.1) and 1.a.2)

Because of the diversity of sensors available to provide trip signals and the redundancy of the RPS design, an allowable out of service time of 12 hours has been shown to be acceptable (Ref. 8) to permit restoration of any inoperable channel to operable status. However, this out of service time is only acceptable provided the associated Trip Function's inoperable channels are in only one trip system and the Trip Function still maintains RPS trip capability (refer to Bases for Table 3.1.1 ACTION Notes 1.b.1), 1.b.2), and 1.c.1)). If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Table 3.1.1 ACTION Note 1.a.1) or 1.a.2). Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), the applicable action of Table 3.1.1 ACTION Note 2 must be taken.

Table 3.1.1 ACTION Notes 1.b.1) and 1.b.2)

Table 3.1.1 ACTION Notes 1.b.1) and 1.b.2) apply when, for any one or more Trip Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is operable, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system.

Table 3.1.1 ACTION Notes 1.b.1) and 1.b.2) limit the time the RPS scram logic, for any Trip Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel Trip Function). The reduced reliability of this logic arrangement was not evaluated in Reference 8 for the 12 hour Completion Time. Within the 6 hour allowance, the associated Trip Function will have all required channels operable or in trip (or any combination) in one trip system. This is accomplished by either placing all inoperable channels in trip or tripping the trip system.

Completing one of these Actions (either Table 3.1.1 ACTION Note 1.b.1) or 1.b.2)) restores RPS to a reliability level equivalent to that evaluated in Reference 8, which justified a 12 hour allowable out of service time as presented in Table 3.1.1 ACTION Note 1.a.1) and 1.a.2). The trip system in the more degraded state should be placed in trip or, alternatively, all the inoperable channels in that trip system should be placed in trip (e.g., a trip system with two inoperable channels could be in a more degraded state than a trip system with four inoperable channels if the two inoperable channels are in the same Trip Function while the four inoperable channels are all in

ACTIONS (continued)

different Trip Functions). The decision of which trip system is in the more degraded state should be based on prudent judgment and take into account current plant conditions (i.e., what Mode the plant is in). If this action would result in a scram, it is permissible to place the other trip system or its inoperable channels in trip.

The 6 hour Completion Time is judged acceptable based on the remaining capability to trip, the diversity of the sensors available to provide the trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Trip Functions, and the low probability of an event requiring the initiation of a scram.

Alternately, if it is not desired to place the inoperable channels (or one trip system) in trip (e.g., as in the case where placing the inoperable channel or associated trip system in trip would result in a scram, the applicable actions of Table 3.1.1 ACTION Note 2 must be taken.

Table 3.1.1 ACTION Note 1.c.1)

Table 3.1.1 ACTION Note 1.c.1) is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same trip system for the same Trip Function result in the Trip Function not maintaining RPS trip capability. A Trip Function is considered to be maintaining RPS trip capability when sufficient channels are operable or in trip (or the associated trip system is in trip), such that both trip systems will generate a trip signal from the given Trip Function on a valid signal. For the typical Trip Function with one-out-of-two taken twice logic and the IRM and APRM Functions, this would require both trip systems to have one channel operable or in trip (or the associated trip system in trip). For Trip Function 1 (Reactor Mode Switch in Shutdown) and Trip Function 2 (Manual Scram), this would require both trip systems to have one channel, each operable or in trip (or the associated trip system in trip). For Trip Function 8 (Scram Discharge Volume High Level), this would require both trip systems to have one channel per instrument volume operable or in trip (or the associated trip system in trip). For Trip Function 9 (Main Steamline Isolation Valve Closure), this would require both trip systems to have each channel associated with the MSIVs in three main steam lines (not necessarily the same main steam lines for both trip systems) operable or in trip (or the associated trip system in trip). For Trip Function 11 (Turbine Stop Valve Closure), this would require both trip systems to have three channels, each operable or in trip (or the associated trip system in trip).

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

ACTIONS (continued)

Table 3.1.1 ACTION Notes 2.a, 2.b, 2.c and 2.d

If any applicable Action and associated completion time of Table 3.1.1 ACTION Note 1.a, 1.b, or 1.c are not met, the applicable Actions of Table 3.1.1 ACTION Note 2 and referenced in Table 3.1.1 (as identified for each Trip Function in the Table 3.1.1 "ACTIONS REFERENCED FROM ACTION NOTE 1" column) must be immediately entered and taken. The applicable Action specified in Table 3.1.1 is Trip Function and Mode or other specified condition dependent.

For Table 3.1.1 ACTION Note 2.a, 2.b, or 2.c, if the applicable channel(s) is not restored to operable status or placed in trip (or the associated trip system placed in trip) within the allowed completion time, the plant must be placed in a Mode or other specified condition in which the LCO does not apply. The allowed completion times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems.

For Table 3.1.1 ACTION Note 2.d, if the applicable channel(s) is not restored to operable status or placed in trip (or the associated trip system placed in trip) within the allowed completion time, the plant must be placed in a Mode or other specified condition in which the LCO does not apply. This is done by immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.1.A.1

As indicated in Surveillance Requirement 4.1.A.1, RPS instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.1.1. Table 4.1.1 identifies, for each RPS Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.1.A.1 also indicates that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours, provided the associated Trip Function maintains RPS trip capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

SURVEILLANCE REQUIREMENTS (continued)

analysis (Ref. 8) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

Surveillance Requirement 4.1.A.2, Automatic Scram Contactor Functional Test

There are four pairs of RPS automatic scram contactors with each pair associated with an RPS scram test switch. Each pair of scram contactors is associated with an automatic scram logic channel (A1, A2, B1, and B2). Using the RPS channel test switches, the automatic scram contactors can be exercised without the necessity of using a scram function trip. However, a Functional Test of any automatic RPS Trip Function may be used to satisfy the requirement to exercise the RPS automatic scram contactors. Surveillance Frequency extensions for RPS Functions, described in Reference 8, are allowed provided the automatic scram contactors are exercised weekly. This Surveillance may be accomplished by placing the associated RPS scram test switch in the trip position, which will deenergize a pair of RPS automatic scram contactors thereby tripping the associated RPS logic channel.

The RPS scram test switches were not specifically credited in the accident analysis. However, because the Manual Scram Trip Functions at the Vermont Yankee Nuclear Power Station (VYNPS) were not configured the same as the generic model in Reference 8, the RPS scram test switches were evaluated and it was concluded that the Frequency extensions for RPS Trip Functions are not affected by the difference in RPS configuration since each automatic RPS channel has a test switch which is functionally the same as the manual scram switches in the generic model. As such, exercising each automatic scram contactor is required to be performed every 7 days. The Frequency of 7 days is based on the reliability analysis of Reference 8 as modified by the VYNPS design specific RPS evaluation.

Surveillance Requirement 4.1.A.3, RPS Response Time Test

This Surveillance Requirement ensures that the individual channel response times are less than or equal to 50 milliseconds. This test may be performed in one measurement or in overlapping segments, with verification that all required components are tested. The "Once every Operating Cycle" Frequency is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

SURVEILLANCE REQUIREMENTS (continued)

Surveillance Requirement 4.1.A.4

The Logic System Functional Test demonstrates the operability of the required initiation logic and simulated automatic operation for a specific channel. The testing required by the Control Rod System Technical Specifications overlaps this Surveillance to provide testing of the assumed safety function. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillancae were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.1.1, Check

Performance of an Instrument Check once per day for Trip Functions 3.a, 5, and 7, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Footnote (a) of Table 4.1.1 provides requirements to verify overlap for Trip Functions 3.a and 4.b to ensure that no gaps in neutron flux indication exist from subcritical to power operation for monitoring core reactivity status. The overlap between SRMs and IRMs is required to be demonstrated to ensure that reactor power will not be increased into a neutron flux region without adequate indication. This is required prior to withdrawing SRMs from the fully inserted position since indication is being transitioned from the SRMs to the IRMs. The overlap between IRMs and APRMs is of concern when reducing power into the IRM range. On power increases, the system design will prevent further increases (by initiating a rod block) if adequate overlap is not maintained. Overlap between IRMs and APRMs exists when sufficient IRMs and APRMs concurrently have onscale readings such that the transition between RUN and STARTUP/HOT STANDBY can be made without either APRM downscale rod block, or IRM upscale rod block. Overlap between SRMs and IRMs similarly exists when,

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SURVEILLANCE REQUIREMENTS (continued)

prior to withdrawing the SRMs from the fully inserted position, IRMs are above mid-scale on range 1 before SRMs have reached the upscale rod block. As noted, IRM/APRM overlap is only required to be met during entry into STARTUP/HOT STANDBY from RUN. That is, after the overlap requirement has been met and indication has transitioned to the IRMs, maintaining overlap is not required (APRMs may be reading downscale once in STARTUP/HOT STANDBY). If overlap for a group of channels is not demonstrated (e.g., IRM/APRM overlap), the reason for the failure of the Surveillance should be determined and the appropriate channel(s) declared inoperable. Only those appropriate channels that are required in the current MODE or condition should be declared inoperable. A Frequency of 7 days is reasonable based on engineering judgment and the reliability of the IRMs and APRMs.

Table 4.1.1, Functional Test

A Functional Test is performed on each required channel to ensure that the channel will perform the intended function. For Trip Function 1, this Surveillance is performed by placing the reactor mode switch in the shutdown position. For Trip Functions 2, 3.a, 3.b, 5, 6, 7, 8, 9, 10, 10.a, 11, and 11.a, this Surveillance verifies the trip of the required channel. For Trip Functions 4.a, 4.b, and 4.c, this Surveillance verifies the trip of the required output relay. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

For Trip Functions 3.a, 3.b, and 4.b, as noted (Table 4.1.1 Footnote (b)), the Functional Test is not required to be performed when entering STARTUP/HOT STANDBY from RUN, since testing of the STARTUP/HOT STANDBY required IRM and APRM Trip Functions cannot be performed in RUN without utilizing jumpers, lifted leads, or movable links. This allows entry into STARTUP/HOT STANDBY if the 7 day Frequency is not met. In this event, the Surveillance must be performed within 12 hours after entering STARTUP/HOT STANDBY from RUN. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the Surveillance.

For Trip Functions 3.a, 3.b and 4.b, a Frequency of 7 days provides an acceptable level of system average unavailability over the Frequency interval.

For Trip Functions 2, 4.a, 4.c, 5, 6, 7, 8, 9, 10, and 11, the Frequency of "Every 3 Months" is based on the reliability analysis of Reference 8.

For Trip Functions 10.a and 11.a, the Frequency of "Every 6 Months" is based in engineering judgment and reliability of the components.

For Trip Function 1, The Frequency of "Each Refueling Outage" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has

SURVEILLANCE REQUIREMENTS (continued)

demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.1.1, Calibration

For Trip Function 4.a, to ensure that the APRMs are accurately indicating the true core average power, the APRMs are adjusted to conform to the reactor power calculated from a heat balance. The Frequency of once per 7 days is based on minor changes in LPRM sensitivity, which could affect the APRM reading between performances of APRM adjustments (per heat balance). Footnote (d) to Table 4.1.1 requires this heat balance Surveillance to be performed only at ≥ 25% Rated Thermal Power because it is difficult to accurately maintain APRM indication of core Thermal Power consistent with a heat balance when < 25% Rated Thermal Power. At low power levels, a high degree of accuracy is unnecessary because of the large, inherent margin to thermal limits (MCPR and APLHGR). At ≥ 25% Rated Thermal Power, the Surveillance is required to have been satisfactorily performed within the last 7 days. Footnote (d) is provided which allows an increase in Thermal Power above 25% if the 7 day Frequency is not met. In this event, the Surveillance must be performed within 12 hours after reaching or exceeding 25% Rated Thermal Power. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the Surveillance.

For Trip Function 4.a, LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the APRM System. The 2000 mega-watt days per short ton (MWD/T) Frequency is based on operating experience with LPRM sensitivity changes, and that the resulting nodal power uncertainty, combined with other uncertainties, remains less than the total uncertainty (i.e., 8.7%) allowed by the GETAB safety limit analysis.

For Trip Functions 3.a, 4.a, 4.b, 5, 6, 7, 8, 9, 10, 10.a, 11, and 11.a, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The Instrument Calibration for Functions 9 and 11 should consist of a physical inspection and actuation of the associated position switches. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

SURVEILLANCE REQUIREMENTS (continued)

For Trip Functions 4.a, 5, 6, 7, and 8, a calibration of the trip units is required (Footnote (e)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. For Trip Functions 5,6,7, and 8, the channel must be declared inoperable if the trip setpoint is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The calibration of Trip Function 4.a, the APRM High Flux Flow Bias Scram, trip units provides a check of the actual trip setpoints. If the trip setting is found to be less conservative than accounted for in the appropriate setpoint calculation, but is not beyond the Allowable Value specified in Table 3.1.1, the channel performance is still within the requirements of the plant safety analysis. However, if the trip setting is found to be less conservative than the Allowable Value specified in Table 3.1.1, the channel should be declared inoperable. Under these conditions, the setpoint should be readjusted to be equal to or more conservative than accounted for in the appropriate setpoint calculation. The Frequency of every 3 months is based on the reliability analysis of Reference 8 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

Footnote (b) to Table 4.1.1 is provided to require the APRM and IRM Surveillances to be performed within 12 hours of entering STARTUP/HOT STANDBY from RUN. Testing of the STARTUP/HOT STANDBY APRM and IRM Trip Functions cannot be performed in RUN without utilizing jumpers, lifted leads, or movable links. This Footnote allows entry into STARTUP/HOT STANDBY from RUN if the associated Frequency is not met. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the Surveillance. Footnote (c) to Table 4.1.1 states that neutron detectors are excluded from Instrument Calibration because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in LPRM neutron detector sensitivity are compensated for by performing the 7 day heat balance calibration and the 2000 MWD/T LPRM calibration against the TIP System.

BASES: 3.1.A/4.1.A REACTOR PROTECTION SYSTEM

REFERENCES

1. UFSAR, Section 7.2.
2. UFSAR, Chapter 14.
3. NEDO-23842, Continuous Control Rod Withdrawal in the Startup Range, April 18, 1978.
4. UFSAR, Section 14.5.3.
5. UFSAR, Section 14.5.1.3.1
6. UFSAR, Section 14.5.1.1.
7. UFSAR, Section 14.5.1.2.
8. NEDC-30851-P-A, Technical Specification Improvement Analyses for BWR Reactor Protection System, March 1988.

Current

Technical Specifications

Markups

3.1 and 4.1 – Reactor Protection System

And related Technical Specifications:

Table of Contents

3.1 LIMITING CONDITIONS FOR OPERATION

3.1 REACTOR PROTECTION SYSTEM (RPS)

Applicability:

Applies to the operability of plant instrumentation and control systems required for reactor safety.

Objective:

To specify the limits imposed on plant operation by those instrument and control systems required for reactor safety.

Specification:

THE RPS instrumentation for each Trip function in Table 3.1.1 shall be operable

A. ~~Plant operation at any power level shall be permitted~~ in accordance with Table 3.1.1. The system response time from the opening of the sensor contact up to and including the opening of the scram solenoid relay shall not exceed 50 milliseconds. A.2 A.3

~~B. Deleted.~~

4.1 SURVEILLANCE REQUIREMENTS

4.1 REACTOR PROTECTION SYSTEM (RPS)

Applicability:

Applies to the surveillance of the plant instrumentation and control systems required for reactor safety.

Objective:

To specify the type and frequency of surveillance to be applied to those instrument and control systems required for reactor safety.

Specification:

A.1 RPS Instrumentation ~~systems~~ shall be checked, functionally tested and calibrated as indicated in Table~~s~~ 4.1.1. ~~and 4.1.2, respectively.~~ A.5 A.6

RPS testing shall also be performed as indicated in Surveillance Requirements 4.1.A.2 and 4.1.A.3.

~~B. Deleted.~~

ADD SR 4.1.A.2 A.7

ADD SR 4.1.A.3 A.3

When an RPS channel is placed in an inoperable status solely for the performance of required surveillances, entry into associated Limiting Conditions for Operations and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains RPS trip capability. A.8

ADD SR 4.1.A.4 LA.10

TABLE 3.1.1

REACTOR PROTECTION SYSTEM ~~(SCRAM)~~ INSTRUMENT ACTION ~~REQUIREMENTS~~

Trip Function	Trip Settings	Applicable Modes or Other Specified Conditions ~~Modes in Which Functions Must be Operating~~ Refuel (1) A.9	Startup/Hot Standby (12) M.1	Run	Required ~~Minimum Number Operating Instrument~~ Channels Per Trip System (2)	A.10 ~~Required ACTIONS When Minimum Conditions For Operation Are Not Satisfied (3)~~ Actions Referenced from Action Note 1
1. Mode Switch in Shutdown ~~(5A-S1)~~ LA.1		X	X	X	1	Note 2.a ~~A~~ Note 2.d L.1
2. Manual Scram ~~(5A-S3A/B)~~ LA.1		X	X	X	1	Note 2.a ~~A~~ Note 2.d L.1
3. IRM ~~(7-41(A-F))~~ LA.1						
a. High Flux	≤120/125	X	X		2	Note 2a ~~A~~ Note 2.d L.1
b. INOP		X	X		2	Note 2a ~~A~~ Note 2.d L.1
4. APRM ~~(APRM A-F)~~ LA.1						
a. High Flux (flow bias)	Two loop operation: ~~(A)~~ LA.5 S≤ 0.4W+ 61.10% for 0% < W ≤ 31.1% S≤ 1.28W+ 33.31% for 31.1% < W ≤ 54.0% S≤ 0.66W+ 67.28% for 54.0% < W ≤ 75.0% With a maximum of 117.0% power for W > 75.0% Single loop operation: ~~(A)~~ LA.5 S≤ 0.4W+ 58.09% for 0% < W ≤ 39.1% S≤ 1.28W+ 23.56% for 39.1% < W ≤ 61.9% S≤ 0.66W+ 62.10% for 61.9% < W ≤ 83.0% With a maximum of 117.0% power for W > 83.0%			X	2	A.14 ~~A or B~~ Note 2.b
b. High Flux (reduced)	≤15%	X	X		2	Note 2.a ~~A~~
c. INOP		X M.2	X	X	2(5) LA.6	~~A or B~~ Note 2.a M.3
5. High Reactor Pressure ~~(PT-2-3-55(A-D)(M))~~ LA.1	≤1055 psig	X	X	X	2	Note 2.a ~~A~~

A.1

Actions Referenced from Action Note 1

TABLE 3.1.1

INSTRUMENTATION

REACTOR PROTECTION SYSTEM ~~(SCRAM)~~ ~~INSTRUMENT~~ REQUIREMENTS
(Continued)

Trip Function	Trip Settings	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS — Modes in Which Functions Must be Operating: Refuel (1)	Startup/Hot Standby (12) M.1	Run	Required ~~Minimum Number Operating Instrument~~ Channels Per Trip System (2)	Required ACTIONS ~~When Minimum Conditions For Operation Are Not Satisfied~~ (3)
6. High Drywell Pressure ~~(PT-5-12(A-D) (M))~~ LA.1	≤2.5 psig	X A.9	X	X	2	~~A~~ Note 2.a
7. Reactor Low Water Level (6) LA.7 ~~(LT-2-3-57A/B(M)) (LT-2-3-58A/B(M))~~ LA.1	≥127.0 inches	X	X	X	2	~~A~~ Note 2.a
8. Scram Discharge Volume High Level ~~(LT-3-231(A-H) (M))~~ LA.1	≤21 gallons	X	X	X	2 (per volume)	~~A~~ Note 2.a; Note 2.d L.1
~~9. Deleted~~						
9 ~~10~~. Main steamline isolation valve closure ~~(POS-2-80A-A1,B1 POS-2-86A-A1,B1 POS-2-80B-A1,B2 POS-2-86B-A1,B2 POS-2-80C-A2,B1 POS-2-86C-A2,B1 POS-2-80D-A2,B2 POS-2-86D-A2,B2)~~ LA.1	≤10% valve closure			X	~~A~~ ~~8~~ A.11	~~A or C~~ Note 2.b L.3
10 ~~11~~. Turbine control valve fast closure ~~(PS-(37-40))~~ LA.1	(9) (10)			X A.12	2	A.14 ~~A or D~~ Note 2.c
11 ~~12~~. Turbine stop valve closure ~~(SVOS-5-(1-4))~~ LA.1	≤10% valve closure (10)			X A.12	~~2~~ 4 A.13	~~A or D~~ Note 2.c

A.1

TABLE 3.1.1 NOTES A.9

COOLANT

(b) ~~1.~~ ~~When the reactor is subcritical and~~ the reactor ~~water~~ temperature is less than 212°F, only the following trip functions need to be operable: L.1

OR EQUAL TO L.11

AND ANY CONTROL ROD WITHDRAWN FROM A CORE CELL CONTAINING ONE OR MORE FUEL ASSEMBLIES

a) mode switch in shutdown
b) manual scram
c) high flux IRM ~~or high flux SRM in coincidence~~ M.5
d) scram discharge volume high water level AND IRM INOP M.5

ACTION NOTE 1 FIRST SENTENCE → ~~2.~~ There shall be two operable or tripped trip systems for each Trip Function, except as provided for below: M.6

A.21 → ACTION NOTE 1.a → ~~a.~~ For each Trip Function with one less than the required minimum number of operable instrument channels, place the inoperable instrument channel and/or its associated trip system in the tripped condition* within 12 hours. ~~Otherwise, initiate the ACTION required by Table 3.1.1 for the Trip Function.~~ LA.4

~~b.~~ For each Trip Function with two or more channels less than the required minimum number of operable instrument channels:

ACTION NOTE 1.c → ~~1)~~ Within one hour, verify sufficient instrument channels remain operable or tripped* to maintain trip capability in the Trip Function, and LA.4

ACTION NOTE 1.b → ~~2)~~ Within 6 hours, place the inoperable instrument channel(s) in one trip system and/or that trip system** in the tripped condition*, and LA.4 LA.4 LA.4

A.21

~~3) Within 12 hours, restore the inoperable instrument channel(s) in the other trip system to an operable status, or place the inoperable instrument channel(s) in the trip system and/or that trip system in the tripped condition*.~~

ACTION NOTE 1 LAST SENTENCE → If any of these three conditions cannot be satisfied, initiate the ACTION required by Table 3.1.1 for the affected Trip Function.

* An inoperable instrument channel or trip system need not be placed in the tripped condition where this would cause the Trip Function to occur. In these cases, if the inoperable instrument channel is not restored to operable status within the required time, the ACTION required by Table 3.1.1 for that Trip Function shall be taken. LA.4

** This action applies to that trip system with the greatest number of inoperable instrument channels. If both systems have the same number of inoperable instrument channels, the ACTION can be applied to either trip system.

When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function maintains RPS trip capability. A.8

A.1

ACTION
TABLE 3.1.1 NOTES (Cont'd)

A.15

2 3. When the requirements in the column "Minimum Number of Operating Instrument Channels Per Trip System" cannot be met for one system, that system shall be tripped. If the requirements cannot be met for both trip systems, the appropriate ACTIONS listed below shall be taken:

PLACE THE REACTOR IN HOT SHUTDOWN L.2

a a) Initiate insertion of operable rods and complete insertion of all operable rods within four hours. (12)

b b) Reduce power level to IRM range and place mode switch in the "Startup/Hot Standby" position within eight hours. LA.2

c) Reduce turbine load and close main steam line isolation valves within 8 hours. L.3

c d) Reduce reactor power to less than 30% of rated within 8 hours. RATED THERMAL POWER OR EQUAL TO L.4

4. The specified APRM High Flux scram (flow bias) Trip Setting is an Allowable Value, which is the limiting value that the trip setpoint may have when tested periodically. The actual scram trip setting is conservatively set in relation to the Allowable Value. "W" is percent rated two loop drive flow where 100% rated drive flow is that flow equivalent to 48 x 10^6 lbs/hr core flow. LA.5

5. To be considered operable an APRM must have at least 2 LPRM inputs per level and at least a total of 13 LPRM inputs, except that channels A, C, D, and F may lose all LPRM inputs from the companion APRM Cabinet plus one additional LPRM input and still be considered operable. LA.6

6. The top of the enriched fuel has been designated as 0 inches and provides common reference level for all vessel water level instrumentation. LA.7

7. Deleted.

8. Deleted.

9. Channel signals for the turbine control valve fast closure trip shall be derived from the same event or events which cause the control valve fast closure.

10. Turbine stop valve closure and turbine control valve fast closure scram signals may be bypassed at <30% of reactor Rated Thermal Power. A.12 LA.8

11. Not used.

12. While performing refuel interlock checks which require the mode switch to be in Startup, the reduced APRM high flux scram need not be operable provided: M.1

a. The following trip functions are operable:

1. Mode switch in shutdown,
2. Manual scram,
3. High flux IRM scram
4. High flux SRM scram in noncoincidence,
5. Scram discharge volume high water level, and;

b. No more than two (2) control rods withdrawn. The two (2) control rods that can be withdrawn cannot be face adjacent or diagonally adjacent.

d. IMMEDIATELY INITIATE ACTION TO FULLY INSERT ALL INSERTABLE CONTROL RODS IN CORE CELLS CONTAINING ONE OR MORE FUEL ASSEMBLIES. L.1

A.1 A.6

VYNPS

REACTOR PROTECTION SYSTEM

TABLE 4.1.1

TESTS AND FREQUENCIES

~~SCRAM~~ INSTRUMENTATION AND LOGIC SYSTEMS FUNCTIONAL TESTS

MINIMUM FUNCTIONAL TEST FREQUENCIES FOR SAFETY INSTRUMENTATION, LOGIC SYSTEMS AND CONTROL CIRCUITS

TRIP FUNCTION Instrument Channel	Group (3)	Functional Test (7) LA.10	Minimum Frequency (4) A.17
1. Mode Switch in Shutdown	A	Place Mode Switch in Shutdown	Each Refueling Outage
2. Manual Scram	A	Trip Channel and Alarm L.7	Every 3 Months
3. IRM			
High Flux (2) M.7	C	Trip Channel and Alarm (8) A.19	Before Each Startup AND DURING EACH STARTUP M.8 & Weekly During Refueling (6)
Inoperative	C	Trip Channel and Alarm	Before Each Startup & Weekly During Refueling (6) A.18
4. APRM			
High Flux	B	Trip Output Relays (5)	Every 3 Months
High Flux (Reduced)	B	Trip Output Relays (5)	Before Each Startup AND DURING EACH STARTUP M.8 & Weekly During Refueling (6) A.18
Inoperative	B	Trip Output Relays A.19	Every 3 Months
Flow Bias	B	Trip Output Relays (5)	Every 3 Months
5. High Reactor Pressure	B	Trip Channel and Alarm (5)	Every 3 Months
6. High Drywell Pressure A.16	B	Trip Channel and Alarm (5)	Every 3 Months
7. Low Reactor Water Level (2) (8) LA.9	B	Trip Channel and Alarm (5)	Every 3 Months
8. High Water Level in Scram Discharge Volume	B	Trip Channel and Alarm (5)	Every 3 Months
9. Main Steam Line Iso. Valve Closure	A	Trip Channel and Alarm	Every 3 Months
10. Turbine Con. Valve Fast Closure	A	Trip Channel and Alarm	Every 3 Months
11. Turbine Stop Valve Closure	A	Trip Channel and Alarm L.7	Every 3 Months
A.7 Scram Test Switch (5X-S2(A-D)) LA.1	A	Trip Channel and Alarm	Once each week (9) A.7
10.a, 11.a First Stage Turbine Pressure - Permissive (PS/5-14(A/D)) LA.1	A	Trip Channel and Alarm	Every 6 Months

L.5 LA.10

L.6

(2) NOT REQUIRED TO BE PERFORMED WHEN ENTERING STARTUP/HOT STANDBY MODE FROM RUN MODE UNTIL 12 HOURS AFTER ENTERING STARTUP/HOT STANDBY MODE.

A.1

TABLE 4.1.1 NOTES

IRM HIGH FLUX — M.7

1. ~~Not used~~

2. An instrument check shall be performed on reactor water level and reactor pressure instrumentation once per day. — A.16

3. ~~A description of the three groups is included in the basis of this Specification.~~ — L.5

4. ~~Functional tests are not required when the systems are not required to be operable or are tripped. If tests are missed, they shall be performed prior to returning the systems to an operable status.~~ — A.17

5. This instrumentation is exempted from the Instrument Functional Test Definition (1.G.). This Instrument Functional Test will consist of injecting a simulated electrical signal into the measurement channels. — A.19

6. Frequency need not exceed weekly. — A.18

7. ~~A functional test of the logic of each channel is performed as indicated. This coupled with placing the mode switch in shutdown each refueling outage constitutes a logic system functional test of the scram system.~~ — LA.10

8. ~~The water level in the reactor vessel will be perturbed and the corresponding level indicator changes will be monitored. This test will be performed every month.~~ — LA.9

9. ~~The automatic scram contactors shall be exercised once every week by either using the RPS channel test switches or performing a functional test of any automatic scram function. If the contactors are exercised using a functional test of a scram function, the weekly test using the RPS channel test switch is considered satisfied.~~ — A.7 The automatic scram contactors shall also be exercised after maintenance on the contactors. — LA.13

A.1 A.6

REACTOR PROTECTION SYSTEM

VYNPS

TABLE 4.1 (1) (2)

TRIP FUNCTION

~~SCRAM~~ INSTRUMENTATION CALIBRATION

~~MINIMUM CALIBRATION FREQUENCIES FOR REACTOR PROTECTION INSTRUMENT CHANNELS~~

~~Instrument Channel~~	Group (1)	Calibration ~~Standard~~ ~~(4)~~ A.3 L.8	Minimum Frequency (2) A.17
4. High Flux APRM			
a. Output Signal	B	Heat Balance L.12	Once Every 7 Days (d) L.10
b. Output Signal (Reduced) ~~(7)~~ (a)	B	~~Heat Balance~~	Once Every 7 Days (c) L.12
c. Flow Bias	B	~~Standard Pressure and Voltage Source~~	Refueling Outage Every 3 Months ~~(9)~~ (e)
4.a LPRM ~~(LPRM ND-2-1-104(80))~~ LA.1	B(5) LA.12	~~Using TIP System~~	Every 2,000 MWD/T average core exposure ~~(8)~~ A.20
5. High Reactor Pressure	B	~~Standard Pressure Source~~	Once/Operating Cycle Every 3 Months (e) M.11
10. Turbine Control Valve Fast Closure	A	~~Standard Pressure Source~~	Every 3 Months
6. High Drywell Pressure	B	~~Standard Pressure Source~~	Once/Operating Cycle
8. High Water Level in Scram Discharge Volume	B	~~Water Level~~	Once/Operating Cycle
7. Low Reactor Water Level	B	~~Standard Pressure Source~~	Once/Operating Cycle
11. Turbine Stop Valve Closure	A	~~(6)~~ LA.11	Refueling Outage
10.a 11.a First Stage Turbine Pressure Permissive ~~(PS-5-14(A-D))~~ LA.1	A	~~Pressure Source~~ L.8	Every 6 Months and After Refueling; Prior to Entering STARTUP/HOT STANDBY for Plant Startup M.9
9. Main Steam Line Isolation Valve Closure	A	~~(6)~~ LA.11	Refueling Outage
	L.5		

(b) Not required to be performed when entering STARTUP/HOT STANDBY MODE from RUN MODE until 12 hours after entering STARTUP/HOT STANDBY MODE. L.6

3. Intermediate Range Monitors (IRM)
a. High Flux (a) — Once/Operating Cycle (b)(c) M.10

(c) Neutron detectors are excluded. M.10 L.12

(d) Not required to be performed until 12 hours after reactor power is ≥ 25% of Rated Thermal Power. L.10

A.1

TABLE 4.1.2 NOTES

L.5

1. ~~A description of the three groups is included in the bases of this Specification.~~

2. ~~Calibration tests are not required when the systems are not required to be operable or are tripped. If tests are missed, they shall be performed prior to returning the systems to an operable status.~~

A.17

3. ~~Deleted.~~

4. Response time is not part of the routine instrument check and calibration, but will be checked every operating cycle. A.3

5. ~~Does not provide scram function.~~ LA.12

6. ~~Physical inspection and actuation.~~ LA.11

(a) ~~7.~~ The IRM and SRM channels shall be determined to overlap during each startup after entering the STARTUP/HOT STANDBY MODE and the IRM and APRM channels shall be determined to overlap during each controlled shutdown, if not performed within the previous 7 days.

8. ~~The specified frequency is met if the calibration is performed within 1.25 times the interval specified, as measured from the previous performance.~~

(e)| ~~9.~~ ~~APRM~~ trip unit calibration only. A.20

M.11

TABLE OF CONTENTS

Monitoring

2

1.0 DEFINITIONS

Z. Surveillance Interval - Relocated to Specification 4.0.1.

AA. Deleted

BB. Source Check - The qualitative assessment of channel response when the channel sensor is exposed to a radioactive source.

CC. Dose Equivalent I-131 - The dose equivalent I-131 shall be that concentration of I-131 (microcurie/gram) which alone would produce the same dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134 and I-135 actually present. The dose conversion factors used for this calculation shall be those listed in Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1988; FGR 12, "External Exposure to Radionuclides In Air, Water, and Soil," 1993; or NRC Regulatory Guide 1.109, Revision 1, October 1977.

DD. Deleted

EE. Deleted

FF. Deleted

GG. Deleted

HH. Deleted

II. Deleted

JJ. Deleted

KK. Deleted

LL. Deleted

MM. Deleted

NN. Core Operating Limits Report - The Core Operating Limits Report is the unit-specific document that provides core operating limits for the current operating reload cycle. These cycle-specific core operating limits shall be determined for each reload cycle in accordance with Specification 6.6.C. Plant operation within these operating limits is addressed in individual specifications.

A.2

OO. Reactor Protection System (RPS) Response Time - RPS Response Time shall be the time from the opening of the sensor contact up to and including the opening of the scram solenoid relay.

A.1

1.1 SAFETY LIMIT

A.9

Position WITH REACTOR COOLANT TEMPERATURE >212°F

/ HOT STANDBY

A.1

2.1 LIMITING SAFETY SYSTEM SETTING

For no combination of loop recirculation flow rate and core thermal power shall the APRM flux scram trip setting be allowed to exceed 120% of rated thermal power.

b. Flux Scram Trip Setting (Refuel or Startup ~~and~~ / Hot Standby Mode) A.1

When the reactor mode switch is in the REFUEL or STARTUP position, average power range monitor (APRM) scram shall be set down to less than or equal to 15% of rated neutron flux ~~(except as allowed by Note 12 of Table 3.1.1)~~. The IRM flux scram setting shall be set at less than or equal to 120/125 of full scale. A.9

the A.1

B. Deleted

C. Reactor low water level scram setting shall be at least 127 inches above the top of the enriched fuel.

4.1

1.1 SAFETY LIMIT

2.1 LIMITING SAFETY SYSTEM SETTING

D. Reactor low-low water level Emergency Core Cooling System (ECCS) initiation shall be ~~at least~~ ≥ 82.5 inches above the top of the enriched fuel.

E. Turbine stop valve scram shall when operating at ~~greater than~~ > 30% of Rated Thermal Power, be less than or equal to ≤ 10% valve closure from full open.

F. Turbine control valve fast closure scram shall when operating at ~~greater than~~ > 30% of Rated Thermal Power, ~~trip upon~~ be actuation of the turbine control valve fast closure relay.

G. Main steam line isolation valve closure scram shall be ~~less than or equal to~~ ≤ 10% valve closure from full open.

H. Main steam line low pressure initiation of main steam line isolation valve closure shall be ~~at least~~ ≥ 800 psig.

Proposed

Technical Specifications

3.2.A and 4.2.A
Emergency Core Cooling System

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the operational status of the plant instrumentation systems which initiate and control a protective function.

Objective:

To assure the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System (ECCS)

The ECCS instrumentation for each Trip Function in Table 3.2.1 shall be operable in accordance with Table 3.2.1.

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the surveillance requirements of the instrumentation systems which initiate and control a protective function.

Objective:

To verify the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System (ECCS)

1. ECCS instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.1.

   When an ECCS instrumentation channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed as follows: (a) for up to 6 hours for Trip Function 3.d; and (b) for up to 6 hours for Trip Functions other than 3.d provided the associated Trip Function or redundant Trip Function maintains ECCS initiation capability.

2. Perform a Logic System Functional Test of ECCS instrumentation Trip Functions once every Operating Cycle.

Table 3.2.1 (page 1 of 4)
Emergency Core Cooling System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Core Spray System				
a. High Drywell Pressure	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	2	Note 1	≤ 2.5 psig
b. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	2	Note 1	≥ 82.5 inches
c. Low Reactor Pressure (Initiation)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	≥ 300 psig and ≤ 350 psig
d. Low Reactor Pressure (System Ready and Valve Permissive)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	2	Note 2	≥ 300 psig and ≤ 350 psig
e. Pump Start Time Delay	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a] , (b)	1	Note 2	≥ 8 seconds and ≤ 10 seconds
f. Pump Discharge Pressure	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2 per pump	Note 8	≥ 100 psig
g. Auxiliary Power Monitor	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	NA
h. Pump Bus Power Monitor	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	NA

(a) With reactor coolant temperature > 212 °F.

(b) When associated ECCS subsystem is required to be operable.

(c) With reactor steam pressure > 150 psig.

Table 3.2.1 (page 2 of 4)
Emergency Core Cooling System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
2. Low Pressure Coolant Injection (LPCI) System				
a. Low Reactor Pressure (Initiation)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a] , (b)	1	Note 2	≥ 300 psig and ≤ 350 psig
b. High Drywell Pressure (Initiation)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	2	Note 1	≤ 2.5 psig
c. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	2	Note 1	≥ 82.5 inches
d. Reactor Vessel Shroud Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	1	Note 3	≥ 2/3 core height
e. LPCI B and C Pump Start Time Delay	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	≥ 3 seconds and ≤ 5 seconds
f. RHR Pump Discharge Pressure	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2 per pump	Note 8	≥ 100 psig
g. High Drywell Pressure (Containment Spray Permissive)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	2	Note 3	≤ 2.5 psig
h. Low Reactor Pressure (System Ready and Valve Permissive)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	2	Note 2	≥ 300 psig and ≤ 350 psig

(a) With reactor coolant temperature > 212 °F.

(b) When associated ECCS subsystem is required to be operable.

(c) With reactor steam pressure > 150 psig.

Table 3.2.1 (page 3 of 4)
Emergency Core Cooling System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
2. LPCI System (Continued)				
i. Auxiliary Power Monitor	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	NA
j. Pump Bus Power Monitor	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	1	Note 2	NA
3. High Pressure Coolant Injection (HPCI) System				
a. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2	Note 4	≥ 82.5 inches
b. Low Condensate Storage Tank Water Level	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2	Note 5	≥ 4.24%[d]
c. High Drywell Pressure	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2	Note 4	≤ 2.5 psig
d. High Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	2	Note 6	≤ 177 inches

(a) With reactor coolant temperature > 212 °F.

(b) When associated ECCS subsystem is required to be operable.

(c) With reactor steam pressure > 150 psig.

(d) Percent of instrument span.

Table 3.2.1 (page 4 of 4)
Emergency Core Cooling System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
4. Automatic Depressurization System (ADS)				
a. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY[(c)], HOT SHUTDOWN[(c)], Refuel[(c)]	2	Note 7	≥ 82.5 inches
b. High Drywell Pressure	RUN, STARTUP/HOT STANDBY[(c)], HOT SHUTDOWN[(c)], Refuel[(c)]	2	Note 7	≤ 2.5 psig
c. Time Delay	RUN, STARTUP/HOT STANDBY[(c)], HOT SHUTDOWN[(c)], Refuel[(c)]	1	Note 8	≤ 120 seconds
d. Sustained Low-Low Reactor Vessel Water Level Time Delay	RUN, STARTUP/HOT STANDBY[(c)], HOT SHUTDOWN[(c)], Refuel[(c)]	2	Note 8	≤ 8 minutes

(c) With reactor steam pressure > 150 psig.

Table 3.2.1 ACTION Notes

1. With one or more channels inoperable for ECCS instrumentation Trip Functions 1.a, 1.b, 2.b and 2.c:
   a. Declare the associated systems inoperable within 1 hour from discovery of loss of initiation capability for feature(s) in both divisions; and
   b. Place any inoperable channel in trip within 24 hours.

   If any applicable Action and associated completion time of Note 1.a or 1.b is not met, immediately declare associated systems inoperable.

2. With one or more channels inoperable for ECCS instrumentation Trip Functions 1.c, 1.d, 1.e, 1.g, 1.h, 2.a, 2.e, 2.h, 2.i and 2.j:
   a. Declare the associated systems inoperable within 1 hour from discovery of loss of initiation capability for feature(s) in both divisions; and
   b. Restore any inoperable channel to operable status within 24 hours.

   If any applicable Action and associated completion time of Note 2.a or 2.b is not met, immediately declare associated systems inoperable.

3. With one or more channels inoperable for ECCS instrumentation Trip Functions 2.d and 2.g:
   a. For Trip Function 2.g only, declare the associated system inoperable within 1 hour from discovery of loss of LPCI initiation capability; and
   b. For Trip Function 2.g, place any inoperable channel in trip within 24 hours.
   c. For Trip Function 2.d restore any inoperable channel to operable status within 24 hours.

   If any applicable Action and associated completion time of Note 3.a, 3.b or 3.c is not met, immediately declare associated systems inoperable.

4. With one or more channels inoperable for ECCS instrumentation Trip Functions 3.a and 3.c:
   a. Declare the HPCI System inoperable within 1 hour from discovery of loss of HPCI System initiation capability; and
   b. Place any inoperable channel in trip within 24 hours.

   If any applicable Action and associated completion time of Note 4.a or 4.b is not met, immediately declare HPCI System inoperable.

5. With one or more channels inoperable for ECCS instrumentation Trip Function 3.b:
   a. Declare the HPCI System inoperable within 1 hour from discovery of loss of HPCI initiation capability when HPCI System suction is aligned to the Condensate Storage Tank; and
   b. Place any inoperable channel in trip or align HPCI System suction to the suppression pool within 24 hours.

   If any applicable Action and associated completion time of Note 5.a or 5.b is not met, immediately declare the HPCI System inoperable.

Table 3.2.1 ACTION Notes
(Continued)

6. With one or more channels inoperable for ECCS instrumentation Trip Function 3.d:
   a. Restore any inoperable channel to operable status within 24 hours.

   If the Action and associated completion time of Note 6.a is not met, immediately declare the HPCI System inoperable.

7. With one or more channels inoperable for ECCS instrumentation Trip Functions 4.a and 4.b:
   a. Declare ADS inoperable within 1 hour from discovery of loss of ADS initiation capability in both trip systems; and
   b. Place any inoperable channel in trip within 96 hours from discovery of the inoperable channel concurrent with HPCI System or RCIC System inoperable, and
   c. Place any inoperable channel in trip within 8 days.

   If any applicable Action and associated completion time of Note 7.a, 7.b or 7.c is not met, immediately declare ADS inoperable.

8. With one or more channels inoperable for ECCS instrumentation Trip Functions 1.f, 2.f, 4.c and 4.d:
   a. Declare ADS inoperable within 1 hour from discovery of loss of ADS initiation capability in both trip systems; and
   b. Restore any inoperable channel to operable status within 96 hours from discovery of the inoperable channel concurrent with HPCI System or RCIC System inoperable, and
   c. Restore any inoperable channel to operable status within 8 days.

   If any applicable Action and associated completion time of Note 8.a, 8.b or 8.c is not met, immediately declare ADS inoperable.

Table 4.2.1 (page 1 of 2)
Emergency Core Cooling System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Core Spray System			
a. High Drywell Pressure	Once/Day	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
b. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
c. Low Reactor Pressure (Initiation)	NA	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
d. Low Reactor Pressure (System Ready and Valve Permissive)	NA	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
e. Pump Start Time Delay	NA	NA	Once/Operating Cycle
f. Pump Discharge Pressure	NA	Every 3 Months	Every 3 Months
g. Auxiliary Power Monitor	Once/Day	Every 3 Months	NA
h. Pump Bus Power Monitor	Once/Day	Every 3 Months	NA
2. Low Pressure Coolant Injection (LPCI) System			
a. Low Reactor Pressure (Initiation)	NA	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
b. High Drywell Pressure (Initiation)	Once/Day	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
c. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
d. Reactor Vessel Shroud Level	NA	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle
e. LPCI B and C Pump Start Time Delay	NA	NA	Once/Operating Cycle
f. RHR Pump Discharge Pressure	NA	Every 3 Months	Every 3 Months
g. High Drywell Pressure (Containment Spray Permissive)	NA	Every 3 Months	Every 3 Months[(a)], Once/Operating Cycle

(a) Trip unit calibration only.

Table 4.2.1 (page 2 of 2)
Emergency Core Cooling System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
2. LPCI System (Continued)			
h. Low Reactor Pressure (System Ready and Valve Permissive)	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
i. Auxiliary Power Monitor	Once/Day	Every 3 Months	NA
j. Pump Bus Power Monitor	Once/Day	Every 3 Months	NA
3. High Pressure Coolant Injection (HPCI) System			
a. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
b. Low Condensate Storage Tank Water Level	NA	Every 3 Months	Every 3 Months
c. High Drywell Pressure	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
d. High Reactor Vessel Water Level	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
4. Automatic Depressurization System (ADS)			
a. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
b. High Drywell Pressure	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
c. Time Delay	NA	NA	Once/Operating Cycle
d. Sustained Low-Low Reactor Vessel Water Level Time Delay	NA	NA	Once/Operating Cycle

(a) Trip unit calibration only.

Proposed

Bases

3.2.A and 4.2.A

Emergency Core Cooling System

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

BACKGROUND

The purpose of the ECCS instrumentation is to initiate appropriate responses from the ECCS to ensure that the fuel is adequately cooled in the event of a design basis accident or transient.

For most abnormal operational transients and Design Basis Accidents (DBAs), a wide range of dependent and independent parameters are monitored.

The ECCS instrumentation actuates core spray (CS), the low pressure coolant injection (LPCI) mode of the Residual Heat Removal (RHR) System, high pressure coolant injection (HPCI), Automatic Depressurization System (ADS), and the diesel generators (DGs). The equipment involved with each of these systems is described in Bases 3.5, "Core and Containment Cooling Systems," and in Bases 3.10, "Auxiliary Electrical Power Systems."

Core Spray System

The CS System consists of two subsystems (A and B). Subsystem A is identical in function to subsystem B. Automatic initiation occurs for conditions of Low - Low Reactor Vessel Water Level and Low Reactor Pressure (Initiation) or High Drywell Pressure. The Low - Low Reactor Vessel Water Level and High Drywell Pressure diverse variables are each monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic (i.e., two trip systems) for each Trip Function. The Low Reactor Pressure (Initiation) signals are initiated from two pressure transmitters that sense reactor pressure. Each pressure transmitter provides an input to both CS trip systems with the contacts arranged in a one-out-of-two logic.

Upon receipt of an initiation signal, if normal AC power is available, both CS pumps start. If an initiation signal is received when normal AC power is not available, the CS pumps are started approximately 9 seconds after power is available to limit the loading of the AC power sources.

The CS test line isolation valve, which is also a primary containment isolation valve (PCIV), is closed on a CS initiation signal to allow full system flow assumed in the accident analyses and maintain primary containment isolated in the event CS is not operating.

The CS System also monitors the pressure in the reactor to ensure that, before the injection valves open, the reactor pressure has fallen to a value below the CS System's maximum design pressure. The variable is monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic.

The status of the normal and emergency AC power supplies necessary for pump operation is also monitored. This ensures that load sequencing occurs

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

BACKGROUND (continued)

if normal AC power is not available. These parameters are monitored by relays (Auxiliary Power Monitors and Pump Bus Power Monitors) whose outputs are arranged in a one-out-of-one logic and a one-out-of-two logic, respectively.

Low Pressure Coolant Injection System

The LPCI is an operating mode of the Residual Heat Removal (RHR) System, with two LPCI subsystems (A and B). Subsystem A is identical in function to subsystem B. Automatic initiation occurs for conditions of Low - Low Reactor Vessel Water Level concurrent with Low Reactor Pressure (Initiation) or High Drywell Pressure (Initiation). Each of these diverse variables, except Low Reactor Pressure (Initiation) is monitored by four redundant transmitters, which, in turn, are connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic (i.e., two trip systems) for each Trip Function. The High Drywell Pressure signals are also used for the containment spray permissive. The Low Reactor Pressure (Initiation) signals are initiated from two pressure transmitters that sense reactor pressure. Each of these pressure transmitters provides an input to both low pressure ECCS logic trains with the contacts arranged in one-out-of-two logic. Once an initiation signal is received by the LPCI control circuitry, the signal is sealed in until manually reset.

Upon receipt of an initiation signal, if normal AC power is available, the LPCI pumps are started with no time delay. If normal AC power is not available, LPCI pumps A and D start immediately once power is available and LPCI pumps B and C are started approximately 4 seconds after power is available to limit the loading of the AC standby power sources.

The RHR containment cooling return line valves, torus spray isolation valves, and drywell spray isolation valves (which are also PCIVs) are also closed on a LPCI initiation signal to allow the full system flow assumed in the accident analyses and maintain primary containment isolated in the event LPCI is not operating.

The LPCI System monitors the pressure in the reactor to ensure that, before an injection valve opens, the reactor pressure has fallen to a value below the LPCI System's maximum design pressure. The variable is monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic.

Additionally, instruments (i.e., reactor water level and reactor pressure) are provided to close the recirculation loop pump discharge valves to ensure that LPCI flow does not bypass the core when it injects into the recirculation lines. The variable is monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

BACKGROUND (continued)

Low reactor water level in the shroud is detected by two additional instruments. When level is greater that the trip setting of the LPCI Reactor Vessel Shroud Level Trip Function, LPCI may no longer be required, therefore, other modes of RHR (e.g., suppression pool cooling) are allowed. Manual overrides for the isolations, when water level is below the associated trip setting, are provided.

The status of the normal and emergency AC power supplies necessary for pump operation is also monitored. This ensures that load sequencing occurs if normal AC power is not available. These parameters are monitored by relays (Auxiliary Power Monitors and Pump Bus Power Monitors) whose outputs are arranged in a one-out-of-one logic and a one-out-of-two logic, respectively.

High Pressure Coolant Injection System

Automatic initiation of the HPCI System occurs for conditions of Low - Low Reactor Vessel Water Level or High Drywell Pressure. Each of these variables is monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic for each Trip Function.

The HPCI test line isolation valves are closed upon receipt of a HPCI initiation signal to allow the full system flow assumed in the accident analysis.

The HPCI System also monitors the water level in the condensate storage tank (CST). Reactor grade water in the CST is the normal source. Upon receipt of a HPCI initiation signal, the CST suction valve is automatically signaled to open. If the water level in the CST falls below a preselected level, first the suppression pool suction valves automatically open. When the suppression pool suction valves start to open, the CST suction valve automatically closes. Two level transmitters are used to detect low water level in the CST. Either transmitter can cause the suppression pool suction valves to open and the CST suction valve to close.

The HPCI System provides makeup water to the reactor until the reactor vessel water level reaches the High Reactor Vessel Water Level trip, at which time the HPCI turbine trips, which causes the turbine's stop valve to close. This variable is monitored by two transmitters, which are, in turn, connected to two trip units. The outputs of the trip units are connected to relays whose contacts are arranged in a two-out-of-two logic to provide high reliability of the HPCI System. The HPCI System automatically restarts if a Low - Low Reactor Vessel Water Level signal is subsequently received.

BACKGROUND (continued)

Automatic Depressurization System

Automatic initiation of the ADS occurs when signals indicating Low - Low Reactor Vessel Water Level; High Drywell Pressure, or sustained Low - Low Reactor Vessel Water Level; and CS or RHR (LPCI Mode) High Pump Discharge Pressure are all present and the ADS Time Delay has timed out. There are two transmitters for Low - Low Reactor Vessel Water Level and High Drywell Pressure in each of the two ADS trip system logics. Each of these transmitters connects to a trip unit, which then drives a relay whose contacts form the initiation logic.

Each ADS trip system logic includes a time delay between satisfying the initiation logic and the actuation of the ADS valves. The ADS Time Delay setpoint chosen is long enough that the HPCI System has sufficient operating time to recover to a level above Low - Low Reactor Vessel Water Level, yet not so long that the LPCI and CS Systems are unable to adequately cool the fuel if the HPCI System fails to maintain that level. An alarm in the control room is annunciated when either of the timers is timing. Resetting the ADS initiation signals resets the ADS Time Delay.

The ADS also monitors the discharge pressures of the four LPCI pumps and the two CS pumps. Each ADS trip system includes two discharge pressure permissive switches from one CS pump and from each LPCI pump. The signals are used as a permissive for ADS actuation, indicating that there is a source of core coolant available once the ADS has depressurized the vessel. Any one of the six low pressure pumps is sufficient to permit automatic depressurization.

The ADS logic in each trip system logic is arranged in two strings. Each string has a contact from each of the following variables: Low - Low Reactor Vessel Water Level; High Drywell Pressure; and Sustained Low - Low Reactor Vessel Water Level Time Delay. All required contacts in both logic strings must close, the ADS Time Delay must time out, and a CS or LPCI pump discharge pressure signal must be present to initiate an ADS trip system logic. Either the A or B trip system logic will cause all the ADS relief valves to open. Once the High Drywell Pressure signal, Sustained Low - Low Reactor Vessel Water Level Time Delay, or the ADS initiation signal is present, the trip system logic is sealed in until manually reset.

Manual inhibit switches are provided in the control room for the ADS; however, their function is not required for ADS operability (provided ADS is not inhibited when required to be operable).

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

BACKGROUND (continued)

Diesel Generators

Automatic initiation of the DGs occurs for conditions of Low - Low Reactor Vessel Water Level or High Drywell Pressure. Each of these diverse variables is monitored by four redundant transmitters, which are, in turn, connected to four trip units. The outputs of the four trip units are connected to relays whose contacts are connected to a one-out-of-two taken twice logic to initiate all DGs. The DGs receive their initiation signals from the CS System initiation logic. The DGs can also be started manually from the control room and locally from the associated DG room. Upon receipt of a loss of coolant accident (LOCA) initiation signal, each DG is automatically started, is ready to load within 13 seconds, and will run in standby conditions (rated voltage and frequency, with the DG output breaker open). The DGs will only energize their respective 4.16 kV emergency buses if a loss of offsite power occurs or if a degraded voltage occurs concurrent with an accident signal.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The actions of the ECCS are explicitly assumed in the safety analyses of References 1 and 2. The ECCS is initiated to preserve the integrity of the fuel cladding by ensuring the requirements of 10 CFR 50.46 are met.

ECCS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). Certain instrumentation Trip Functions are retained for other reasons and are described below in the individual Trip Functions discussion.

The operability of the ECCS instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions specified in Table 3.2.1. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.1. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

In general, the individual Trip Functions are required to be operable in the Modes or other specified conditions that may require ECCS (or DG) initiation to mitigate the consequences of a design basis transient or accident. Table 3.2.1 Footnotes (a), (b), and (c) specifically indicate other conditions when certain ECCS Instrumentation Trip Functions are required to be operable. To ensure reliable ECCS and DG function, a combination of Trip Functions is required to provide primary and secondary initiation signals.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Trip Function by Trip Function basis.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Core Spray and Low Pressure Coolant Injection Systems

1.a, 2.b. High Drywell Pressure

High pressure in the drywell could indicate a break in the reactor coolant pressure boundary (RCPB). The low pressure ECCS and associated DGs are initiated upon receipt of the High Drywell Pressure Trip Function in order to minimize the possibility of fuel damage. The High Drywell Pressure Trip Function, along with the Low - Low Reactor Vessel Water Level Trip Function is directly assumed in the analysis of the recirculation line break (Ref. 1). The core cooling function of the ECCS, along with the scram action of the Reactor Protection System (RPS), ensures that the requirements of 10 CFR 50.46 are met.

High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Trip Setting was selected to be indicative of a LOCA inside primary containment.

The High Drywell Pressure Trip Function is required to be operable when the ECCS or DG is required to be operable in conjunction with times when the primary containment is required to be operable. Thus, four channels of the CS and LPCI High Drywell Pressure Trip Functions are required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN and Refuel (with reactor coolant temperature > 212°F) to ensure that no single instrument failure can preclude ECCS and DG initiation. In other Modes or conditions, the High Drywell Pressure Trip Function is not required, since there is insufficient energy in the reactor to pressurize the primary containment to High Drywell Pressure setpoint.

1.b, 2.c. Low - Low Reactor Vessel Water Level

Low reactor pressure vessel (RPV) water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The low pressure ECCS and associated DGs are initiated at Low - Low Reactor Vessel Water Level to ensure that core spray and flooding functions are available to prevent or minimize fuel damage. The Low - Low Reactor Vessel Water Level is one of the Trip Functions assumed to be operable and capable of initiating the ECCS and associated DGs during the accidents analyzed in References 1 and 2. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met.

Low - Low Reactor Vessel Water Level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Low - Low Reactor Vessel Water Level Trip Setting is chosen to allow time for the low pressure core flooding systems to activate and provide adequate cooling. The Trip Setting is referenced from the top of enriched fuel.

Four channels of Low - Low Reactor Vessel Water Level Trip Function are only required to be operable when the ECCS or DG(s) are required to be operable to ensure that no single instrument failure can preclude ECCS and DG initiation.

1.c, 2.a. Low Reactor Pressure (Initiation)

Low reactor pressure signals, in conjunction with low RPV level, indicate that the capability to cool the fuel may be threatened. The low pressure ECCS are initiated upon simultaneous receipt of a low reactor pressure and a low-low reactor vessel water level signal to ensure that the core spray and flooding functions are available to prevent and minimize fuel damage. The Low Reactor Pressure (Initiation) is one of the Trip Functions assumed to be operable and capable of permitting initiation of the ECCS during the accidents analyzed in References 1 and 2. In addition, the Low Reactor Pressure (Initiation) Trip Function is directly assumed in the analysis of the recirculation line break (Ref. 1). The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met.

The Low Reactor Pressure (Initiation) signals are initiated from two pressure transmitters that sense the reactor pressure. Each transmitter provides an input to both low pressure ECCS logic trains, such that failure of one transmitter will cause a loss of redundancy but will not result in a loss of automatic low pressure ECCS pump start capability.

The Trip Setting is low enough to prevent overpressurizing the equipment in the low pressure ECCS, but high enough such that the ECCS injection will ensure the requirements of 10 CFR 50.46 are met.

Two channels per trip system of Low Reactor Pressure (Initiation) Trip Function are only required to be operable when the ECCS or DG(s) are required to be operable to ensure that no single instrument failure can preclude ECCS and DG initiation.

1.d, 2.h. Low Reactor Pressure (System Ready and Valve Permissive)

Low reactor pressure signals are used as permissives for the low pressure ECCS subsystems. This ensures that, prior to opening the injection valves of the low pressure ECCS subsystems, the reactor pressure has fallen to a value below these subsystems' maximum design pressure. These low reactor pressure signals are also used as permissives for recirculation pump discharge valve closure and recirculation pump discharge bypass valve closure. This ensures that the LPCI subsystems inject into the proper RPV location assumed in the safety

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

analysis. Low Reactor Pressure (System Ready and Valve Permissive) is one of the Trip Functions assumed to be operable and capable of permitting initiation and injection of the ECCS and capable of closing the recirculation pump discharge valve(s) and recirculation pump discharge bypass valve(s) during the accidents and transients analyzed in References 1 and 2. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met. The Low Reactor Pressure (System Ready and Valve Permissive) Trip Function is directly assumed in the analysis of the recirculation line break (Ref. 1).

The Low Reactor Pressure (System Ready and Valve Permissive) signals are initiated from four pressure transmitters that sense the reactor pressure.

The Trip Setting is chosen to be low enough to prevent overpressurizing the equipment in the low pressure ECCS, but high enough such that the ECCS injection will ensure the requirements of 10 CFR 50.46 are met and to ensure that the recirculation pump discharge valves and recirculation pump discharge bypass valves close prior to commencement of LPCI injection flow into the core, as assumed in the safety analysis.

Four channels of the Low Reactor Pressure (System Ready and Valve Permissive) Trip Function are only required to be operable when the ECCS or DG(s) are required to be operable to ensure that no single instrument failure can preclude proper ECCS initiation and injection.

1.e, 2.e. CS and LPCI B and C Pump Start Time Delay

The purpose of these time delays is to stagger the start of the CS and RHR (LPCI) B and C pumps on the associated Division 1 and Division 2 buses, thus limiting the starting transients on the 4.16 kV emergency buses. These Trip Functions are necessary when power is being supplied from the standby power sources. The Core Spray Pump Start Time Delay and the LPCI B and C Pump Start Time Delay Trip Functions are assumed to be operable in the accident and transient analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

There are two Core Spray Pump Start Time Delay relays, one for each trip system. Each time delay relay is dedicated to a single pump start logic, such that a single failure of a Core Spray Pump Start Time Delay relay will not result in failure of more than one CS pump. In this condition, one of the two CS pumps will remain operable; thus, single failure criterion is satisfied.

There are two LPCI B and C Pump Start Time Delay relays, one for each trip system. Each time delay relay is dedicated to a single pump start logic, such that a single failure of a LPCI B or C Pump Start Time Delay relay will not result in failure of more than one of the two associated LPCI pumps. In this condition, one of the two associated LPCI pumps will remain operable; thus, single failure criterion is satisfied.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Trip Settings for the Core Spray and LPCI Pump B and C Pump Start Time Delays are chosen to be long enough so that most of the starting transient of the previously started pump is complete before starting a subsequent pump on the same 4.16 kV emergency bus and short enough so that ECCS operation is not degraded.

Each channel of the Core Spray and LPCI B and C Pump Start Time Delay Trip Functions is required to be operable when the associated CS and LPCI subsystems are required to be operable.

1.f, 2.f. CS and RHR Pump Discharge Pressure

The Pump Discharge Pressure signals from the CS and RHR pumps are used as permissives for ADS initiation, indicating that there is a source of low pressure cooling water available once the ADS has depressurized the vessel. Pump Discharge Pressure is one of the Trip Functions assumed to be operable and capable of permitting ADS initiation during the events analyzed in Reference 1 with an assumed HPCI failure. For these events, the ADS depressurizes the reactor vessel so that the low pressure ECCS can perform the core cooling functions. This core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met.

Pump discharge pressure signals are initiated from twelve pressure switches, two on the discharge side of each of the six low pressure ECCS pumps. In order to generate an ADS permissive in one trip system logic, it is necessary that only one pump (one of the two channels for the pump) indicate the high discharge pressure condition. The Pump Discharge Pressure Trip Setting is less than the pump discharge pressure when the pump is operating at all flow ranges and high enough to avoid any condition that results in a discharge pressure permissive when the CS and LPCI pumps are aligned for injection and the pumps are not running. The actual operating point of this function is not assumed in any transient or accident analysis.

Twelve channels of Core Spray and RHR Pump Discharge Pressure Trip Functions are only required to be operable when the ADS is required to be operable to ensure that no single instrument failure can preclude ADS initiation. Two CS channels associated with CS pump A and four LPCI channels associated with RHR pumps A and C are required for trip system logic A. Two CS channels associated with CS pump B and four LPCI channels associated with RHR pumps B and D are required for trip system logic B. However, each channel output is also electrically cross-connected such that each channel provides one logic contact in each ADS trip system logic.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1.g, 2.i. CS and LPCI Auxiliary Power Monitors

The function of the CS and LPCI Auxiliary Power Monitors is to monitor emergency bus status and to implement load sequencing if the normal AC power supply is not available. The CS and LPCI Auxiliary Power Monitors are assumed to be operable in the accident and transient analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

There are a total of two CS and LPCI Auxiliary Power Monitors, one dedicated to CS A and LPCI subsystem A, and one dedicated to CS B and LPCI subsystem B.

There are no Trip Settings specified for these Trip Functions, since they are logic relays that cannot be adjusted.

Each channel of the CS and LPCI Auxiliary Power Monitors is only required to be operable when the associated CS and LPCI subsystems are required to be operable to ensure that no single instrument failure can preclude proper DG load sequencing and subsequent low pressure ECCS initiation as assumed in the safety analyses.

1.h, 2.j. CS and LPCI Pump Bus Power Monitors

The function of the CS and LPCI Pump Bus Power Monitors is to monitor emergency bus status and to delay implementation of load sequencing until the associated emergency bus is powered, assuming a loss of the normal AC power supply. Alternately, assuming no loss of normal AC power supply, these monitors will prevent the CS and LPCI pump motor breakers from closing until the respective bus is energized. The CS and LPCI Pump Bus Power Monitors are assumed to be operable in the accident and transient analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

There are a total of four CS and LPCI Pump Bus Power Monitors, two dedicated to CS A and LPCI subsystem A, and two dedicated to CS B and LPCI subsystem B.

There are no Trip Settings specified for these Trip Functions, since they are logic relays that cannot be adjusted.

One of the two channels per Trip System of the CS and LPCI Pump Bus Power Monitors are only required to be operable when the associated CS and LPCI subsystems are required to be operable to ensure that no single instrument failure can preclude proper DG load sequencing and subsequent low pressure ECCS initiation as assumed in the safety analyses.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2.e. Reactor Vessel Shroud Level

The Reactor Vessel Shroud Level Trip Function is provided as a permissive to allow the RHR System to be manually aligned from the LPCI mode to the suppression pool cooling/spray or drywell spray modes. The permissive ensures that water level in the vessel is at least two thirds core height before the manual transfer is allowed. This ensures that LPCI is available to prevent or minimize fuel damage. This Trip Function may be overridden during accident conditions as allowed by plant procedures. The Reactor Vessel Shroud Level Trip Function is implicitly assumed in the analysis of the recirculation line break (Ref. 1) since the analysis assumes that no LPCI flow diversion occurs when reactor water level is below the Reactor Vessel Shroud Level.

Reactor Vessel Shroud Level signals are initiated from two level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

The Reactor Vessel Shroud Level Trip Setting is chosen to allow the low pressure core flooding systems to activate and provide adequate cooling before allowing a manual transfer.

Two channels of the Reactor Vessel Shroud Level Trip Function are only required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN and Refuel (with reactor coolant temperature > 212°F). In other Modes or conditions, the specified initiation time of the LPCI subsystems is not assumed, and other administrative controls are adequate to control the valves that this Trip Function isolates (since the systems that the valves are opened for are not required to be operable in these other Modes or conditions and are normally not used).

2.g. LPCI High Drywell Pressure (Containment Spray Permissive)

The High Drywell Pressure (Containment Spray Permissive) Trip Function is provided as a permissive to allow the RHR System to be manually aligned from the LPCI mode to the suppression pool cooling/spray or drywell spray modes. The permissive prevents the operator from inadvertently initiating containment spray, when it is not required to reduce drywell pressure, during a LOCA. This ensures that LPCI is available to prevent or minimize fuel damage. The High Drywell Pressure (Containment Spray Permissive) Trip Function is implicitly assumed in the analysis of the recirculation line break (Ref. 1) since the analysis assumes that LPCI flow is available when required.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Trip Setting was selected to be indicative of a LOCA inside primary containment.

The High Drywell Pressure (Containment Spray Permissive) Trip Function is required to be operable when LPCI is required to be operable in conjunction with times when the primary containment is required to be operable. Thus, four channels of the High Drywell Pressure (Containment Spray Permissive) Trip Function are required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN and Refuel (with reactor coolant temperature > 212°F) to ensure that no single instrument failure can preclude LPCI initiation or cause inadvertent flow diversion. In other Modes or conditions, the specified initiation time of the LPCI subsystems is not assumed, and other administrative controls are adequate to control the valves that this Trip Function isolates (since the systems that the valves are opened for are not required to be operable in these other Modes or conditions and are normally not used).

HPCI System

3.a. Low - Low Reactor Vessel Water Level

Low RPV water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, the HPCI System is initiated at Low - Low Reactor Vessel Water Level to maintain level above the top of the active fuel. The Low - Low Reactor Vessel Water Level is one of the Trip Functions assumed to be operable and capable of initiating HPCI during the accidents and transients analyzed in References 1 and 2.

Low - Low Reactor Vessel Water Level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. The Low - Low Reactor Vessel Water Level Trip Setting is high enough above the top of enriched fuel to start HPCI in time to prevent fuel uncovering for small breaks, but far enough below normal levels that spurious HPCI startups are avoided. The Trip Setting is referenced from the top of enriched fuel.

Four channels of Low - Low Reactor Vessel Water Level Trip Function are required to be operable only when HPCI is required to be operable to ensure that no single instrument failure can preclude HPCI initiation.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3.b Low Condensate Storage Tank Level

Low level in the CST indicates the unavailability of an adequate supply of makeup water from this normal source. Normally the suction valves between HPCI and the CST are open and, upon receiving a HPCI initiation signal, water for HPCI injection would be taken from the CST. However, if the water level in the CST falls below a preselected level, first the suppression pool suction valves automatically open. When the suppression pool suction valves both start to open, the CST suction valve automatically closes. This ensures that an adequate supply of makeup water is available to the HPCI pump. To prevent losing suction to the pump, the suction valves are interlocked so that the suppression pool suction valves must both start to open before the CST suction valve automatically closes. The Trip Function is implicitly assumed in the accident and transient analyses (which take credit for HPCI) since the analyses assume that the HPCI suction source is the suppression pool.

The Low Condensate Storage Tank Level signal is initiated from two level transmitters. The logic is arranged such that either level transmitter can cause the suppression pool suction valves to open and the CST suction valve to close. The Low Condensate Storage Tank Level Trip Function Trip Setting is high enough to ensure adequate pump suction head while water is being taken from the CST. The Trip Setting is presented in terms of percent instrument span.

Two channels of the Low Condensate Storage Tank Level Trip Function are required to be operable only when HPCI is required to be operable to ensure that no single instrument failure can preclude HPCI swap to suppression pool source.

3.c. High Drywell Pressure

High pressure in the drywell could indicate a break in the RCPB. The HPCI System is initiated upon receipt of the High Drywell Pressure Trip Function in order to minimize the possibility of fuel damage. The High Drywell Pressure Trip Function associated with HPCI is not assumed in accident or transient analyses. It is retained since it is a potentially significant contributor to risk.

High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Trip Setting was selected to be as low as possible to be indicative of a LOCA inside primary containment.

Four channels of the High Drywell Pressure Trip Function are required to be operable when HPCI is required to be operable to ensure that no single instrument failure can preclude HPCI initiation.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3.d. High Reactor Vessel Water Level

High RPV water level indicates that sufficient cooling water inventory exists in the reactor vessel such that there is no danger to the fuel. Therefore, the High Reactor Vessel Water Level signals are used to trip the HPCI turbine to prevent overflow into the main steam lines (MSLs) to preclude an unanalyzed event.

High Reactor Vessel Water Level signals for HPCI are initiated from two level transmitters from the narrow range water level measurement instrumentation. Both High Reactor Vessel Water Level signals are required in order to close the HPCI turbine stop valve. This ensures that no single instrument failure can preclude HPCI initiation. The High Reactor Vessel Water Level Trip Setting is high enough to avoid interfering with HPCI System operation during reactor water level recovery resulting from low reactor water level events and low enough to prevent flow from the HPCI System from overflowing into the MSLs. The Trip Setting is referenced from the top of enriched fuel.

Two channels of the High Reactor Vessel Water Level Trip Function are required to be operable only when HPCI is required to be operable.

Automatic Depressurization System (ADS)

4.a. Low - Low Reactor Vessel Water Level

Low RPV water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, ADS receives one of the signals necessary for initiation from this Trip Function. The Low - Low Reactor Vessel Water Level is one of the Trip Functions assumed to be operable and capable of initiating the ADS during the accident analyzed in Reference 1. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met.

Low - Low Reactor Vessel Water Level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Four channels of Low - Low Reactor Vessel Water Level Trip Function are required to be operable only when ADS is required to be operable to ensure that no single instrument failure can preclude ADS initiation. Two channels input to ADS trip system logic A, while the other two channels input to ADS trip system logic B.

The Low - Low Reactor Vessel Water Level Trip Setting is chosen to allow time for the low pressure core flooding systems to initiate and provide adequate cooling. The Trip Setting is referenced from the top of enriched fuel.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

4.b High Drywell Pressure

High pressure in the drywell could indicate a break in the RCPB. Therefore, ADS receives signals necessary for initiation from this Trip Function in order to minimize the possibility of fuel damage. The High Drywell Pressure Trip Function is assumed to be operable and capable of initiating the ADS during accidents analyzed in Reference 1. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the requirements of 10 CFR 50.46 are met.

High drywell pressure signals are initiated from four pressure transmitters that sense drywell pressure. The Trip Setting was selected to be as low as possible to be indicative of a LOCA inside primary containment. Four channels of High Drywell Pressure Trip Function are required to be operable only when ADS is required to be operable to ensure that no single instrument failure can preclude ADS initiation. Two channels input to ADS trip system logic A, while the other two channels input to ADS trip system logic B.

4.c. Time Delay

The purpose of the ADS Time Delay is to delay depressurization of the reactor vessel to allow the HPCI System time to restore and maintain reactor vessel water level. Since the rapid depressurization caused by ADS operation is one of the most severe transients on the reactor vessel, its occurrence should be limited. By delaying initiation of the ADS function, the operator is given the chance to monitor the success or failure of the HPCI System to maintain water level, and then to decide whether or not to allow ADS to initiate or to inhibit initiation. The ADS Time Delay Trip Function is assumed to be operable for the accident analyses of Reference 1 that require ECCS initiation and assume failure of the HPCI System.

There are two ADS Time Delay relays, one in each of the two ADS trip system logics. The Trip Setting for the ADS Time Delay is chosen to be long enough to allow HPCI to start and avoid an inadvertent blowdown yet short enough so that there is still time after depressurization for the low pressure ECCS subsystems to provide adequate core cooling.

Two channels of the ADS Time Delay Trip Function are only required to be operable when the ADS is required to be operable to ensure that no single instrument failure can preclude ADS initiation. One channel inputs to ADS trip system logic A, while the other channel inputs to ADS trip system logic B.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

4.d. Sustained Low - Low Reactor Vessel Water Level Time Delay

One of the signals received for ADS initiation is High Drywell Pressure. However, if the event requiring ADS occurs outside the drywell (e.g., main steam line break outside containment), a high drywell pressure signal may never be present. Therefore, the Sustained Low - Low Reactor Vessel Water Level Time Delay Trip Function is used to bypass the High Drywell Pressure Trip Function after a certain time period has elapsed. The instrumentation is retained in the TS because ADS is part of the primary success path for mitigation of a DBA.

There are four Sustained Low - Low Reactor Vessel Water Level Time Delay relays, two in each of the two ADS trip system logics. The Trip Setting for the Sustained Low - Low Reactor Vessel Water Level Time Delay is chosen to ensure that there is still time after depressurization for the low pressure ECCS subsystems to provide adequate core cooling.

Four channels of the Sustained Low - Low Reactor Vessel Water Level Time Delay Trip Function are only required to be operable when the ADS is required to be operable to ensure that no single instrument failure can preclude ADS initiation.

ACTIONS

Table 3.2.1 ACTION Note 1

Table 3.2.1 ACTION Note 1.a is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in redundant automatic initiation capability being lost for the feature(s). Table 3.2.1 ACTION Note 1.a features would be those that are initiated by Trip Function 1.a, 1.b, 2.b, and 2.c (e.g., low pressure ECCS). Redundant automatic initiation capability is lost if (a) two Trip Function 1.a channels are inoperable and untripped in the same trip system, (b) two Trip Function 1.b channels are inoperable and untripped in the same trip system, (c) two Trip Function 2.b channels are inoperable and untripped in the same system, or (d) two Trip Function 2.c channels are inoperable and untripped in the same trip system. Each inoperable channel would only require the affected portion of the associated system of low pressure ECCS and DGs to be declared inoperable. However, since channels in both associated low pressure ECCS subsystems (e.g., both CS subsystems) are inoperable and untripped, and the completion times of Table 3.2.1 ACTION Note 1.a started concurrently for the channels in both subsystems, this results in the affected portions in the associated low pressure ECCS and DGs being concurrently declared inoperable.

In this situation (loss of redundant automatic initiation capability), the 24 hour allowance of Table 3.2.1 ACTION Note 1.b is not appropriate and the feature(s) associated with the inoperable, untripped channels must be declared

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

ACTIONS (continued)

inoperable within 1 hour. The Table 3.2.1 ACTION Note completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 1.a, the completion time only begins upon discovery of a loss of initiation capability for feature(s) in both divisions (i.e., that a redundant feature in the same system (e.g., both CS subsystems) cannot be automatically initiated due to inoperable, untripped channels within the same Trip Function as described in the paragraph above). The 1 hour completion time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.1 ACTION Note 1.b. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue.

Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), the associated systems must be declared inoperable. With any applicable Action and associated completion time not met, the associated subsystem(s) may be incapable of performing the intended function, and the supported subsystem(s) associated with inoperable untripped channels must be declared inoperable immediately.

Table 3.2.1 ACTION Note 2

Table 3.2.1 ACTION Note 2.a is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same Trip Function result in automatic initiation capability being lost for the feature(s). Table 3.2.1 ACTION Note 2.a features would be those that are initiated by Trip Functions 1.c, 1.d, 1.e, 1.g, 1.h, 2.a, 2.e, 2.h, 2.i, and 2.j (i.e., low pressure ECCS). Automatic initiation capability is lost if either (a) two Trip Function 1.c channels are inoperable, (b) two Trip Function 1.d channels are inoperable in the same trip system, (c) one Trip Function 1.e channel is inoperable in each trip system, (d) one Trip Function 1.g channel is inoperable in each trip system, (e) two Trip Function 1.h channels inoperable in each trip system, (f) two Trip Function 2.a channels are inoperable, (g) one Trip Function 2.e channel inoperable in each trip system, (h) two Trip Function 2.h channels inoperable in the same trip system, (i) one Trip Function 2.i channel inoperable in each trip system or (j) two Trip Function 2.j channels inoperable in each trip system. Each inoperable channel would only require the affected portion of the associated system of low pressure

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ACTIONS (continued)

ECCS to be declared inoperable. However, since channels in both associated low pressure ECCS subsystems (e.g., both CS subsystems) are inoperable and untripped, and the completion times of Table 3.2.1 ACTION Note 2.a started concurrently for the channels in both subsystems, this results in the affected portions in the associated low pressure ECCS being concurrently declared inoperable. For Functions 1.e and 2.e, the affected portions are the associated low pressure ECCS pumps.

In this situation (loss of automatic initiation capability), the 24 hour allowance of Table 3.2.1 ACTION Note 2.b is not appropriate and the feature(s) associated with the inoperable channels must be declared inoperable within 1 hour. The Table 3.2.1 ACTION Note completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 2.a, the Completion Time only begins upon discovery of a loss of initiation capability for feature(s) in both divisions (i.e., that a redundant feature in the same system (e.g., both CS subsystems) cannot be automatically initiated due to inoperable, untripped channels within the same Trip Function as described in the paragraph above). The 1 hour completion time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the associated systems must be declared inoperable. With any applicable Action and associated completion time not met, the associated subsystem(s) may be incapable of performing the intended function, and the supported subsystem(s) associated with inoperable channels must be declared inoperable immediately. The Required Actions do not allow placing the channel in trip since this action would either cause the initiation or it would not necessarily result in a safe state for the channel in all events.

Table 3.2.1 ACTION Note 3

Table 3.2.1 ACTION Note 3.a is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same Trip Function result in redundant automatic initiation capability being lost for the feature(s). Table 3.2.1 ACTION Note 3.a features would be those that are initiated by Trip Functions 2.d and 2.g (i.e., LPCI). Redundant automatic initiation capability is lost if one Trip Function 2.d channel is inoperable in each trip system or if two Trip Function 2.g channels are inoperable in the same trip system. Each inoperable channel would only require the affected portion of the associated LPCI subsystem to be declared inoperable. However, since channels in both associated LPCI subsystems are inoperable and untripped, and the completion times of Table 3.2.1 ACTION Note 3.a started concurrently for the

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ACTIONS (continued)

channels in both subsystems, this results in the affected portions in the associated LPCI subsystems being concurrently declared inoperable. Table 3.2.1 ACTION Note 3.a is not applicable to Trip Function 2.d, since this Trip Function provides backup to administrative controls ensuring that operators do not divert LPCI flow from injecting into the core when needed. Thus, a total loss of Trip Function 2.d capability for 24 hours is allowed, since the LPCI subsystems remain capable of performing their intended function.

In the situation of loss of redundant automatic initiation capability for Trip Function 2.g, the 24 hour allowance of Table 3.2.1 ACTION Note 3.b is not appropriate and the feature(s) associated with the inoperable channels must be declared inoperable within 1 hour. The Table 3.2.1 ACTION Note completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 3.a, the Completion Time only begins upon discovery of a loss of LPCI initiation capability due to inoperable, untripped channels within the Trip Function 2.g as described in the paragraph above. The 1 hour completion time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref.3) to permit restoration of any inoperable channel to operable status. If an inoperable channel for Trip Function 2.d cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.1 ACTION Note 3.b. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accomodate a single failure, and allow operation to continue. If an inoperable channel for Trip Function 2.g cannot be restored to operable status within the allowable out of service time, the associated systems must be delcared inoperable. With any applicable Action and associated completion time not met, the associated subsystem(s) may be incapable of performing the intended function, and the supported subsystem(s) associated with the inoperable channels must be declared inoperable immediately.

Table 3.2.1 ACTION Note 4

Table 3.2.1 ACTION Note 4.a is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same Trip Function result in redundant automatic initiation capability being lost for the feature(s). The Table 3.2.1 ACTION Note 4.a feature would be HPCI. Redundant automatic initiation capability is lost if two Trip Function 3.a or two Trip Function 3.c channels are inoperable and untripped in the same trip system logic.

In this situation (loss of redundant automatic initiation capability), the 24 hour allowance of Table 3.2.1 ACTION Note 4.b is not appropriate and the feature(s) associated with the inoperable, untripped channels must be declared inoperable within 1 hour. The Table 3.2.1 ACTION Note completion time is intended to allow the operator time to evaluate and repair any discovered ACTIONS (continued)

inoperabilities. For Table 3.2.1 ACTION Note 4.a, the completion time only begins upon discovery of a loss of HPCI initiation capability due to inoperable, untripped channels within the same Trip Function as described in the paragraph above. The 1 hour completion time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.1 ACTION Note 4.b. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue.

Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), the HPCI System must be declared inoperable. With any applicable Action and associated completion time not met, the HPCI System may be incapable of performing the intended function, and the HPCI System must be declared inoperable immediately.

Table 3.2.1 ACTION Note 5

Table 3.2.1 ACTION Note 5.a is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in a complete loss of automatic component initiation capability for the HPCI System. Automatic component initiation capability is lost if two Trip Function 3.b channels are inoperable and untripped. In this situation (loss of automatic suction swap), the 24 hour allowance of Table 3.2.1 ACTION Note 5.b is not appropriate and the HPCI System must be declared inoperable within 1 hour after discovery of loss of HPCI initiation capability. Table 3.2.1 ACTION Note 5.a is only applicable if the HPCI pump suction is not aligned to the suppression pool, since, if aligned, the Trip Function is already performed.

The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 5.a, the completion time only begins upon discovery that the HPCI System cannot be automatically aligned to the suppression pool due to two inoperable, untripped channels in the same Trip Function as described in the paragraph

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ACTIONS (continued)

above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition or the suction source must be aligned to the suppression pool per Table 3.2.1 ACTION Note 5.b. Placing the inoperable channel in trip performs the intended function of the channel (shifting the suction source to the suppression pool). Performance of either of the two actions of Table 3.2.1 ACTION Note 5.b will allow operation to continue. If Table 3.2.1 ACTION Note 5.b is performed, measures should be taken to ensure that the HPCI System piping remains filled with water. Alternately, if it is not desired to perform Table 3.2.1 ACTION NOTE 5.b (e.g., as in the case where shifting the suction source could drain down the HPCI suction piping), the HPCI System must be declared inoperable. With any applicable Action and associated completion time not met, the HPCI System may be incapable of performing the intended function, and the HPCI System must be declared inoperable immediately.

Table 3.2.1 ACTION Note 6

For Trip Function 3.d, the loss of one or more channels results in a loss of the function (two-out-of-two logic). This loss was considered during the development of Reference 3 and considered acceptable for the 24 hours allowed to permit restoration of the inoperable channel to operable status by Table 3.2.1 ACTION Note 6.a. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the HPCI System must be declared inoperable. With any applicable Action and associated completion time not met, the HPCI System may be incapable of performing the intended function, and the HPCI System must be declared inoperable immediately. The Required Actions do not allow placing the channel in trip since this action would either cause the initiation or it would not necessarily result in a safe state for the channel in all events.

Table 3.2.1 ACTION Note 7

Table 3.2.1 ACTION Note 7.a is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in redundant automatic initiation capability being lost for the ADS. Redundant automatic initiation capability is lost if either (a) one or more Trip Function 4.a channels are inoperable and untripped in each trip system logic, or (b) one or more Trip Function 4.b channels are inoperable and untripped in each trip system.

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ACTIONS (continued)

In this situation (loss of automatic initiation capability), the 96 hour or 8 day allowance, as applicable, of Table 3.2.1 ACTION Note 7.b or 7.c, respectively, is not appropriate and all ADS valves must be declared inoperable within 1 hour after discovery of loss of ADS initiation capability. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 7.a, the completion time only begins upon discovery that the ADS cannot be automatically initiated due to inoperable, untripped channels within the same Trip Function as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 8 days has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status if both HPCI and RCIC are operable (Table 3.2.1 ACTION Note 7.c). If either HPCI or RCIC is inoperable, the time is shortened to 96 hours (Table 3.2.1 ACTION Note 7.b). If the status of HPCI or RCIC changes such that the completion time changes from 8 days to 96 hours, the 96 hours begins upon discovery of HPCI or RCIC inoperability. However, the total time for an inoperable, untripped channel cannot exceed 8 days. If the status of HPCI or RCIC changes such that the completion time changes from 96 hours to 8 days, the 8 day allowable out of service time begins upon discovery of the inoperable, untripped channel. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.1 ACTION Note 7.b or 7.c, as applicable. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), the ADS must be declared inoperable. With any applicable Action and associated completion time not met, the ADS may be incapable of performing the intended function, and the ADS must be declared inoperable immediately.

Table 3.2.1 ACTION Note 8

Table 3.2.1 ACTION Note 8.a is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same Trip Function result in redundant automatic initiation capability being lost for the ADS. Redundant automatic initiation capability is lost if either (a) one Trip Function 4.c channel is inoperable in each trip system logic (i.e., 2 channels are inoperable), (b) one or more Trip Function 4.d channels are inoperable in each trip system logic, or (c) all Trip Function 1.f and 2.f channels are inoperable.

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

ACTIONS (continued)

In this situation (loss of automatic initiation capability), the 96 hour or 8 day allowance, as applicable, of Table 3.2.1 ACTION Note 8.b or 8.c, respectively, is not appropriate and all ADS valves must be declared inoperable within 1 hour after discovery of loss of ADS initiation capability. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.1 ACTION Note 8.a, the completion time only begins upon discovery that the ADS cannot be automatically initiated due to inoperable channels within the same Trip Function as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 8 days has been shown to be acceptable (Ref. 3) to permit restoration of any inoperable channel to operable status if both HPCI and RCIC are operable (Table 3.2.1 ACTION Note 8.c). If either HPCI or RCIC is inoperable, the time shortens to 96 hours (Table 3.2.1 ACTION Note 8.b). If the status of HPCI or RCIC changes such that the completion time changes from 8 days to 96 hours, the 96 hours begins upon discovery of HPCI or RCIC inoperability. However, the total time for an inoperable channel cannot exceed 8 days. If the status of HPCI or RCIC changes such that the completion time changes from 96 hours to 8 days, the 8 day allowable out of service time begins upon discovery of the inoperable channel. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the ADS must be declared inoperable. With any applicable Action and associated completion time not met, the ADS may be incapable of performing the intended function, and the ADS must be declared inoperable immediately. The Required Actions do not allow placing the channel in trip since this action would not necessarily result in a safe state for the channel in all events.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.A.1

As indicated in Surveillance Requirement 4.2.A.1, ECCS instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.1. Table 4.2.1 identifies, for each ECCS Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.A.1 also indicates that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours as follows: (a) for Trip Function 3.d; and (b) for Trip Functions other than 3.d provided the associated Trip Function or redundant Trip Function maintains initiation capability. Upon completion of the

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SURVEILLANCE REQUIREMENTS (continued)

Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Ref. 3) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the ECCS will initiate when necessary.

Surveillance Requirement 4.2.A.2

The Logic System Functional Test demonstrates the operability of the required initiation logic and simulated automatic operation for a specific channel. The simulated automatic actuation testing required by the ECCS Technical Specifications and Diesel Generator Technical Specifications overlaps this Surveillance to provide testing of the assumed safety function. For the ADS Trip Functions, this Logic System Functional Test requirement does not include solenoids of the ADS valves. However, a simulated automatic actuation, which opens all pilot valves of the ADS valves, shall be performed such that each trip system logic can be verified independent of its redundant counterpart. In addition, for the ADS Trip Functions, the Logic System Functional Test will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the ADS manual inhibit switches prevent opening all ADS valves will be accomplished in conjunction with Surveillance Requirement 4.5.F.1. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.2.1, Check

Performance of an Instrument Check once per day for Trip Functions 1.a, 1.b, 1.g, 1.h, 2.b, 2.c, 2.i, 2.j, 3.a, 3.c, 4.a, and 4.b, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency

BASES: 3.2.A/4.2.A EMERGENCY CORE COOLING SYSTEM (ECCS)

SURVEILLANCE REQUIREMENTS (continued)

is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Table 4.2.1, Functional Test

For Trip Functions 1.a, 1.b, 1.c, 1.d, 1.f, 1.g, 1.h, 2.a, 2.b, 2.c, 2.d, 2.f, 2.g, 2.h, 2.i, 2.j, 3.a, 3.b, 3.c, 3.d, 4.a, and 4.b, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The Frequency of "Every 3 Months" is based on the reliability analysis of Reference 3.

Table 4.2.1, Calibration

For Trip Functions 1.a, 1.b, 1.c, 1.d, 1.e, 1.f, 2.a, 2.b, 2.c, 2.d, 2.e, 2.f, 2.g, 2.h, 3.a, 3.b, 3.c, 3.d, 4.a, 4.b, 4.c, and 4.d, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

For Trip Functions 1.a, 1.b, 1.c, 1.d, 2.a, 2.b, 2.c, 2.d, 2.g, 2.h, 3.a, 3.c, 3.d, 4.a, and 4.b, a calibration of the trip units is required (Footnote (a)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. The channel must be declared inoperable if the trip setting is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The Frequency of every 3 months is based on the reliability analysis of Reference 3 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

REFERENCES

1. UFSAR, Section 6.5.

2. UFSAR, Chapter 14.

3. NEDC-30936-P-A, BWR Owners' Group Technical Specification Improvement Methodology (With Demonstration for BWR ECCS Actuation Instrumentation), Parts 1 and 2, December 1988.

Current

Technical Specifications

Markups

3.2.A and 4.2.A

Emergency Core Cooling System

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the operational status of the plant instrumentation systems which initiate and control a protective function.

Objective:

To assure the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System (ECCS)

A.2 L.1 L.4

When the system(s) it initiates or controls is required in accordance with Specification 3.5, the instrumentation which initiates the emergency core cooling system(s) shall be operable in accordance with Table 3.2.1.

The ECCS instrumentation for each Trip Function in Table 3.2.1

B. Primary Containment Isolation

When primary containment integrity is required, in accordance with Specification 3.7, the instrumentation that initiates primary containment isolation shall be operable in accordance with Table 3.2.2.

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

The instrumentation that initiates the isolation of the reactor building ventilation system and the actuation of the standby gas treatment system shall be operable in accordance with Table 3.2.3.

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the surveillance requirements of the instrumentation systems which initiate and control a protective function.

Objective:

To verify the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System (ECCS)

1. ECCS ~~Instrumentation and logic systems~~ shall be functionally checked tested and calibrated as indicated in Table 4.2.1. A.3 A.4

<Move to separate page>

B. Primary Containment Isolation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.2.

<Move to separate page>

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.3.

When an ECCS instrumentation channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed as follows: (a) for up to 6 hours for Trip Function 3.d; and (b) for up to 6 hours for Trip Functions other than 3.d provided the associated Trip Function or redundant Trip ...

A.5

A.1

TABLE 3.2.1

EMERGENCY CORE COOLING SYSTEM ~~ACTUATION~~ INSTRUMENTATION

LA.2

Actions when Required Channels are Inoperable

Core Spray - ~~A & B (Note 1)~~

	Minimum Number of Operable Instrument Channels per Trip System	A.5	Trip Function	Trip ~~Level~~ Setting (A.1)	Required ACTION When Minimum Conditions For Operation Are Not Satisfied
1.a	2	~~(Note 8)~~	High Drywell Pressure ~~(PT-10-101 (A-D) (M))~~	≤2.5 psig	Note ~~10~~ 1
1.b	2	~~(Note 8)~~	Low-Low Reactor Vessel Water Level ~~(LT-2-3-72 (A-D) (M))~~	~~≥82.5" above top of enriched fuel~~ LA.3	Note ~~10~~ 1
1.c	1	~~(Note 8)~~	Low Reactor Pressure ~~(PT-2-3-56C/D (M))~~	$300 \leq P \leq 350$ psig	Note ~~11~~ 2
1.d	2	~~(Note 8)~~	Low Reactor Pressure ~~(PT-2-3-56A/B (M) & PT-2-3-52C/D (M))~~ LA.1	$300 \leq P \leq 350$ psig	Note ~~11~~ 2
1.e	1	~~(Note 8)~~ 8 M.1	Pump Start Time Delay ~~(14A-K16A & B)~~	$8 \leq t \leq 10$ seconds	Note ~~12~~ 2
1.f	M.7 2 per pump	~~(Note 8)~~	Pump ~~(P-46-1A/B)~~ Discharge Pressure ~~(PS-14-44 (A-D))~~	≥100 psig	Note ~~18~~ 8
1.g	1	~~(Note 8)~~	Auxiliary Power Monitor ~~(LNPX C/D)~~	--	Note ~~10~~ 2
1.h	1	~~(Note 8)~~	Pump Bus Power Monitor ~~(27/3A/B, 27/4A/B)~~	--	Note ~~10~~ 2
	~~1~~		~~Trip System Logic~~	~~--~~	~~Note 5~~ L.5

A.1

TABLE 3.2.1
(Cont'd)

EMERGENCY CORE COOLING SYSTEM ~~ACTUATION~~ INSTRUMENTATION

Low Pressure Coolant Injection System ~~(A & B (Note 1))~~ LA.2

Actions when Required Channels are Inoperable

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip ~~Level~~ Setting (A.1)	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~	
2.a	1 ~~(Note 8)~~ A.5	Low Reactor Pressure ~~(PT-2-3-56C/D(M))~~	300 $\leq$ p $\leq$ 350 psig	Note ~~1~~ 2	LA.1
2.b	2 ~~(Note 8)~~	High Drywell Pressure ~~(PT-10-101(A-D)(M))~~	$\leq$2.5 psig	Note ~~10~~ 1	LA.1
2.c	2 ~~(Note 8)~~	Low-Low Reactor Vessel Water Level ~~(LT-2-3-72(A-D)(S1))~~	$\geq$82.5" ~~above top of enriched fuel~~	Note ~~10~~ 1	LA.3
2.d	1 (Note ~~9~~ 8) M.1	Reactor Vessel Shroud Level ~~(LT-2-3-73A/B(M))~~	$\geq$2/3 core height	Note ~~11~~ 3	LA.1
A.5	~~1 (Note 9)~~	~~Time Delay (10A-K72A & B)~~	~~$\leq$60 seconds~~	~~Note 12~~	R.1
2.e M.1	1 (Note ~~9~~) 8	Pump Start Time Delay ~~(10A-K50A & B)~~	3 $\leq$ t $\leq$ 5 seconds	Note ~~12~~ 2	LA.1
	1 (Note 9)	Low Reactor Pressure (PS-2-128A & B)	100 $\leq$ p $\leq$ 150 psig	Note 10	A.8
2.f.	2 per pump ~~(Note 8)~~	RHR Pump ~~(A-D)~~ Discharge Pressure ~~(PS-10-105(A-H))~~	$\geq$100 psig	Note ~~18~~ 8	LA.1
2.g	2 ~~(Note 8)~~ A.5	High Drywell Pressure ~~(PT-10-101(A-D)(S1))~~	$\leq$2.5 psig	Note ~~13~~ 3	LA.1

A.1

Actions when Required Channels are Inoperable

TABLE 3.2.1
(Cont'd)

EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION

LA.2

Low Pressure Coolant Injection System A & B (Note 1)			
Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Level Setting (A.1)	Required ACTION When Minimum Conditions For Operation Are Not Satisfied
1 (Note 9)	Time Delay (10A-K45A & B)	≤6 minutes	Note 12 (R.2)
2.h 2 (Note 8)	Low Reactor Pressure (PT-2-3-56A/B(M) & PT-2-3-52C/D(M)) (LA1)	300 ≤ p ≤ 350 psig	Note ~~1~~ 2
2.i 1 (Note 8)	Auxiliary Power Monitor (LNPX 07/D)	--	Note ~~10~~ 2
2.j 1 (Note 8)	Pump Bus Power Monitor (27/3A/B, 27/4A/B)	--	Note ~~10~~ 2
1	Trip System Logic	--	Note 5 (L.5)

A.1

TABLE 3.2.1
(Cont'd)

EMERGENCY CORE COOLING SYSTEM ~~ACTUATION~~ INSTRUMENTATION

High Pressure Coolant Injection System

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip ~~Level~~ Setting	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~ Actions when Required Channels are Inoperable
3.a	2 ~~(Notes 3)~~ (8)	Low-Low Reactor Vessel Water Level (LT-2-3-72(A-D)(S1))	~~Same as LPCI~~ ≥ 82.5 inches A.1	Note ~~14~~ 4
3.b	2 ~~(Notes 4)~~ 8)	Low Condensate Storage Tank Water Level (LSL-107-5A/B)	~~≥ 3%~~ 4.24% (4) M.6	Note ~~15~~ 5
3.c	2 ~~(Notes 3)~~ 8)	High Drywell Pressure (PT-10-101(A-D)(M)) LA.1	~~Same as LPCI~~ ≤ 2.5 psig A.1	Note ~~14~~ 4
	~~1~~ ~~(Note 4)~~ L.5	~~Trip System Logic~~ L.5	~~--~~	~~Note 5~~ L.5
3.d	2 ~~(Notes 7)~~ 9) LA.4	High Reactor Vessel Water Level (LT-2-3-72A/B)(S4))	≤177 inches ~~above top of enriched fuel~~ LA.3	Note ~~16~~ 6

A.5 A.1

(4) PERCENT OF INSTRUMENT SPAN.

A.1

TABLE 3.2.1
(Cont'd)

EMERGENCY CORE COOLING SYSTEM ~~ACTUATION~~ INSTRUMENTATION

	Automatic Depressurization			
	Minimum Number of Operable Instrument Channels per Trip System ~~(Notes 4)~~ LA.4	Trip Function	Trip ~~Level~~ Setting A.1	Required ACTION When Minimum Conditions For Operation Are Not Satisfied
4.a	2 (Note 8)	Low-Low Reactor Vessel Water Level ~~(LT-2-3-72(A-D)(M))~~	~~Same as Core Spray~~ ≥ 82.5 inches A.1	Note ~~17~~ 7
4.b	2 (Note 8)	High Drywell Pressure ~~(PT-10-101(A-D)(S1))~~ LA.1	≤2.5 psig	Note ~~17~~ 7
4.c	1 (Note 8)	Time Delay ~~(2E-K5A/B)~~	≤120 seconds	Note ~~18~~ 8
	~~1~~ L.5	~~Trip System Logic~~ L.5	~~--~~	~~Note 6~~ L.5
4.d	2 (Note 8) A.5	Time Delay ~~(2E-K16A/B, 2E-K17A/B)~~	≤8 minutes	Note ~~18~~ 8

A 1

TABLE 3.2.1
(Cont'd)

RECIRCULATION PUMP TRIP ACTUATION INSTRUMENTATION

Recirculation Pump Trip - A & B (Note 1)			
Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Level Setting	Required ACTION When Minimum Conditions For Operation Are Not Satisfied
2 (Note 8)	Low-Low Reactor Vessel Water Level (LM-2-3-68(A-D))	$\geq$ 6' 10.5" above top of enriched fuel	Note 19
2 (Note 8)	High Reactor Pressure (PM-2-3-54(A-D))	$\leq$ 1150 psig	Note 19
2 (Note 8)	Time Delays (2-3-68(A-D)(X))	$\leq$ 10 seconds	Note 19
1	Trip Systems Logic	--	Note 2

A.9

A.1

TABLE 3.2.1 ACTION NOTES

1. Each of the two Core Spray, LPCI and RPT, subsystems are initiated and controlled by a trip system. The subsystem "B" is identical to the subsystem "A". LA.2

2. If the minimum number of operable instrument channels are not available, the inoperable channel shall be tripped using test jacks or other permanently installed circuits. If the channel cannot be tripped by the means stated above, that channel shall be made operable within 24 hours or an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours. A9

3. One trip system with initiating instrumentation arranged in a one-out-of-two taken twice logic. LA.4

4. One trip system with initiating instrumentation arranged in a one-out-of-two logic.

L.5

~~5.~~ If the minimum number of operable channels are not available, the system is considered inoperable and the requirements of Specification 3.5 apply. A6

~~6.~~ Any one of the two trip systems will initiate ADS. If the minimum number of operable channels in one trip system is not available, the requirements of Specification 3.5.F.2 and 3.5.F.3 shall apply. If the minimum number of operable channels is not available in both trip systems, Specifications 3.5.F.3 shall apply. L.5

7. One trip system arranged in a two-out-of-two logic. LA.4

~~8.~~ When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function or redundant Trip Function maintains ECCS initiation capability or Recirculation Pump Trip capability. A.5 A.7

~~9.~~ When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours. A.5

1. ~~10.~~ With one or more channels inoperable for Core Spray and/or LPCI:

both L.2

~~A.~~ Within one hour from discovery of loss of initiation capability for feature(s) in one divisions declare the associated systems inoperable, and

~~B.~~ Within 24 hours, place channel in trip.

~~C.~~ If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable.

2. ~~11.~~ With one or more channels inoperable for injection permissive and/or recirculation discharge valve permissive: or power monitors M.2

both L.2

~~A.~~ Within one hour from discovery of loss of initiation capability for feature(s) in one divisions declare the associated systems inoperable, and

~~B.~~ Within 24 hours, restore channel to operable status.

~~C.~~ If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable.

A.1

ACTION

TABLE 3.2.1 NOTES (Cont'd)

2. ~~12.~~ With one or more actuation timer channels inoperable for Core Spray and/or LPCI:

both — L.2

~~A~~. Within one hour from discovery of loss of initiation capability for feature(s) in ~~one~~ division(s) declare the associated systems inoperable, and

restore — to operable status — M.3

~~B~~. Within 24 hours, ~~place~~ channel ~~in trip~~.

~~C~~. If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable.

3. ~~13.~~ With one or more channels inoperable for Containment Spray:

For Trip Function 2.g only, — associated — L.3

~~A~~. Within one hour from discovery of loss of LPCI System initiation capability, declare the ~~LPCI~~ ~~System~~ inoperable, and

~~B~~. Within 24 hours, place channel in trip for High Drywell Pressure and restore channel to operable status for Reactor Vessel Shroud Level.

~~C~~. If required action and associated completion times of actions A and B are not met, immediately declare the ~~LPCI System~~ inoperable.

associated systems

4. ~~14.~~ With one or more channels inoperable for HPCI:

HPCI

~~A~~. Within one hour from discovery of loss of system initiation capability, declare the HPCI System inoperable, and

~~B~~. Within 24 hours, place channel in trip.

~~C~~. If required actions and associated completion times of actions A or B are not met, immediately declare the HPCI System inoperable.

5. ~~15.~~ With one or more channels inoperable for HPCI:

HPCI

~~A~~. Within one hour from discovery of loss of initiation capability while suction for the HPCI System is aligned to the CST, declare the HPCI System inoperable, and

~~B~~. Within 24 hours, place channel in trip or align suction for the HPCI System to the suppression pool.

~~C~~. If required actions and associated completion times of actions A or B are not met, immediately declare the HPCI System inoperable.

6. ~~16.~~ With one or more channels inoperable for HPCI:

~~A~~. Within 24 hours, restore channel to operable status.

~~B~~. If required action and associated completion time of action A is not met, immediately declare HPCI System inoperable.

7. ~~17.~~ With one or more channels inoperable for ADS:

both — L.2

A. Within one hour from discovery of loss of ADS initiation capability in ~~one~~ trip system(s) declare ADS inoperable, and

B. Within 96 hours from discovery of an inoperable channel concurrent with HPCI or RCIC System inoperable, place the channel in trip, and

C. Within 8 days, place a channel in trip.

D. If required actions and associated completion times of actions A, B or C are not met, immediately declare ADS inoperable.

A.1

ACTION

TABLE 3.2.1 NOTES (Cont'd)

8. ~~18.~~ With one or more channels inoperable for ADS:

both — L.2

~~A.~~ Within one hour from discovery of loss of ADS initiation capability in ~~one~~ trip systems declare ADS inoperable, and

~~B.~~ Within 96 hours from discovery of an inoperable channel concurrent with HPCI or RCIC System inoperable, restore channel to operable status, and

~~C.~~ Within 8 days, restore channel to operable status.

~~D.~~ If required actions and associated completion times of actions A, B or C are not met, immediately declare ADS inoperable.

19. With one or more channels inoperable for Recirculation Pump Trip:

A. Within one hour from discovery of loss of Recirculation Pump Trip capability restore one Trip Function or remove the associated recirculation pump from service in 6 hours or be in Startup/Hot Standby in 6 hours.

B. Within 14 days from discovery of an inoperable channel, restore channel to operable status or place in trip, and

C. Within 72 hours from discovery of one trip function capability not maintained, restore trip function to operable status and,

D. If required actions and associated completion times of actions A, B or C are not met, immediately remove the associated recirculation pump from service in 6 hours or be in Startup/Hot Standby in 6 hours.

A.9

A.1

TABLE 4.2.1

MINIMUM TESTS AND CALIBRATION FREQUENCIES

EMERGENCY CORE COOLING ACTUATION INSTRUMENTATION SYSTEM

Core Spray System

	Trip Function	Functional Test (8) A.10	Calibration (8) A.10	Instrument Check
1.a	High Drywell Pressure	Every Three Months	Once/Operating Cycle	Once Each Day
1.b	Low-Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle	Once Each Day
1.c	~~Low Reactor Pressure~~ ~~(PT-2-3-56C/D(M))~~ LA.1	Every Three Months	Once/Operating Cycle Every 3 Months (1) M.5	--
1.d	Low Reactor Pressure ~~(PT-2-3-56A/B(M) & 52C/D(M))~~ LA.1	Every Three Months	Once/Operating Cycle	--
1.f	Pump ~~(P-46-1A/B)~~ Discharge Pressure LA.1	Every Three Months	Every Three Months	--
1.g	Auxiliary Power Monitor	Every Three Months	None	Once Each Day
1.h	Pump Bus Power Monitor	Every Three Months	None	Once Each Day
4.2.A.2	Trip System Logic	Once/Operating Cycle	Once/Operating Cycle	-- A.3
1.e	Pump Start Time Delay		~~(Note 3)~~	A.11

(1) Trip unit calibration only M.5

A.1

TABLE 4.2.1
(Cont'd)

MINIMUM TESTS AND CALIBRATION FREQUENCIES

EMERGENCY CORE COOLING ~~ACTUATION~~ INSTRUMENTATION
SYSTEM

Low Pressure Coolant Injection System

	Trip Function	Functional Test (8) A.10	Calibration (8) A.10	Instrument Check
2.a	Low Reactor Pressure (~~PT-2-3-56C/D(M)~~) LA.1	Every Three Months	Once/Operating Cycle Every 3 Months,(1)	--
2.b	High Drywell Pressure (~~PT-10-101A-D(M)~~) LA.1	Every Three Months	Once/Operating Cycle Every 3 Months,(1)	Once Each Day
2.c	Low-Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle Every 3 Months,(1) M.5	Once Each Day
2.d	Reactor Vessel Shroud Level	Every Three Months	Once/Operating Cycle Every 3 Months,(1)	--
	Low Reactor Pressure (PS-2-128A/B)	Every Three Months	Every Three Months	-- A.8
2.f	RHR Pump Discharge Pressure	Every Three Months	Every Three Months	--
2.g	High Drywell Pressure (~~PT-10-101A-D(SI)~~) LA.1	Every Three Months	Once/Operating Cycle Every 3 Months,(1)	--
2.h	Low Reactor Pressure (~~PT-2-3-56A/B) (M) & 52C/D(M)~~) LA.1	Every Three Months	Once/Operating Cycle Every 3 Months,(1) M.5	--
2.i	Auxiliary Power Monitor	Every Three Months	None	Once Each Day
2.j	Pump Bus Power Monitor	Every Three Months	None	Once Each Day
SR4.2.A.2	Trip System Logic	Once/Operating Cycle	Once/Operating Cycle (~~Note 3~~)	-- A.3
2.e	LPCI B and C Pump Start Time Delay		A.11	

(1) Trip unit calibration only M.5

A.1

TABLE 4.2.1
(Cont'd)

MINIMUM TESTS AND CALIBRATION FREQUENCIES

EMERGENCY CORE COOLING ACTUATION INSTRUMENTATION SYSTEM

	Trip Function	Functional Test (8) A.10	Calibration (8) A.10	Instrument Check
	High Pressure Coolant Injection System			
3.a	Low-Low Reactor Vessel Water Level	Every Three Months	Once/operating cycle Every 3 Months,(1) M.5	Once each day
3.b	Low Condensate Storage Tank Water Level	Every Three Months	Every three months	--
3.c	High Drywell Pressure	Every Three Months	Once/operating cycle	Once each day
SR4.2.A.2	Trip System Logic	Once/operating cycle	~~Once/Operating cycle (Note 3)~~ A.12	-- A.3
3.d	High Reactor Vessel Water Level	Every Three Months	Once/operating cycle Every 3 Months,(1) M.5	--

(1) Trip unit calibration only M.5

A.1

TABLE 4.2.1
(Cont'd)

~~MINIMUM~~ TESTS AND ~~CALIBRATION~~ FREQUENCIES

EMERGENCY CORE COOLING ~~ACTUATION~~ SYSTEM INSTRUMENTATION

Automatic Depressurization System

	Trip Function	Functional Test ~~(8)~~ A.10	Calibration ~~(8)~~ A.10	Instrument Check
4.a	Low-Low Reactor Vessel Water Level	Every Three Months	~~Once/Operating Cycle~~ Every 3 Months,(1) M.5	Once Each Day
4.b	High Drywell Pressure	Every Three Months	~~Once/Operating Cycle~~ Every 3 Months,(1) M.5	Once Each Day
SR4.2.A.2	Trip System Logic ~~(Except Solenoids of Valves)~~ LA.5	Once/Operating Cycle ~~(Notes 2 and 11)~~ LA.5	Once/Operating Cycle ~~(Note 3)~~ A.11	-- A.3
4.c	Time Delay		Once/Operating Cycle	
4.d	Sustained Low-Low Reactor Vessel Water Level Time Delay		Once/Operating Cycle	

(1) Trip unit calibration only. M.5

A.1

TABLE 4.2.1
(Cont'd)

MINIMUM TEST AND CALIBRATION FREQUENCIES

EMERGENCY CORE COOLING ACTUATION INSTRUMENTATION

Recirculation Pump Trip Actuation System			
Trip Function	Functional Test(8)	Calibration(8)	Instrument Check
Low-Low Reactor Vessel Water Level	Every Three Months (Note 4)	Once/Operating Cycle	Once Each Day
High Reactor Pressure	Every Three Months (Note 4)	Once/Operating Cycle	Once Each Day
Trip System Logic	Once/Operating Cycle	Once/Operating Cycle	--

A.9

A.1

~~TABLE 4.2 NOTES~~

~~1. Not used.~~

~~2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart.~~ LA.5

~~3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system.~~ A.11

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.13

~~5. Deleted.~~

~~6. Deleted.~~

~~7. Deleted.~~

~~8. Functional tests and calibrations are not required when systems are not required to be operable.~~ A.10

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle. A.15

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation. A.16

~~11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.~~ LA.5

12. Trip system logic testing is not applicable to this function.. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage. A.17

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power). A.17

Proposed

Technical Specifications

3.2.B and 4.2.B

Primary Containment Isolation

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

B. Primary Containment Isolation

The primary containment isolation instrumentation for each Trip Function in Table 3.2.2 shall be operable in accordance with Table 3.2.2.

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

B. Primary Containment Isolation

1. The primary containment isolation instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.2.

   When a primary containment isolation channel, and/or the affected primary containment isolation valve, is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains isolation capability.

2. Perform a Logic System Functional Test of Primary Containment isolation instrumentation Trip Functions once every Operating Cycle.

Table 3.2.2 (page 1 of 3)
Primary Containment Isolation Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
1. Main Steam Line Isolation					
a. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.a	≥ 82.5 inches
b. High Main Steam Line Area Temperature	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	8	Note 1	Note 2.a	≤ 196 °F for channels monitoring outside steam tunnel and ≤ 200 °F for channels monitoring inside steam tunnel
c. High Main Steam Line Flow	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2 per main steam line	Note 1	Note 2.a	≤ 140% of rated flow
d. Low Main Steam Line Pressure	RUN	2	Note 1	Note 2.c	≥ 800 psig
e. High Main Steam Line Flow - Not in RUN	STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.a	≤ 40% of rated flow
f. Condenser Low Vacuum	RUN, STARTUP/HOT STANDBY[(b)], HOT SHUTDOWN[(b)], Refuel[(a and b)]	2	Note 1	Note 2.a	≤ 12 inches Hg absolute
2. Primary Containment Isolation					
a. Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.b	≥ 127.0 inches
b. High Drywell Pressure	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.b	≤ 2.5 psig

(a) With reactor coolant temperature > 212 °F.

(b) With any turbine stop valve or turbine bypass valve not closed.

Table 3.2.2 (page 2 of 3)
Primary Containment Isolation Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
3. High Pressure Coolant Injection (HPCI) System Isolation					
a. High Steam Line Space Temperature	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	6	Note 1	Note 2.d	≤ 196 °F
b. High Steam Line d/p (Steam Line Break)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	1	Note 1	Note 2.d	≤ 195 inches of water
c. Low Steam Supply Pressure	RUN, STARTUP/HOT STANDBY[(c)], HOT SHUTDOWN[(c)], Refuel[(c)]	4	Note 1	Note 2.d	≥ 70 psig
d. High Main Steam Line Tunnel Temperature	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.d	≤ 200 °F
e. High Main Steam Line Tunnel Temperature Time Delay	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	1	Note 1	Note 2.d	≤ 35 minutes
4. Reactor Core Isolation Cooling (RCIC) System Isolation					
a. High Main Steam Line Tunnel Temperature	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	2	Note 1	Note 2.d	≤ 200 °F
b. High Main Steam Line Tunnel Temperature Time Delay	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	1	Note 1	Note 2.d	≤ 35 minutes
c. High Steam Line Space Temperature	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[(a)]	6	Note 1	Note 2.d	≤ 196 °F

(a) With reactor coolant temperature > 212 °F.

(c) With reactor steam pressure > 150 psig.

Table 3.2.2 (page 3 of 3)
Primary Containment Isolation Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	ACTIONS REFERENCED FROM ACTION NOTE 1	TRIP SETTING
4. RCIC System Isolation (Continued)					
d. High Steam Line d/p (Steam Line Break)	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	1	Note 1	Note 2.d	≤ 195 inches of water
e. High Steam Line d/p Time Delay	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	1	Note 1	Note 2.d	≥ 3 seconds and ≤ 7 seconds
f. Low Steam Supply Pressure	RUN, STARTUP/HOT STANDBY[c], HOT SHUTDOWN[c], Refuel[c]	4	Note 1	Note 2.d	≥ 50 psig
5. Residual Heat Removal Shutdown Cooling Isolation					
a. High Reactor Pressure	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN' Refuel[a]	1	Note 1	Note 2.d	≤ 150 psig

(a) With reactor coolant temperature > 212 °F.

(c) With reactor steam pressure > 150 psig.

Table 3.2.2 ACTION Notes

1. With one or more required Primary Containment Isolation Instrumentation channels inoperable, take all of the applicable Actions in Notes 1.a and 1.b below.

   a. With one or more Trip Functions with one or more required channels inoperable:

      1) For Trip Functions 2.a and 2.b, place any inoperable channel in trip within 12 hours; and
      2) For Trip Functions 3.e, 4.b, and 4.e, restore any inoperable channel to operable status within 24 hours; and
      3) For all other Trip Functions, place any inoperable channel in trip within 24 hours.

   b. With one or more Trip Functions with isolation capability not maintained:

      1) Restore isolation capability within 1 hour.

   Penetration flow paths, isolated as a result of complying with the above Actions, may be unisolated intermittently under administrative controls.

   If any applicable and associated completion time of Note 1.a or 1.b is not met, take the applicable Actions of Note 2 below and referenced in Table 3.2.2 for the channel.

2. a. Isolate the associated Main Steam Line within 12 hours (penetration flow paths may be unisolated intermittently under administrative control); or Place the reactor in HOT SHUTDOWN within 12 hours and place the reactor in COLD SHUTDOWN within the next 12 hours.

   b. Place the reactor in COLD SHUTDOWN within 24 hours.

   c. Place the reactor in STARTUP/HOT STANDBY within 8 hours.

   d. Isolate the affected penetration flow path within 1 hour (penetration flow paths may be unisolated intermittently under administrative control).

Table 4.2.2 (page 1 of 2)
Primary Containment Isolation Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Main Steam Line Isolation			
a. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
b. High Main Steam Line Area Temperature	NA	Every 3 Months	Each Refueling Outage
c. High Main Steam Line Flow	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
d. Low Main Steam Line Pressure	NA	Every 3 Months	Every 3 Months
e. High Main Steam Line Flow - Not in RUN	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
f. Condenser Low Vacuum	NA	Every 3 Months	Every 3 Months
2. Primary Containment Isolation			
a. Low Reactor Vessel Water Level	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
b. High Drywell Pressure	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
3. High Pressure Coolant Injection (HPCI) System Isolation			
a. High Steam Line Space Temperature	NA	Every 3 Months	Each Refueling Outage
b. High Steam Line d/p (Steam Line Break)	NA	Every 3 Months	Every 3 Months
c. Low Steam Supply Pressure	NA	Every 3 Months	Every 3 Months
d. High Main Steam Line Tunnel Temperature	NA	Every 3 Months	Each Refueling Outage
e. High Main Steam Line Tunnel Temperature Time Delay	NA	NA	Once/Operating Cycle

(a) Trip unit calibration only.

Table 4.2.2 (page 2 of 2)
Primary Containment Isolation Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
4. Reactor Core Isolation Cooling (RCIC) System Isolation			
a. High Main Steam Line Tunnel Temperature	NA	Every 3 Months	Each Refueling Outage
b. High Main Steam Line Tunnel Temperature Time Delay	NA	NA	Once/Operating Cycle
c. High Steam Line Space Temperature	NA	Every 3 Months	Each Refueling Outage
d. High Steam Line d/p (Steam Line Break)	NA	Every 3 Months	Every 3 Months
e. High Steam Line d/p (Steam Line Break) Time Delay	NA	Every 3 Months	Every 3 Months
f. Low Steam Supply Pressure	NA	Every 3 Months	Every 3 Months
5. Residual Heat Removal Shutdown Cooling Isolation			
a. High Reactor Pressure	NA	Every 3 Months	Every 3 Months

Proposed

Bases

3.2.B and 4.2.B

Primary Containment Isolation

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

BACKGROUND

The primary containment isolation instrumentation automatically initiates closure of appropriate primary containment isolation valves (PCIVs). The function of the PCIVs, in combination with other accident mitigation systems, is to limit fission product release during and following postulated Design Basis Accidents (DBAs). Primary containment isolation within the time limits specified for those isolation valves designed to close automatically ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a DBA.

The isolation instrumentation includes the sensors, relays, and switches that are necessary to cause initiation of primary containment and reactor coolant pressure boundary (RCPB) isolation. Most channels include electronic equipment (e.g., trip units) that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs a primary containment isolation signal to the isolation logic. Functional diversity is provided by monitoring a wide range of independent parameters. The input parameters to the isolation logics are (a) reactor vessel water level, (b) area ambient temperatures, (c) main steam line (MSL) flow, (d) main steam line pressure, (e) condenser vacuum, (f) drywell pressure, (g) high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) steam line d/p, (h) HPCI and RCIC steam line pressure, and (i) reactor vessel pressure. Redundant sensor input signals from each parameter are provided for initiation of isolation.

Primary containment isolation instrumentation has inputs to the trip logic of the isolation functions listed below.

1. Main Steam Line Isolation

The Low - Low Reactor Vessel Water Level, Low Main Steam Line Pressure, High Main Steam Line Flow - Not in RUN, and Condenser Low Vacuum Trip Functions each receive inputs from four channels. The outputs of these channels are combined in a one-out-of-two taken twice logic to initiate isolation of all main steam isolation valves (MSIVs), MSL drain valves, and recirculation loop sample isolation valves.

The High Main Steam Line Flow Trip Function uses 16 flow channels, four for each steam line. One channel from each steam line inputs to one of the four trip strings. Two trip strings make up each trip system and both trip systems must trip to cause an isolation of all MSIVs, MSL drain valves, and recirculation sample isolation valves. Each trip string has four inputs (one per MSL), any one of which will trip the trip string. The trip strings are arranged in a one-out-of-two taken twice logic. This is effectively a one-out-of-eight taken twice logic arrangement to initiate isolation.

The High Main Steam Line Area Temperature Trip Function receives input from 16 channels, four for each of four main steam line areas. The logic is arranged similar to the High Main Steam Line Flow Trip Function. One channel from each steam tunnel area inputs to one of four trip strings. Two trip strings make up a trip system and both trip systems must trip to cause isolation.

MSL Isolation Trip Functions isolate the Group 1 valves.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

BACKGROUND (continued)

2. Primary Containment Isolation

The Low Reactor Vessel Water Level and High Drywell Pressure Trip Functions each receive inputs from four channels. For each Trip Function, the outputs of these channels are combined in a one-out-of-two taken twice logic to initiate isolation of the PCIVs identified in Reference 1.

Primary Containment Isolation Trip Functions isolate the Groups 2, 3, and 4 valves. Group 5 valves are also isolated by the Low Reactor Vessel Water Level Trip Function.

3, 4. High Pressure Coolant Injection System Isolation and Reactor Core Isolation Cooling System Isolation

The HPCI High Steam Line d/p, RCIC High Steam Line d/p, and RCIC High Steam Line d/p Time Delay Trip Functions each receive input from two channels, with each channel in one trip system using a one-out-of-one logic. The trip systems are arranged in a one-out-of-two logic. Each of the two trip systems is connected to both valves on the associated penetration.

The HPCI and RCIC Low Steam Supply Line Pressure Trip Functions each receive input from four steam supply pressure channels. The outputs from the associated steam supply pressure channels are connected in a one-out-of-two-twice trip system logic arrangement. There are two trip system logics which provide input to one trip system. The trip system must trip to initiate isolation of both valves on the associated penetration.

The HPCI and RCIC High Main Steam Line Tunnel Temperature Trip Functions each receive input from 4 channels. Four channels, each with an associated temperature switch, are connected in a one-out-of-two-twice arrangement which provides input to two trip systems. Both trip systems must trip to initiate isolation of both valves on the associated penetration. In addition, the HPCI and RCIC High Main Steam Line Tunnel Temperature Trip Functions each have time delays. These Time Delay Trip Functions each receive input from two channels, with each channel in one of the trip system using a one-out-of-one logic. The trip systems are arranged in a one-out-of-two logic.

The HPCI and RCIC High Steam Line Space Temperature Trip Functions each receive input from 12 channels. There are three steam line areas each monitored by one set of four channels. One channel from each of the three steam line areas inputs to one of the four trip strings. Two trip strings make up each trip system and both trip systems must trip to cause an isolation of both valves on the associated penetration. The trip strings are arranged in a one-out-of-two taken twice logic. This is effectively a one-out-of-six taken twice logic arrangement to initiate isolation.

HPCI System and RCIC System Isolation Trip Functions isolate the Group 6 valves, as appropriate.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

BACKGROUND (continued)

5. Residual Heat Removal Shutdown Cooling Isolation

The High Reactor Pressure Trip Function receives input from two channels. The outputs from these channels are arranged in a one-out-of-two logic to initiate isolation of the Shutdown Cooling (SDC) supply isolation valves.

The Residual Heat Removal Shutdown Cooling Isolation Trip Function isolates the Group 4 SDC supply isolation valves.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The isolation signals generated by the primary containment isolation instrumentation are implicitly assumed in the safety analyses of Reference 2 to initiate closure of valves to limit offsite doses.

Primary containment isolation instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii). Certain instrumentation Trip Functions are retained for other reasons and are described below in the individual Trip Functions discussion.

The operability of the primary containment isolation instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions specified in Table 3.2.2. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.2. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

Certain Emergency Core Cooling Systems (ECCS) valves (e.g., containment spray isolation valves) also serve the dual function of automatic PCIVs. The signals that isolate these valves are also associated with the automatic initiation of the ECCS. Some instrumentation requirements and Actions associated with these signals are addressed in Specification 3.2.A, "Emergency Core Cooling Systems (ECCS)," and are not included in this specification.

In general, the individual Trip Functions are required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel (with reactor coolant temperature > 212°F) consistent with the Applicability for Primary Containment Integrity requirements in Specification 3.7.A.2. Trip Functions that have different Applicabilities are discussed below in the individual Trip Functions discussion.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Trip Function by Trip Function basis.

Main Steam Line Isolation

1.a. Low - Low Reactor Vessel Water Level

Low reactor pressure vessel (RPV) water level indicates that the capability to

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, isolation of the MSIVs and other interfaces with the reactor vessel occurs to prevent offsite dose limits from being exceeded. The Low - Low Reactor Vessel Water Level Trip Function is one of the many Trip Functions assumed to be operable and capable of providing isolation signals. The Low - Low Reactor Vessel Water Level Trip Function associated with isolation is assumed in the analysis of the recirculation line break (Ref. 3). The isolation of the MSLs supports actions to ensure that offsite dose limits are not exceeded for a DBA.

Reactor vessel water level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Four channels of Low - Low Reactor Vessel Water Level Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Low - Low Reactor Vessel Water Level Trip Setting is chosen to be the same as the ECCS Low - Low Reactor Vessel Water Level Trip Setting (Specification 3.2.A) to ensure that the MSLs isolate on a potential loss of coolant accident (LOCA) to prevent offsite doses from exceeding 10 CFR 50.67 limits. The Trip Setting is referenced from the top of enriched fuel.

This Function isolates the Group 1 valves.

1.b. High Main Steam Line Area Temperature

Main steam line tunnel temperature is provided to detect a leak in the RCPB in the steam tunnel and provides diversity to the high flow instrumentation. Temperature is sensed in four different areas of the steam tunnel in the vicinity of the main steam lines. The isolation occurs when a very small leak has occurred in any one of the four areas. If the small leak is allowed to continue without isolation, offsite dose limits may be reached. However, credit for these instruments is not taken in any transient or accident analysis in the UFSAR, since bounding analyses are performed for large breaks, such as MSLBs.

Main steam line area temperature signals are initiated from a total of sixteen temperature switches located in the four areas being monitored. Sixteen channels of High Main Steam Line Area Temperature Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The High Main Steam Line Area Temperature Trip Setting is chosen to provide early indication of a steam line break.

These Functions isolate the Group 1 valves.

1.c. High Main Steam Line Flow

High Main Steam Line Flow is provided to detect a break of the MSL and to initiate closure of the MSIVs. If the steam were allowed to continue flowing out of the break, the reactor would depressurize and the core could uncover. If the RPV water level decreases too far, fuel damage could occur. Therefore,

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

the isolation is initiated on high flow to prevent or minimize core damage. The High Main Steam Line Flow Trip Function is directly assumed in the analysis of the main steam line break (MSLB) (Ref. 4). The isolation action, along with the scram function of the Reactor Protection System (RPS), ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46 and offsite doses do not exceed the 10 CFR 50.67 limits.

The MSL flow signals are initiated from 16 differential pressure transmitters that are connected to the four MSLs (the differential pressure transmitters sense differential pressure across a flow restrictor). The differential pressure transmitters are arranged such that, even though physically separated from each other, all four connected to one MSL would be able to detect the high flow. Four channels of High Main Steam Line Flow Trip Function for each MSL (two channels per trip system) are available and are required to be operable so that no single instrument failure will preclude detecting a break in any individual MSL.

The Trip Setting is chosen to ensure that fuel peak cladding temperature and offsite dose limits are not exceeded due to the break.

This Trip Function isolates the Group 1 valves.

1.d. Low Main Steam Line Pressure

Low MSL pressure indicates that there may be a problem with the turbine pressure regulation, which could result in a low reactor vessel water level condition and the RPV cooling down more than 100°F/hr if the pressure loss is allowed to continue. The Low Main Steam Line Pressure Trip Function is directly assumed in the analysis of the pressure regulator fãilure (Ref. 5). For this event, the closure of the MSIVs ensures that the RPV temperature change limit (100°F/hr) is not reached. In addition, this Trip Function supports actions to ensure that Safety Limit 1.1.B is not exceeded. (This Trip Function closes the MSIVs prior to pressure decreasing below 785 psig, which results in a scram due to MSIV closure, thus reducing reactor power to < 25% RATED THERMAL POWER.)

The MSL low pressure signals are initiated from four pressure switches that are connected to the MSL header. The switches are arranged such that, even though physically separated from each other, each pressure switch is able to detect low MSL pressure. Four channels of Low Main Steam Line Pressure Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Setting was selected to be high enough to prevent excessive RPV depressurization.

The Low Main Steam Line Pressure Trip Function is only required to be operable in the RUN Mode since this is when the assumed transient can occur (Ref. 5).

This Trip Function isolates the Group 1 valves.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1.e. High Main Steam Line Flow - Not in RUN

High Main Steam Line Flow when the reactor mode switch is not in RUN provides protection for a turbine pressure regulator malfunction which causes the turbine control valves and turbine bypass valves to open or protection for a main steam line break. These events would result in a rapid depressurization and cooldown of the RPV. The High Main Steam Line Flow - Not in RUN Trip Function was credited in the MSLB at low power analysis.

The MSL flow signals are initiated from 4 differential pressure transmitters, one connected to each of the four MSLs (the differential pressure switches sense differential pressure across a flow restrictor). Four channels of High Main Steam Line Flow - Not in RUN Trip Function (two channels per trip system) are available and are required to be operable so that no single instrument failure will preclude providing protection against a turbine pressure regulator malfunction or a break in any individual MSL.

The Trip Setting is chosen to provide early indication of a steam line break.

The High Main Steam Line Flow - Not in RUN Trip Function is only required to be operable in STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel (with reactor coolant temperature > 212°F). In the RUN Mode, protection for the depressurization resulting from a turbine pressure regulator malfunction is provided by the Low Main Steam Line Pressure Trip Function and protection for depressurization resulting from a main steam line break is provided by the High Main Steam Line Flow Trip Function.

This Trip Function isolates the Group 1 valves.

1.f. Low Condenser Vacuum

The Low Condenser Vacuum Trip Function is provided to prevent overpressurization of the main condenser in the event of a loss of the main condenser vacuum. Since the integrity of the condenser is an assumption in offsite dose calculations, the Low Condenser Vacuum Trip Function is assumed to be operable and capable of initiating closure of the MSIVs. The closure of the MSIVs is initiated to prevent the addition of steam that would lead to additional condenser pressurization and possible rupture, thereby preventing a potential radiation leakage path following an accident.

Condenser vacuum pressure signals are derived from four pressure switches that sense the pressure in the condenser. Four channels of Low Condenser Vacuum Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Setting is chosen to prevent damage to the condenser due to pressurization, thereby ensuring its integrity for offsite dose analysis. As indicated in Footnote (b) to Table 3.2.2, the channels are not required to be operable in STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel (with reactor coolant temperature > 212°F) when all turbine stop valves (TSVs) and turbine bypass valves (TBVs) are closed, since the potential for condenser overpressurization is minimized. A key lock switch is provided to manually bypass the Low Condenser Vacuum Trip Function channels to enable plant

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

startup and shutdown when condenser vacuum is greater than 12 inches Hg absolute and all TSVs and TBVs are closed.

This Trip Function isolates the Group 1 valves

Primary Containment Isolation

2.a. Low Reactor Vessel Water Level

Low RPV water level indicates that the capability to cool the fuel may be threatened. The valves whose penetrations communicate with the primary containment are isolated to limit the release of fission products. The isolation of the primary containment on low RPV water level supports actions to ensure that offsite dose limits of 10 CFR 50.67 are not exceeded. The Low Reactor Vessel Water Level Trip Function associated with isolation is implicitly assumed in the UFSAR analysis as these leakage paths are assumed to be isolated post LOCA.

Low Reactor Vessel Water Level signals are initiated from level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Four channels of Low Reactor Vessel Water Level Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Low Reactor Vessel Water Level Trip Setting was chosen to be the same as the RPS Low Reactor Vessel Water Level scram Trip Setting (Specification 3.1.A), since isolation of these valves is not critical to orderly plant shutdown. The Trip Setting is referenced from the top of enriched fuel.

This Trip Function isolates the Groups 2, 3, 4, and 5 valves.

2.b. High Drywell Pressure

High drywell pressure can indicate a break in the RCPB inside the primary containment. The isolation of some of the primary containment isolation valves on high drywell pressure supports actions to ensure that offsite dose limits of 10 CFR 50.67 are not exceeded. The High Drywell Pressure Trip Function, associated with isolation of the primary containment, is implicitly assumed in the UFSAR accident analysis as these leakage paths are assumed to be isolated post LOCA.

High drywell pressure signals are initiated from pressure transmitters that sense the pressure in the drywell. Four channels of High Drywell Pressure Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Setting was selected to be the same as the ECCS High Drywell Pressure (Specification 3.2.A) and RPS High Drywell Pressure (Specification 3.1.A) Trip Settings, since this may be indicative of a LOCA inside primary containment.

This Trip Function isolates the Groups 2, 3 and 4 valves.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

High Pressure Coolant Injection System Isolation and Reactor Core Isolation Cooling System Isolation

3.a, 4.c HPCI and RCIC High Steam Line Space Temperature

High Steam Line Space Temperature Trip Functions are provided to detect a leak from the associated system steam piping. The isolation occurs when a very small leak has occurred and is diverse to the high flow instrumentation. If the small leak is allowed to continue without isolation, offsite dose limits may be reached. These Trip Functions are not assumed in any UFSAR transient or accident analysis, since bounding analyses are performed for large breaks such as recirculation or MSL breaks. However, these instruments prevent the RCIC or HPCI steam line breaks from becoming bounding.

High Steam Line Space Temperature signals are initiated from temperature switches that are appropriately located to detect a leak from the system piping that is being monitored. For each Trip Function, there are four instruments that monitor each of three locations. Twelve channels for HPCI High Steam Line Space Temperature are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function. Twelve channels for RCIC High Steam Line Space Temperature are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Settings are set high enough above anticipated normal operating levels to avoid spurious isolation, yet low enough to provide timely detection of a HPCI or RCIC steam line break.

These Trip Functions isolate the associated Group 6 valves.

3.b., 4.d. HPCI and RCIC High Steam Line d/p (Steam Line Break)

High Steam Line d/p (Steam Line Break) Trip Functions are provided to detect a break of the RCIC or HPCI steam lines and initiate closure of the steam line isolation valves of the appropriate system. If the steam is allowed to continue flowing out of the break, the reactor will depressurize and the core can uncover. Therefore, the isolations are initiated on high d/p to prevent or minimize core damage. The isolation action, along with the scram function of the RPS, ensures that the requirements of 10 CFR 50.46 are met. Specific credit for these Trip Functions is not assumed in any UFSAR accident analyses since the bounding analysis is performed for large breaks such as recirculation and MSL breaks. However, these instruments prevent the RCIC or HPCI steam line breaks from becoming bounding.

The HPCI and RCIC High Steam Line d/p (Steam Line Break) signals are initiated from differential pressure switches (two for HPCI and two for RCIC) that are connected to the associated system steam lines. Two channels of both HPCI and RCIC High Steam Line d/p (Steam Line Break) Trip Functions are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Trip Settings are set high enough above anticipated normal operating levels to avoid spurious isolation, yet low enough to provide timely detection of a HPCI or RCIC steam line break.

These Trip Functions isolate the associated Group 6 valves.

3.c., 4.f. HPCI and RCIC Low Steam Supply Pressure

Low steam supply pressure indicates that the pressure of the steam in the HPCI or RCIC turbine may be too low to continue operation of the associated system's turbine. These isolations are for equipment protection. However, they also provide a diverse signal to indicate a possible system break. These instruments are included in Technical Specifications because of the potential for possible system initiation failure resulting from these instruments.

The HPCI and RCIC Low Steam Supply Pressure signals are initiated from pressure switches (four for HPCI and four for RCIC) that are connected to the associated system steam line. Four channels of both HPCI and RCIC Low Steam Supply Pressure Trip Functions are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Settings are selected to be below the pressure at which the system's turbine can effectively operate.

Since these Trip Functions are provided for equipment protection, they are only required to be operable when the HPCI and RCIC System are required to be operable. Therefore, as indicated in Footnote (c) to Table 3.2.2, in STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel, the channels are only required to be operable when reactor steam pressure is > 150 psig.

These Trip Functions isolate the associated Group 6 valves.

3.d., 3.e., 4.a., 4.b. HPCI and RCIC High Main Steam Line Tunnel Temperature and Time Delay

HPCI and RCIC High Main Steam Line Tunnel Temperature Trip Functions are provided to detect a leak from the associated system steam piping. The isolation occurs when a very small leak has occurred and is diverse to the high flow instrumentation. If the small leak is allowed to continue without isolation, offsite dose limits may be reached. These Trip Functions are not assumed in any UFSAR transient or accident analysis., since bounding analyses are performed for large breaks such as recirculation or MSL breaks. However, these instruments prevent the RCIC or HPCI steam line breaks from becoming bounding.

HPCI and RCIC High Main Steam Line Tunnel Temperature signals are initiated from temperature switches that are appropriately located to detect a leak from the associated system piping that is being monitored. For each Trip Function, there are four instruments that monitor the area. Four channels for HPCI High Main Steam Line Tunnel Temperature are available and are

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

required to be operable to ensure that no single instrument failure can preclude the isolation function. Four channels for RCIC High Main Steam Line Tunnel Temperature are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Settings are set high enough above anticipated normal operating levels to avoid spurious isolation, yet low enough to provide timely detection of a HPCI or RCIC steam line break.

These Trip Functions isolate the associated Group 6 valves.

4.e RCIC High Steam Line d/p Time Delay

The RCIC High Steam Line d/p Time Delay is provided to prevent false isolations on RCIC High Steam Line d/p during system startup transients and therefore improves system reliability. This Trip Function is not assumed in any UFSAR transient or accident analyses.

The RCIC High Steam Line d/p Time Delay Trip Function delays the RCIC High Steam Line d/p (Steam Line Break) signal by use of time delay relays. When a RCIC High Steam Line d/p (Steam Line Break) signal is generated, the time delay relays delay the tripping of the associated RCIC isolation trip system for a short time. Two channels of RCIC High Steam Line d/p Time Delay Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function.

The Trip Setting is chosen to be long enough to prevent false isolations due to system starts but not so long as to impact compliance with 10CFR50.46 requirements.

This Trip Function, in conjunction with the RCIC High Steam Line d/p (Steam Line Break) Trip Function, isolates the RCIC System Group 6 valves.

Residual Heat Removal Shutdown Cooling Isolation

5.a. High Reactor Pressure

The High Reactor Pressure Trip Function is provided to isolate the shutdown cooling portion of the Residual Heat Removal (RHR) System. This interlock is provided only for equipment protection to prevent an intersystem LOCA scenario, and credit for the interlock is not assumed in the accident or transient analysis in the UFSAR.

The High Reactor Pressure signals are initiated from two pressure switches. Two channels of High Reactor Pressure Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation function. The Trip Function is only required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel (with reactor coolant temperature > 212°F), since these are the only Modes in which the reactor can be pressurized; thus, equipment protection is needed.

The Trip Setting was chosen to be low enough to protect the system equipment from overpressurization.

This Trip Function isolates the Group 4 SDC supply isolation valves.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

ACTIONS

Table 3.2.2 ACTION Note 1

Because of the diversity of sensors available to provide isolation signals and the redundancy of the isolation design, an allowable out of service time of 12 hours or 24 hours, depending on the Trip Function (12 hours for those Trip Functions that have channel components common to RPS instrumentation, i.e., Trip Functions 2.a and 2.b, and 24 hours for those Trip Functions that do not have channel components common to RPS instrumentation, i.e., all other Trip Functions), has been shown to be acceptable (Refs. 6 and 7) to permit restoration of any inoperable channel to operable status. This out of service time is only acceptable provided the associated Trip Function is still maintaining isolation capability (refer to the next paragraph). For all Trip Functions except for Trip Functions 3.e, 4.b, and 4.e, if the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.2 ACTION Note 1.a.1) or 1.a.3), as applicable. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue with no further restrictions. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an isolation), the applicable actions of Table 3.2.2 ACTION Note 2 must be taken. For Trip Functions 3.e, 4.b, and 4.e, Table 3.2.2 ACTION Note 1.a.2) requires the channel to be restored to operable status. Table 3.2.2 ACTION Note 1.a.2) does not allow placing the channel in trip since this action would not necessarily result in a safe state for the channel in all events.

Table 3.2.2 ACTION Note 1.b is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in redundant automatic isolation capability being lost for the associated penetration flow path(s). The Trip Functions are considered to be maintaining isolation capability when sufficient channels are operable or in trip, such that both trip systems will generate a trip signal from the given Trip Function on a valid signal. For Trip Functions 1.a, 1.d, 1.e, 1.f, 2.a, 2.b, 3.b, 3.d, 4.a, 4.d, and 5.a, this would require both trip systems to have one channel operable or in trip. For Trip Function 1.c, this would require both trip systems to have one channel, associated with each MSL, operable or in trip. Trip Functions 1.b, 3.a and 4.c, consist of channels that monitor several locations within a given area (e.g., different locations within the main steam tunnel area). Therefore, this would require both trip systems to have one channel per location operable or in trip. For Trip Functions 3.e, 4.b and 4.e, this would require both trip systems to have one channel operable. For Trip Functions 3.c and 4.f (which only have one trip system for each Trip Function), this would require one trip system to have one channel in each trip system logic operable or in trip.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

ACTIONS (continued)

Table 3.2.2 ACTION Note 1 also allows penetration flow path(s) to be unisolated intermittently under administrative controls. These administrative controls consist of stationing a dedicated operator at the controls of the valve, who is in continuous communication with the control room. In this way, the penetration can be rapidly isolated when a need for primary containment isolation is indicated.

Table 3.2.2 ACTION Notes 2.a, 2.b, 2.c and 2.d

If any applicable Action and associated completion time of Table 3.2.2 ACTION Note 1.a or 1.b are not met, the applicable Actions of Table 3.2.2 ACTION Note 2 and referenced in Table 3.2.2 (as identified for each Trip Function in the Table 3.2.2 "ACTIONS REFERENCED FROM ACTION NOTE 1" column) must be immediately entered and taken. The applicable Action specified in Table 3.2.2 is Trip Function and Mode or other specified condition dependent.

For Table 3.2.2 ACTION Note 2.a, if the channel is not restored to operable status or placed in trip within the allowed Completion Time the associated MSLs may be isolated, and, if allowed (i.e., plant safety analysis allows operation with an MSL isolated), operation with that MSL isolated may continue. Isolating the affected MSL accomplishes the safety function of the inoperable channel. This action will generally only be used if a Trip Function 1.c channel is inoperable and untripped. The associated MSL(s) to be isolated are those whose High Main Steam Line Flow Trip Function channel(s) are inoperable. Alternately, the plant must be placed in a Mode or other specified condition in which the LCO does not apply. This is done by placing the plant in at least HOT SHUTDOWN within 12 hours and in COLD SHUTDOWN within the next 12 hours. The Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. Table 3.2.2 ACTION Note 2.a also allows penetration flow path(s) to be unisolated intermittently under administrative controls. These administrative controls consist of stationing a dedicated operator at the controls of the valve, who is in continuous communication with the control room. In this way, the penetration can be rapidly isolated when a need for primary containment isolation is indicated.

For Table 3.2.2 ACTION Note 2.b, if the channel is not restored to operable status or placed in trip within the allowed Completion Time, the plant must be placed in a Mode or other specified condition in which the LCO does not apply. This is done by placing the plant in COLD SHUTDOWN within 24 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

For Table 3.2.2 ACTION Note 2.c, if the channel is not restored to OPERABLE status or placed in trip within the allowed Completion Time, the plant must be placed in a Mode or other specified condition in which the LCO does not apply. This is done by placing the plant in at least STARTUP/HOT STANDBY within 8 hours. The allowed Completion Time of 8 hours is reasonable, based on operating experience, to reach STARTUP/HOT STANDBY from full power conditions in an orderly manner and without challenging plant systems.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

ACTIONS (continued)

For Table 3.2.2 ACTION Note 2.d, if the channel is not restored to operable status or placed in trip within the allowed Completion Time, plant operations may continue if the affected penetration flow path(s) is isolated. Isolating the affected penetration flow path(s) accomplishes the safety function of the inoperable channel. The 1 hour Completion Time is acceptable because it minimizes risk while allowing sufficient time for plant operations personnel to isolate the affected penetration flow path(s). Table 3.2.2 ACTION Note 2.d also allows penetration flow path(s) to be unisolated intermittently under administrative controls. These administrative controls consist of stationing a dedicated operator at the controls of the valve, who is in continuous communication with the control room. In this way, the penetration can be rapidly isolated when a need for primary containment isolation is indicated.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.B.1

As indicated in Surveillance Requirement 4.2.B.1, primary containment isolation instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.2. Table 4.2.2 identifies, for each Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.B.1 also indicates that when a channel (and/or the affected PCIV) is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains isolation capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Refs. 6 and 7) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the PCIVs will isolate the penetration flow path(s) when necessary.

Surveillance Requirement 4.2.B.2

The Logic System Functional Test demonstrates the operability of the required initiation logic and simulated automatic operation for a specific channel. The automatic initiation testing required by the PCIV Technical Specifications overlaps this Surveillance to provide testing of the assumed safety function. For Main Steam Line Isolation Trip Functions, a simulated automatic actuation, which opens all pilot valves of the main steam line isolation valves, shall be performed such that each trip system logic can be verified independent of its redundant counterpart. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

SURVEILLANCE REQUIREMENTS (continued)

Table 4.2.2, Check

Performance of an Instrument Check once per day for Trip Functions 1.a, 1.c, 1.e, and 2.b, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Table 4.2.2, Functional Test

For Trip Functions 1.a, 1.b, 1.c, 1.d, 1.e, 1.f, 2.a, 2.b, 3.a, 3.b, 3.c, 3.d, 4.a, 4.c, 4.d, 4.e, 4.f, and 5.a, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The Frequency of "Every 3 Months" is based on the reliability analysis of References 6 and 7.

Table 4.2.2, Calibration

For Trip Functions 1.a, 1.b, 1.c, 1.d, 1.e, 1.f, 2.a, 2.b, 3.a, 3.b, 3.c, 3.d, 3.e, 4.a, 4.b, 4.c, 4.d, 4.e, 4.f, and 5.a, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

BASES: 3.2.B/4.2.B PRIMARY CONTAINMENT ISOLATION

SURVEILLANCE REQUIREMENTS (continued)

For Trip Functions 1.a, 1.c, 1.e, 2.a, and 2.b, a calibration of the trip units is required (Footnote (a)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. The channel must be declared inoperable if the trip setting is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The Frequency of every 3 months is based on the reliability analysis of References 6 and 7 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

REFERENCES

1. Technical Requirements Manual.

2. UFSAR, Chapter 14.

3. UFSAR, Table 6.5.3.

4. UFSAR, Section 14.6.5.

5. UFSAR, Section 14.5.4.1.

6. NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," July 1990.

7. NEDC-30851P-A Supplement 2, "Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," March 1989.

Current

Technical Specifications

Markups

3.2.B and 4.2.B

Primary Containment Isolation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the operational status of the plant instrumentation systems which initiate and control a protective function.

Objective:

To assure the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System

When the system(s) it initiates or controls is required in accordance with Specification 3.5, the instrumentation which initiates the emergency core cooling system(s) shall be operable in accordance with Table 3.2.1.

B. Primary Containment Isolation

A.2

L.1

When primary containment integrity is required, in accordance with Specification 3.7, ~~the instrumentation that initiates primary containment isolation~~ shall be operable in accordance with Table 3.2.2.

The primary containment isolation instrumentation for each Trip Function in Table 3.2 2

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

The instrumentation that initiates the isolation of the reactor building ventilation system and the actuation of the standby gas treatment system shall be operable in accordance with Table 3.2.3.

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the surveillance requirements of the instrumentation systems which initiate and control a protective function.

Objective:

To verify the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.1.

<Move to separate page>

1. The primary containment isolation

B. Primary Containment Isolation

A.3

~~Instrumentation and logic systems~~ shall be checked, functionally tested and calibrated as indicated in Table 4.2.2.

A.4

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C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.3.

When a channel, and/or the affected primary containment isolation valve, is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into associated Limiting Conditions for Operation may be delayed for up to 6 hours provided the associated Trip Function maintains isolation capability.

A.5

primary containment isolation

A.1

PRIMARY CONTAINMENT ISOLATION — A.7

TABLE 3.2.~~1~~ 2
(Cont'd)

A.8

Actions when Required Channels are Inoperable

Actions Referenced from Action Note 1

~~EMERGENCY CORE COOLING SYSTEM ACTUATION~~ INSTRUMENTATION

~~Low Pressure Coolant Injection System A & B (Note 1)~~

Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip ~~Level~~ Setting A.1	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~
1 (Note 8)	Low Reactor Pressure (PT-2-3-56C/D(M))	300 ≤ p ≤ 350 psig	Note 11
2 (Note 8)	High Drywell Pressure (PT-10-101(A-D)(M))	≤2.5 psig	Note 10
2 (Note 8)	Low-Low Reactor Vessel Water Level (LT-2-3-72(A-D)(S1))	≥82.5" above top of enriched fuel	Note 10
1 (Note 9)	Reactor Vessel Shroud Level (LT-2-3-73A/B(M))	≥2/3 core height	Note 13
1 (Note 9)	Time Delay (10A-K72A & B)	≤60 seconds	Note 12
1 (Note 9)	Pump Start Time Delay (10A-K50A & B)	3 ≤ t ≤ 5 seconds	Note 12
5.a 1 ~~(Note 9)~~ A.5	~~Low~~ A.6 High Reactor Pressure ~~(PS-2-128A & B)~~ LA.1	LA.2 ~~100 ≤~~ p ≤ 150 psig	Note 1 Note ~~10~~ 2.d A.8
2 per pump (Note 8)	RHR Pump (A-D) Discharge Pressure (PS-10-105(A-H))	≥100 psig	Note 18
2 (Note 8)	High Drywell Pressure (PT-10-101(A-D)(S1))	≤2.5 psig	Note 13

A.9

A.9

A 1

PRIMARY CONTAINMENT ISOLATION

A.7

VYNPS

TABLE 3.2.~~1~~ 2
(Cont'd)

~~EMERGENCY CORE COOLING SYSTEM ACTUATION~~ INSTRUMENTATION

~~Low Pressure Coolant Injection System A & B (Note 1)~~

A.8

Actions when Required Channels are Inoperable

Actions Referenced from Action Note 1

Minimum Number of Operable Instrument Channels per Trip System		Trip Function	Trip ~~Level~~ Setting	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~
1	(Note 9)	Time Delay (10A-K45A & B)	$\leq$6 minutes	Note 12
2	(Note 8)	Low Reactor Pressure (PT-2-3-56A/B(M) & PT-2-3-52C/D(M))	300 $\leq$ p $\leq$ 350 psig	Note 11
1	(Note 8)	Auxiliary Power Monitor (LNPX C/D)	--	Note 10
1	(Note 8)	Pump Bus Power Monitor (27/3A/B, 27/4A/B)	--	Note 10
~~1~~		~~Trip System Logic~~	~~--~~	~~Note 5~~

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5.b

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TABLE 3.2.~~1~~ 2 NOTES ACTION

1. Each of the two Core Spray, LPCI and RPT, subsystems are initiated and controlled by a trip system. The subsystem "B" is identical to the subsystem "A".

2. If the minimum number of operable instrument channels are not available, the inoperable channel shall be tripped using test jacks or other permanently installed circuits. If the channel cannot be tripped by the means stated above, that channel shall be made operable within 24 hours or an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours. A.9

3. One trip system with initiating instrumentation arranged in a one-out-of-two taken twice logic.

4. One trip system with initiating instrumentation arranged in a one-out-of-two logic.

5. ~~If the minimum number of operable channels are not available, the system is considered inoperable and the requirements of Specification 3.5 apply.~~ L.4

6. Any one of the two trip systems will initiate ADS. If the minimum number of operable channels in one trip system is not available, the requirements of Specification 3.5.F.2 and 3.5.F.3 shall apply. If the minimum number of operable channels is not available in both trip systems, Specifications 3.5.F.3 shall apply. A.9

7. One trip system arranged in a two-out-of-two logic.

8. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function or redundant Trip Function maintains ECCS initiation capability or Recirculation Pump Trip capability.

9. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours. A.5

Action Note 1 10. With one or more channels inoperable ~~for Core Spray and/or LPCI~~:

Action Note 1.b A. Within one hour from discovery of loss of ~~initiation~~ isolation capability ~~for feature(s) in one division~~, ~~declare the associated systems inoperable~~, and A.7 L.2 M.1

Action Note 1.a.3 B. Within 24 hours, place channel in trip.

Action Notes 1 & 2.d C. If required actions and associated completion times of actions A or B are not met, ~~immediately declare the associated systems inoperable~~. M.1

11. With one or more channels inoperable for injection permissive and/or recirculation discharge valve permissive:

A. Within one hour from discovery of loss of initiation capability for feature(s) in one division, declare the associated systems inoperable, and

B. Within 24 hours, restore channel to operable status.

C. If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable. A.9

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A.10

ACTIONS REFERENCED FROM ACTION NOTE 1

TABLE 3.2.2

PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Setting	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied (Note 2)~~
1.a	2 (Notes ~~11~~, 12) A.5 A.11	Low-Low Reactor Vessel Water Level ~~(LT-2-3-57A/B(S2), LT-2-3-58A/B(S2))~~	≥82.5" ~~above the top of enriched fuel~~ LA.3	~~A~~ NOTE 2.a L.3
1.b	M.2 8 ~~2 of 4 in each of 2 channels~~ (Notes ~~11~~, 12)	High Main Steam Line Area Temperature ~~(TS-2-(121-124)(A-D))~~	~~≤212°F~~ ≤196°F FOR CHANNELS MONITORING OUTSIDE STEAM TUNNEL AND ≤200°F FOR CHANNELS MONITORING INSIDE STEAM TUNNEL M.7	~~B~~ NOTE 2.a M.3
1.c	A.5 2/steam line (Notes ~~11~~, 12)	High Main Steam Line Flow ~~(DPT-2-(116-119)(A-D)(M))~~	≤140% of rated flow	~~B~~ NOTE 2.a M.3
1.d	2 (Notes ~~1~~, ~~11~~, 12) A.13	Low Main Steam Line Pressure ~~(PS-2-134(A-D))~~ LA.1	≥800 psig	~~B~~ NOTE 2.c
1.e	2 (Notes 6, ~~11~~, 12) A.14 A.5	High Main Steam Line Flow ~~(DPT-2-116A, 117B, 118C, 119D(S1))~~ – NOT IN RUN A.12	≤40% of rated flow	~~B~~ NOTE 2.a M.3
2.a	2 (Notes ~~11~~, 12)	Low Reactor Vessel Water Level ~~(LT-2-3-57A/B(M), LT-2-3-58A/B(M))~~	~~Same as Reactor Protection System~~ ≥127.0 INCHES A.1	~~A~~ NOTE 2.b
2.b	A.5 2 (Notes ~~11~~, 12)	High Drywell Pressure	~~Same as Reactor Protection System~~ ≤2.5 PSIG A.1	~~A~~ NOTE 2.b
1.f	2 (Notes ~~10~~, ~~11~~, 12) A.15	Condenser Low Vacuum	≤12" Hg absolute	~~A~~ NOTE 2.a L.3
	~~1~~	~~Trip System Logic~~	~~--~~	~~A~~ L.4

A.1

TABLE 3.2.2
(Cont'd)

HIGH PRESSURE COOLANT INJECTION SYSTEM ISOLATION INSTRUMENTATION

Actions Referenced from Action Note 1

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip ~~Level~~ Setting A.1	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~
3.a	~~2 per set of 4~~ 6 A.16 (Notes ~~11~~, ~~12~~) A.5 A.11	High Steam Line Space Temperature ~~(TS-23-(101-104)(B-D))~~ LA.1	~~≤212°F~~ ≤ 196°F M.7	Note ~~8~~ 2.d
3.b	1 (Notes ~~12~~, ~~22~~) A.5 A.11	High Steam Line d/p (Steam Line Break) ~~(DPIS-23-76/77)~~	≤195 inches of water	Note ~~8~~ 2.d
3.c	4 (Notes ~~8~~, ~~11~~, ~~13~~) A.5 A.11 LA.7	Low HPCI Steam Supply Pressure ~~(PS-23-68(A-D))~~	≥70 psig	Note ~~8~~ 2.d
3.d	2 (Notes ~~11~~, ~~12~~) A.5 A.11	HIGH Main Steam Line Tunnel Temperature ~~(TS-23-(101-104)A)~~	~~≤212°F~~ ≤ 200°F M.7	Note ~~8~~ 2.d
3.e	1 (Notes ~~11~~, ~~12~~) A.5 A.11	Time Delay ~~(23A-K48)~~ ~~(23A-K49)~~	≤35 minutes	Note ~~8~~ 2.d
	~~1~~	~~Trip System Logic~~		~~Note 3~~ L.4

HIGH MAIN STEAM TUNNEL TEMPERATURE

A.1

TABLE 3.2.2
(Cont'd)

REACTOR CORE ISOLATION COOLING SYSTEM ISOLATION INSTRUMENTATION

Actions Relocated from Action Note 1

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip ~~Level~~ Setting	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~
		HIGH MAIN STEAM LINE TUNNEL TEMPERATURE	A.1	
4.a	2 (Notes ~~(1)~~, (12)) A.5 A.11	HIGH Main Steam Line Tunnel Temperature ~~(TS-13-(79-82)A)~~	~~≤212°F~~ ≤ 200 °F M.7	Note ~~(3)~~ 2.d
4.b	1 (Notes ~~(1)~~, (12)) A.5 A.11	Time Delay ~~(13A-K41)~~ ~~(13A-K42)~~	≤35 minutes	Note ~~(3)~~ 2.d
4.c	~~2 per set of 4~~ (Notes ~~(1)~~, (12)) A.5 A.11 6 A.16	High Steam Line Space Temperature ~~(TS-13-(79-82)(B,C,D))~~ LA.1	~~≤212°F~~ ≤ 196 °F M.7	Note ~~(3)~~ 2.d
4.d	1 (Notes ~~(1)~~, (12)) A.5 A.11	High Steam Line d/p (Steam Line Break) ~~(DPIS-13-83/84)~~	≤195 inches of water	Note ~~(3)~~ 2.d
4.f	4 (Notes (8), ~~(1)~~, (13)) A.5 A.11 LA.7 ~~(2)~~ L.4	Low Steam Supply Pressure ~~(PS-13-87(A-D))~~	≥50 psig	Note ~~(3)~~ 2.d
		~~Trip System Logic~~ L.4	~~--~~	~~Note 3~~ L.4
4.e	1 (Notes ~~(1)~~, (12)) A.5 A.11	Time Delay ~~(13A-K7)~~ ~~(13A-K31)~~ HIGH STEAM LINE d/p	3≤ t ≤7 seconds	Note ~~(8)~~ 2.d

A.1 ADD ACTION NOTE 2.a L.3 M.3

TABLE 3.2.2 ACTION NOTES

1. The main steam line low pressure need be available only in the "Run" mode. A.13

2. If the minimum ~~number~~ of operable ~~instrument~~ channels are ~~not~~ available for one trip ~~system~~, that trip system ~~shall~~ be tripped. If ~~the~~ minimum number of ~~operable instrument~~ channels ~~are~~ not available for ~~both~~ trip systems, the ~~appropriate~~ actions listed ~~below~~ shall be taken: A.19

ACTION NOTE 2.b ~~A.~~ ~~Initiate an orderly shutdown and~~ have reactor in the cold shutdown condition in 24 hours. LA.4

ACTION NOTE 2.c ~~B.~~ ~~Initiate an orderly load reduction and~~ have reactor in "Hot Standby" within 8 hours.

ACTION NOTE 2.d ~~C.~~ Close isolation valves in system ~~and comply with Specification 3.5.~~ A.17

ISOLATE THE AFFECTED PENETRATION FLOW PATH WITHIN 1 HOUR M.4

4. ~~Deleted~~

5. One trip system arranged in a one-out-of-two twice logic LA.7

6. The main steam line high flow is available only in the "Refuel," "Shutdown," and "Startup" modes. A.14

PENETRATION FLOW PATHS MAY BE UNISOLATED UNDER ADMINISTRATIVE CONTROLS L.5

7. ~~Deleted.~~

8. ~~Deleted.~~

9. ~~Deleted.~~

A.15 LA.5

10. A key lock switch is provided to permit the bypass of this trip function to enable plant startup and shutdown when the condenser vacuum is greater than 12 inches Hg absolute provided that both turbine stop and bypass valves are closed.

~~11.~~ When a channel, and/or the affected primary containment isolation valve, is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into associated Limiting Conditions for Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function maintains isolation capability. A.5

ACTION NOTE 1 ~~12.~~ Whenever Primary Containment integrity is required by Specification 3.7.A.2, ~~there~~ shall be ~~two~~ operable or ~~tripped~~ trip ~~systems~~ for each Trip Function, except as provided for below: A.2 LA.6

ACTION NOTE 1.b ~~A.~~ With one or more ~~automatic~~ functions with isolation capability not maintained restore isolation capability in 1 hour or take the ACTION required by Table 3.2.2. A.18

ACTION NOTE 1.a ~~B.~~ With one or more channels inoperable, place the inoperable channels (s) in the tripped condition within:

1) 12 hours for trip functions common to RPS instrumentation, and
2) 24 hours for trip functions not common to RPS instrumentation,

or, initiate the ACTION required by Table 3.2.2.

PENETRATION FLOW PATHS, ISOLATED AS A RESULT OF COMPLYING WITH THE ABOVE ACTIONS, MAY BE UNISOLATED INTERMITTENTLY UNDER ADMINISTRATIVE CONTROLS. L.5

ACTION

TABLE 3.2.2 NOTES (Cont'd)

~~13~~ Whenever the High Pressure Cooling Injection System and Reactor Core Isolation Cooling System are required to be operable in accordance with Specification 3.5, the low steam supply pressure automatic isolation trip system shall be operable, ~~except as provided below:~~ A.2

ACTION NOTE 1

A.18

ACTION NOTE 1.b A. With the ~~automatic~~ isolation trip function not maintained, restore isolation capability in 1 hour or take the ACTION required by Table 3.2.2.

ACTION NOTE 1.a B. With one or more required channels inoperable, place the inoperable channel(s) in the tripped condition within 24 hours, or take the ACTION required by Table 3.2.2. M.5

PENETRATION FLOW PATHS, ISOLATED AS A RESULT OF COMPLYING WITH THE ABOVE ACTIONS, MAY BE UNISOLATED INTERMITTENTLY UNDER ADMINISTRATIVE CONTROLS.

L.5

A 1

PRIMARY CONTAINMENT ISOLATION — A.7

TABLE 4.2.~~1~~ 2
(Cont'd)

~~MINIMUM~~ TEST~~S~~ AND ~~CALIBRATION~~ FREQUENCIES

~~EMERGENCY CORE COOLING ACTUATION~~ INSTRUMENTATION

~~Low Pressure Coolant Injection System~~

Trip Function	Functional Test (8) A.21	Calibration (8) A.21	Instrument Check
Low Reactor Pressure (PT-2-3-56C/D(M))	Every Three Months	Once/Operating Cycle	--
High Drywell Pressure (PT-10-101A-D(M))	Every Three Months	Once/Operating Cycle	Once Each Day
Low-Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle	Once Each Day
Reactor Vessel Shroud Level	Every Three Months	Once/Operating Cycle	--
~~Low~~ High A 6 Reactor Pressure ~~(PS-2-128A/B)~~ LA.1	Every Three Months	Every Three Months	--
RHR Pump Discharge Pressure	Every Three Months	Every Three Months	--
High Drywell Pressure (PT-10-101A-D(S1))	Every Three Months	Once/Operating Cycle	--
Low Reactor Pressure (PT-2-3-56A/B)(M) & 52C/D(M))	Every Three Months	Once/Operating Cycle	--
Auxiliary Power Monitor	Every Three Months	None	Once Each Day
Pump Bus Power Monitor	Every Three Months	None	Once Each Day
Trip System Logic	Once/Operating Cycle	~~Once/Operating Cycle (Note 3)~~ A.20	--

A.9 A.9 A.3

5.a

SR 4.2.B.2

A.1

A.10

TABLE 4.2.2

~~MINIMUM~~ TES~~TS~~ AND ~~CALIBRATION~~ FREQUENCIES

PRIMARY CONTAINMENT ISOLATION INSTRUMENTATION

A.21

	Trip Function	Functional Test ~~(8)~~	Calibration ~~(8)~~	Instrument Check
1.a	Low-Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle	Once Each Day
1.b	High MAIN Steam Line Area Temperature	Every Three Months	~~Each Refueling Outage~~ EVERY 3 MONTHS (1), M.6	--
1.c, 1.e	High MAIN Steam Line Flow " " " " " — NOT IN RUN	Every Three Months	Once/Operating Cycle	Once Each Day
1.d	Low Main Steam Line Pressure	Every Three Months	Every Three Months	--
2.a	Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle	--
2.b	High Drywell Pressure	Every Three Months	Once/Operating Cycle	Once Each Day
1.f	Condenser Low Vacuum	Every Three Months	Every Three Months	--
SR 4.2.B.2	Trip System Logic	Once/Operating Cycle ~~(Note 2)~~ LA.8	~~Once/Operating Cycle (Note 3)~~ A.20	-- A.3

(1) TRIP UNIT CALIBRATION ONLY M.6

A.1

TABLE 4.2.2
(Cont'd)

MINIMUM TESTS AND CALIBRATION FREQUENCIES

HIGH PRESSURE COOLANT INJECTION SYSTEM ISOLATION INSTRUMENTATION

	Trip Function	Functional Test (8) A.21	Calibration (8) A.21	Instrument Check
3.a	High Steam Line Space Temperature	Every Three Months	Each refueling outage	--
3.b	High Steam Line D/P (Steam Line Break)	Every Three Months	Every three months	--
3.c	Low HPCI Steam Supply Pressure	Every Three Months	Every three months	--
3.d	Main Steam Line Tunnel Temperature	Every Three Months	Each refueling outage	--
SR4.2.B.2	Trip System Logic	Once/operating cycle	Once/operating cycle (Note 31)	-- A.3
3.e	High Main Line Tunnel Temperature Time Delay			

A.22

A.1

TABLE 4.2.2
(Cont'd)

MINIMUM TESTS AND CALIBRATION FREQUENCIES

REACTOR CORE ISOLATION COOLING SYSTEM ISOLATION INSTRUMENTATION

	Trip Function	Functional Test (8) A.21	Calibration (8) A.21	Instrument Check	
4.a	HIGH Main Steam Line Tunnel Temperature	Every Three Months	Each refueling outage	--	
4.c	High Steam Line Space Temperature	Every Three Months	Each refueling outage	--	
4.d 4.e	High Steam Line d/p including time delay relays (Steam Line Break)	Every Three Months	Every three months	--	
4.f	Low RCIC Steam Supply Pressure	Every Three Months	Every three months	--	
SR 4.2.B.2	Trip System Logic	Once/operating cycle	Once/operating cycle ~~(Note 3)~~	--	A.3 A.22
4.i	High Main Steam Line Tunnel Temperature Time Delay				

A.1

TABLE 4.2 NOTES

LA.8

1. Not used.

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart.

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system. A.22

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.9

5. Deleted.

6. Deleted.

7. Deleted.

A.21

8. Functional tests and calibrations are not required when systems are not required to be operable.

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage.

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

A.9

Proposed

Technical Specifications

3.2.C and 4.2.C

Reactor Building Ventilation Isolation and
Standby Gas Treatment System Initiation

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

The reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation for each Trip Function in Table 3.2.3 shall be operable in accordance with Table 3.2.3.

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

1. The reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.3.

   When a channel is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into the associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains reactor building ventilation isolation capability and Standby Gas Treatment System initiation capability.

2. Perform a Logic System Functional Test of reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation Trip Functions once every Operating Cycle.

Table 3.2.3 (page 1 of 1)
Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b)	2	Note 1	≥ 127.0 inches
2. High Drywell Pressure	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a]	2	Note 1	≤ 2.5 psig
3. High Reactor Building Ventilation Radiation	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b), (c), (d)	1	Note 1	≤ 14 mR/hr
4. High Refueling Floor Zone Radiation	RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel[a], (b), (c), (d)	1	Note 1	≤ 100 mR/hr

(a) With reactor coolant temperature > 212 °F.

(b) During operations with potential for draining the reactor vessel.

(c) During movement of irradiated fuel assemblies or fuel cask in secondary containment.

(d) During Alteration of the Reactor Core.

Table 3.2.3 ACTION Note

1. With one or more required Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation Instrumentation channels inoperable, take all of the applicable Actions in Notes 1.a and 1.b below.

   a. With one or more Trip Functions with one or more required channels inoperable:

      1) For Trip Functions 1 and 2, place any inoperable channel in trip within 12 hours; and
      2) For Trip Functions 3 and 4, place any inoperable channel in trip within 24 hours.

   b. With one or more Trip Functions with isolation or initiation capability not maintained:

      1) Restore isolation and initiation capability within 1 hour.

   If any applicable Action and associated completion time of Note 1.a or 1.b is not met, isolate the Reactor Building Ventilation System and place the Standby Gas Treatment System in operation within 1 hour.

Table 4.2.3 (page 1 of 1)
Reactor Building Ventilation Isolation and
Standby Gas Treatment System Initiation Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Low Reactor Vessel Water Level	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
2. High Drywell Pressure	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
3. High Reactor Building Ventilation Radiation	Once/Day	Every 3 Months	Every 3 Months
4. High Refueling Floor Zone Radiation	Once/Day During Refueling	Every 3 Months	Every 3 Months

(a) Trip unit calibration only.

Proposed

Bases

3.2.C and 4.2.C

Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

BACKGROUND

The reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation automatically initiates closure of the Reactor Building Automatic Ventilation System Isolation Valves (RBAVSIVs) and starts the Standby Gas Treatment (SGT) System. The function of these components and systems, in combination with other accident mitigation systems, is to limit fission product release during and following postulated Design Basis Accidents (DBAs) (Ref. 1). Reactor Building (i.e., secondary containment) isolation and establishment of vacuum with the SGT System ensures that fission products that leak from primary containment following a DBA, or are released outside primary containment, or are released during certain operations when primary containment is not required to be operable, are maintained within applicable limits.

The isolation instrumentation includes the sensors, relays, and switches that are necessary to cause initiation of reactor building ventilation isolation and Standby Gas Treatment System operation. Most channels include electronic equipment (e.g., trip units) that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs a reactor building ventilation isolation and Standby Gas Treatment System initiation signal to the isolation and initation logic. Functional diversity is provided by monitoring a wide range of independent parameters. The input parameters to the isolation and initiation logic are (1) reactor vessel water level, (2) drywell pressure, (3) reactor building ventilation radiation, and (4) refueling floor zone radiation. Redundant sensor input signals from each parameter are provided for initiation and isolation.

For both the Low Reactor Vessel Water Level and High Drywell Pressure Trip Functions, the reactor building ventilation isolation and Standby Gas Treatment System initiation logic receives input from four channels. The outputs of the channels are arranged in one-out-of-two taken twice logics.

For the High Reactor Building Ventilation Radiation and High Refueling Floor Zone Radiation Trip Functions, two radiation detectors and monitors are provided for each Trip Function. Each channel includes a radiation detector and associated monitor. The outputs of the channels are arranged in a one-out-of-two logic. In addition, the outputs of each channel are provided to both Trip Systems A and B. As such, any High Reactor Building Ventilation Radiation or High Refueling Floor Zone Radiation Trip Function channel will initiate reactor building ventilation isolation and Standby Gas Treatment System operation. (For the purposes of the Technical Specifications, the A radiation detectors and monitors should be considered to be associated with the Trip System A and the B radiation detectors and monitors should be considered to be associated with Trip System B.) Trip System A initiates startup of SGT subsystem A and initiates isolation of the reactor building supply and exhaust outboard isolation valves. Trip System B initiates startup of SGT subsystem B and initiates isolation of the reactor building supply and exhaust inboard isolation valves. As such, either Trip System isolates the secondary containment and provides the necessary filtration of fission products.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The isolation and initiation signals generated by the reactor building ventilation isolation and Standby Gas Treatment System initiation

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

instrumentation are implicitly assumed in the safety analyses of References 2, 3, and 4, to initiate closure of the RBAVSIVs and start the SGT System to limit offsite doses.

Reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

The operability of the reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions specified in Table 3.2.3. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.3. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

In general, the individual Trip Functions are required to be OPERABLE in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel (with reactor coolant temperature > 212°F), during operations with the potential for draining the reactor vessel (OPDRVs), during movement of irradiated fuel assemblies or fuel cask in secondary containment, and during Alteration of the Reactor Core; consistent with the Applicability for the SGT System and secondary containment requirements in Specifications 3.7.B and 3.7.C. Trip Functions that have different Applicabilities are discussed below in the individual Trip Functions discussion.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Trip Function by Trip Function basis.

1. Low Reactor Vessel Water Level

Low reactor pressure vessel (RPV) water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. An isolation of the secondary containment and actuation of the SGT System are initiated in order to minimize the potential of an offsite release. The Low Reactor Vessel Water Level Trip Function is one of the Trip Functions assumed to be operable and capable of providing isolation and initiation signals. The isolation and initiation of systems on Low Reactor Vessel Water Level support actions to ensure that any offsite releases are within the limits calculated in the safety analysis.

Low Reactor Vessel Water Level signals are initiated from level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Four channels of Low Reactor Vessel Water Level Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation and initiation function.

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Low Reactor Vessel Water Level Trip Setting was chosen to be the same as the Reactor Protection System (RPS) Low Reactor Vessel Water Level Trip Setting (Specification 3.1.A), since this could indicate that the capability to cool the fuel is being threatened. The Trip Setting is referenced from the top of enriched fuel.

The Low Reactor Vessel Water Level Trip Function is required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel (with reactor coolant temperature > 212°F) where considerable energy exists in the Reactor Coolant System (RCS); thus, there is a possibility of pipe breaks resulting in significant releases of radioactive steam and gas. In COLD SHUTDOWN and Refuel (with reactor coolant temperature ≤ 212°F), the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these Modes; thus, this Trip Function is not required. In addition, the Trip Function is also required to be operable during OPDRVs to ensure that offsite dose limits are not exceeded if core damage occurs.

2. High Drywell Pressure

High drywell pressure can indicate a break in the reactor coolant pressure boundary (RCPB). An isolation of the secondary containment and actuation of the SGT System are initiated in order to minimize the potential of an offsite release. The isolation and initiation of systems on High Drywell Pressure supports actions to ensure that any offsite releases are within the limits calculated in the safety analysis.

High drywell pressure signals are initiated from pressure transmitters that sense the pressure in the drywell. Four channels of High Drywell Pressure Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude performance of the isolation and initiation function.

The Trip Setting was chosen to be the same as the RPS High Drywell Pressure Trip Setting (Specification 3.1.A) since this is indicative of a loss of coolant accident (LOCA).

The High Drywell Pressure Trip Function is required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel (with reactor coolant temperature > 212°F) where considerable energy exists in the RCS; thus, there is a possibility of pipe breaks resulting in significant releases of radioactive steam and gas. This Trip Function is not required in COLD SHUTDOWN and Refuel (with reactor coolant temperature ≤ 212°F) because the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these Modes.

3, 4. High Reactor Building Ventilation Radiation and High Refueling Floor Zone Radiation

High reactor building ventilation radiation or refuel floor zone radiation is an indication of possible gross failure of the fuel cladding. The release may

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

have originated from the primary containment due to a break in the RCPB or the refueling floor due to a fuel handling accident. When High Reactor Building Ventilation Radiation or High Refueling Floor Zone Radiation is detected, secondary containment isolation and actuation of the SGT System are initiated to support actions to limit the release of fission products as assumed in the UFSAR safety analyses (Ref. 4).

The High Reactor Building Ventilation Radiation and High Refueling Floor Zone Radiation signals are initiated from radiation detectors that are located on the ventilation exhaust duct coming from the reactor building and the refueling floor zones, respectively. Two channels of High Reactor Building Ventilation Radiation Trip Function and two channels of High Refueling Floor Radiation Trip Function are available and are required to be operable to ensure that no single instrument failure can preclude the isolation and initiation function.

The Trip Settings are chosen to promptly detect gross failure of the fuel cladding.

The High Reactor Building Ventilation Radiation and High Refueling Floor Zone Radiation Trip Functions are required to be operable in RUN, STARTUP/HOT STANDBY, HOT SHUTDOWN, Refuel (with reactor coolant temperature > 212°F)where considerable energy exists in the RCS; thus, there is a possibility of pipe breaks resulting in significant releases of radioactive steam and gas. In COLD SHUTDOWN and Refuel (with reactor coolant temperature ≤ 212°F), the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these Modes; thus, these Trip Functions are not required. In addition, the Trip Functions are also required to be operable during OPDRVs, during movement of irradiated fuel assemblies or fuel cask in the secondary containment, and during Alteration of the Reactor Core, because the capability of detecting radiation releases due to fuel failures (due to fuel uncovery or dropped fuel assemblies) must be provided to ensure that offsite dose limits are not exceeded.

ACTIONS

Table 3.2.3 ACTION Note 1

Because of the diversity of sensors available to provide isolation signals and the redundancy of the isolation design, an allowable out of service time of 12 hours or 24 hours depending on the Trip Function (12 hours for those Trip Functions that have channel components common to RPS instrumentation, i.e., Trip Functions 1 and 2, and 24 hours for those Trip Functions that do not have channel components common to RPS instrumentation, i.e., all other Trip Functions), has been shown to be acceptable (Refs. 5 and 6) to permit restoration of any inoperable channel to operable status. This out of service time is only acceptable provided the associated Trip Function is still maintaining isolation capability (refer to next paragraph). If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.3 Note 1.a.1) or 1.a.2), as applicable. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately,

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

ACTIONS (continued)

if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an isolation or initiation), the Reactor Building Ventilation System must be isolated and the SGT System must be placed in operation within the next one hour. Isolating the Reactor Building Ventilation System and placing the SGT System in operation performs the intended function of the instrumentation and allows operation to continue.

Table 3.2.3 Note 1.b is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in a complete loss of isolation capability for the associated penetration flow path(s) or a complete loss of initiation capability for the SGT System. A Trip Function is considered to be maintaining isolation and initiation capability when sufficient channels are operable or in trip in both trip systems, such that a trip signal will be generated from the given Trip Function on a valid signal. This ensures that isolation of the two RBAVSIVs in the associated penetration flow path and the operation of the SGT System can be initiated on an isolation and initiation signal from the given Trip Function. For the Trip Functions 1 and 2, this would require each trip system to have one channel operable or in trip. For Trip Functions 3 and 4, this would require one channel to be operable or in trip. The one hour Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

If any applicable Action and associated Completion Time of Table 3.2.3 ACTION Note 1.a or 1.b are not met, the ability to isolate the secondary containment and start the SGT System cannot be ensured. Therefore, further actions must be performed to ensure the ability to maintain the secondary containment isolation and SGT System initiation function. Isolating the associated penetration flow path(s) and starting the associated SGT System within the next one hour performs the intended function of the instrumentation and allows operation to continue. One hour is sufficient for plant operations personnel to establish required plant conditions or to declare the associated components inoperable without unnecessarily challenging plant systems.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.C.1

As indicated in Surveillance Requirement 4.2.C.1, reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.3. Table 4.2.3 identifies, for each Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.C.1 also indicates that when a channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains isolation and

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

initiation capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the

SURVEILLANCE REQUIREMENTS (continued)

applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Refs. 5 and 6) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RBAVSIVs will isolate the penetration flow path(s) and that the SGT System will initiate when necessary.

Surveillance Requirement 4.2.C.2

The Logic System Functional Test demonstrates the operability of the required initiation logic and simulated automatic operation for a specific channel. The testing required by the SGT System and RBAVSIVs Technical Specifications overlaps this Surveillance to provide testing of the assumed safety function. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.2.3, Check

Performance of an Instrument Check once per day, for Trip Function 3, and once per day during Refueling, for Trip Function 4, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Table 4.2.3, Functional Test

For Trip Functions 1, 2, 3, and 4, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current

BASES: 3.2.C/4.2.C REACTOR BUILDING VENTILATION ISOLATION AND STANDBY GAS TREATMENT SYSTEM INITIATION

plant specific setpoint methodology. The Frequency of "Every 3 Months" is based on the reliability analysis of References 5 and 6.
SURVEILLANCE REQUIREMENTS (continued)

Table 4.2.3, Calibration

For Trip Functions 1, 2, 3, and 4, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

For Trip Functions 1 and 2, a calibration of the trip units is required (Footnote (a)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. The channel must be declared inoperable if the trip setting is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The Frequency of every 3 months is based on the reliability analysis of Reference 6 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

REFERENCES

1. UFSAR, Section 5.3.

2. UFSAR, Section 7.17.2.

3. UFSAR, Section 14.6.3.6.

4. UFSAR, Section 14.6.4.4.

5. NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," July 1990.

6. NEDC-30851P-A Supplement 2, "Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," March 1989.

Current

Technical Specifications

Markups

3.2.C and 4.2.C

Reactor Building Ventilation Isolation and
Standby Gas Treatment System Initiation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

3.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the operational status of the plant instrumentation systems which initiate and control a protective function.

Objective:

To assure the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System

When the system(s) it initiates or controls is required in accordance with Specification 3.5, the instrumentation which initiates the emergency core cooling system(s) shall be operable in accordance with Table 3.2.1.

B. Primary Containment Isolation

When primary containment integrity is required, in accordance with Specification 3.7, the instrumentation that initiates primary containment isolation shall be operable in accordance with Table 3.2.2.

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

~~The instrumentation that initiates the isolation of the reactor building ventilation system and the actuation of the standby gas treatment system~~ shall be operable in accordance with Table 3.2.3.

The reactor building ventilation isolation and Standby Gas Treatment System initiation instrumentation for each Trip function in Table 3.2.3

4.2 SURVEILLANCE REQUIREMENTS

4.2 PROTECTIVE INSTRUMENT SYSTEMS

Applicability:

Applies to the surveillance requirements of the instrumentation systems which initiate and control a protective function.

Objective:

To verify the operability of protective instrumentation systems.

Specification:

A. Emergency Core Cooling System

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.1.

B. Primary Containment Isolation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.2.

{Move to separate pages}

1. The reactor building ventilation isolation and Standby Gas Treatment System initiation

C. Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation

~~Instrumentation and logic systems~~ shall be functionally checked tested and calibrated as indicated in Table 4.2.3.

A.2

A.3

When a channel is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into the associated Limiting Conditions for Operation and required actions may be delayed for up to 6 hours provided the associated Trip Function maintains reactor building ventilation isolation capability and Standby Gas Treatment System initiation capability.

A.4

A.1

INSTRUMENTATION

TABLE 3.2.3

REACTOR BUILDING VENTILATION ISOLATION & STANDBY GAS TREATMENT SYSTEM INITIATION

REQUIRED

Actions When Required Channels(1) are Inoperable

A.4 A.5 LA.1 A.6 L.3

	Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Setting	Required ACTION When Minimum Conditions For Operation Are Not Satisfied
1.	2 (Notes ~~2~~ 3)	Low Reactor Vessel Water Level ~~(LT-2-3-57A/B(M), LT-2-3-58A/B(M))~~	~~Same as PCIS~~ ≥ 127.0 inches A.1	Note 1
2.	2 (Notes ~~2~~ 3)	High Drywell Pressure ~~(PT-5-12(A-D)(M))~~ LA.1	~~Same as PCIS~~ ≤ 2.5 psig A.1	Note 1
3.	1 (Notes ~~2~~ 3)	Reactor Building ~~Vent~~ Ventilation Radiation ~~(RM-17-452A/B)~~ High A.6	≤14 mR/hr	Note 1
4.	1 (Notes ~~2~~ 3)	Refueling Floor Zone Radiation ~~(RM-17-453A/B)~~ LA.1	≤100 mR/hr	Note 1
	~~1~~	~~Reactor Building Vent Trip System Logic~~	~~--~~	~~Note 1~~
	~~1~~	~~Standby Gas Treatment Trip System Logic~~	~~--~~	~~Note 1~~

A.1

TABLE 3.2.3 NOTES ACTION

Action Note 1

1. If the minimum number of operable instrument channels is not available in either trip system, the reactor building ventilation system shall be isolated and the standby gas treatment system operated, ~~until the instrumentation is repaired.~~ within 1 hour A.7 A.1 M.1

A.1 <Moved to proposed SR 4.2.B.1>

2. When a channel, ~~and/or the affected primary containment isolation valve~~, is placed in an inoperable status solely for performance of required instrumentation surveillances, entry into associated Limiting Conditions for operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function maintains Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation. A.4

3. Whenever Reactor Building Ventilation Isolation and Standby Gas Treatment System Initiation are required by Specification 3.7.B and 3.7.C, ~~there shall be two operable or tripped trip systems~~ for each ~~Trip Function~~, except as provided for below: A.8 LA.2 L.1 L.2

Action Note 1.b A. With one or more automatic functions with isolation capability not maintained restore isolation and initiation capability in 1 hour ~~or take the ACTION required by Table 3.2.3.~~ A.7

Action Note 1.a B. With one or more channels inoperable, place the inoperable channels (s) in the tripped condition within:

1) 12 hours for trip functions common to RPS instrumentation, and
2) 24 hours for trip functions not common to RPS instrumentation,

or, initiate the ACTION required by Table 3.2.3. A.7

A.1

TABLE 4.2.3

MINIMUM TESTS AND CALIBRATION FREQUENCIES

REACTOR BUILDING VENTILATION AND STANDBY GAS TREATMENT SYSTEM ISOLATION

	Trip Function	Functional Test (8) A.9	Calibration (8) A.9	Instrument Check
1.	Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle Every 3 Months, (1) M.2	--
2.	High Drywell Pressure	Every Three Months	Once/Operating Cycle	--
3.	Reactor Building Ventilation Exhaust Radiation High A.6	Every Three Months	Every Three Months	Once Each Day
4.	Refueling Floor Zone Radiation	Every Three Months	Every Three Months	Once Each Day During Refueling
SR 4.2.C.2	Reactor Building Vent Trip System Logic	Once/Operating Cycle	~~Once/Operating Cycle (Note 3)~~ A.10	-- A.2
SR 4.2.C.2	Standby Gas Treatment Trip System Logic	Once/Operating Cycle	~~Once/Operating Cycle (Note 3)~~	--

(1) Trip unit calibration only — M.2

A.1

TABLE 4.2 NOTES

1. Not used.

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.11

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system. A.10

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.11

5. Deleted.

6. Deleted.

7. Deleted.

8. Functional tests and calibrations are not required when systems are not required to be operable. A.9

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage.

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

A.11

Proposed

Technical Specifications

3.2.D and 4.2.D

Off-Gas System Isolation

3.2 LIMITING CONDITIONS FOR OPERATION

D. Deleted.

E. Control Rod Block Actuation

The control rod block instrumentation for each Trip Function in Table 3.2.5 shall be operable in accordance with Table 3.2.5.

4.2 SURVEILLANCE REQUIREMENTS

D. Deleted.

E. Control Rod Block Actuation

1. The control rod block instrumentation shall be functionally tested and calibrated as indicated in Table 4.2.5.

   When a Rod Block Monitor channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains control rod block initiation capability.

Current

Technical Specifications

Markups

3.2.D and 4.2.D

Off-Gas System Isolation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

D. ~~Off-Gas System Isolation~~ R.1

Deleted

~~During reactor power operation, the instrumentation that initiates isolation of the off-gas system shall be operable in accordance with Table 3.2.4.~~

E. Control Rod Block Actuation

During reactor power operation the instrumentation that initiates control rod block shall be operable in accordance with Table 3.2.5.

F. Mechanical Vacuum Pump Isolation Instrumentation

When the reactor is in the RUN or STARTUP/HOT STANDBY Mode and the mechanical vacuum pump is in service, four (4) channels of the High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be operable, except as provided below.

1. With one or more channels inoperable, within 12 hours:

   a. Restore the inoperable channel(s) to operable status; or

   b. Place the inoperable channel(s) or associated trip system in the trip condition (not applicable if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve).

4.2 SURVEILLANCE REQUIREMENTS

D. ~~Off-Gas System Isolation~~ R.1

Deleted

~~Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.4.~~

<MOVE TO SEPARATE PAGE>

E. Control Rod Block Actuation A.2

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.5.

F. Mechanical Vacuum Pump Isolation Instrumentation

The High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be checked, functionally tested and calibrated as indicated in Surveillance Requirements 4.2.F.1, 2, 3, 4 and 5.

When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required actions may be delayed for up to six (6) hours provided the associated trip function maintains mechanical vacuum pump isolation capability.

1. Perform an instrument check once each day.

2. Perform an instrument functional test once every three (3) months.

<MOVE TO SEPARATE PAGE>

TABLE 3.2.4

OFF-GAS SYSTEM ISOLATION INSTRUMENTATION

Minimum Number of Operable Instrument Channels per Trip System	Trip Function	Trip Setting	Required Action When Minimum Conditions For Operation Are Not Satisfied
1	Time Delay (Stack Off-Gas Valve Isolation) (15TD & 16TD)	≤ 2 minutes ≤ 30 minutes	Note 1
1	Trip System Logic	--	Note 1

Note 1 - At least one of the radiation monitors between the charcoal bed system and the plant stack shall be operable during operation of the augmented off-gas system. If this condition cannot be met, continued operation of the augmented off-gas system is permissible for a period of up to 7 days provided that at least one of the stack monitoring systems is operable and off-gas system temperature and pressure are measured continuously.

R.1

VYNPS

TABLE 4.2.4

MINIMUM TEST AND CALIBRATION FREQUENCIES

OFF-GAS SYSTEM ISOLATION INSTRUMENTATION

Trip Function	Functional Test(8)	Calibration(8)	Instrument Check
Augmented Off-Gas Trip System Logic (AOG)	Once/Operating Cycle (Note 2)	Once/Operating Cycle (Note 3)	--

R.1

A.1

TABLE 4.2 NOTES

~~1. Not used.~~

~~2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart.~~

~~3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system.~~

R.1

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel.

A.2

~~5. Deleted.~~

~~6. Deleted.~~

~~7. Deleted.~~

~~8. Functional tests and calibrations are not required when systems are not required to be operable~~

R.1

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage.

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

A.2

Proposed

Technical Specifications

3.2.E and 4.2.E

Control Rod Block Actuation

And related Technical Specifications:

3.3 – Control Rod System

3.11 – Reactor Fuel Assemblies

3.2 LIMITING CONDITIONS FOR OPERATION

D. Deleted.

E. <u>Control Rod Block Actuation</u>

The control rod block instrumentation for each Trip Function in Table 3.2.5 shall be operable in accordance with Table 3.2.5.

4.2 SURVEILLANCE REQUIREMENTS

D. Deleted.

E. <u>Control Rod Block Actuation</u>

1. The control rod block instrumentation shall be functionally tested and calibrated as indicated in Table 4.2.5.

   When a Rod Block Monitor channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains control rod block initiation capability.

Table 3.2.5 (page 1 of 1)
Control Rod Block Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP FUNCTION	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Rod Block Monitor				
a. Upscale (Flow Bias)	> 30% RATED THERMAL POWER	2	Note 1	$\leq 0.66(W)+N^{(b)}$ with a maximum as defined in the COLR
b. Downscale	> 30% RATED THERMAL POWER	2	Note 1	≥ 2/125 full scale
c. Inop	> 30% RATED THERMAL POWER	2	Note 1	NA
2. Reactor Mode Switch - Shutdown Position	(a)	2	Note 2	NA

(a) When reactor mode switch is in the shutdown position.

(b) Trip Setting $\leq 0.66\ (W-\Delta W)+N$ for single loop operation.

Table 3.2.5 ACTION Notes

1. With one or two RBM channels inoperable, take all of the applicable Actions in Notes 1.a and 1.b below.

   a. If one RBM channel is inoperable, restore the inoperable channel to operable status within 24 hours.

   b. If the required Action and associated completion time of Note 1.a above is not met, or if two RBM channels are inoperable, place one RBM channel in trip within the next hour.

2. With one or more Reactor Mode Switch - Shutdown Position channels inoperable, immediately suspend control rod withdrawal and immediately initiate actions to fully insert all insertable control rods in core cells containing one or more fuel assemblies.

Table 4.2.5 (page 1 of 1)
Control Rod Block Instrumentation
Tests and Frequencies

TRIP FUNCTION	FUNCTIONAL TEST	CALIBRATION
1. Rod Block Monitor (RBM)		
a. Upscale (Flow Bias)	Every 3 Months	Every 3 Months[b][c]
b. Downscale	Every 3 Months	Every 3 Months[b]
c. Inop	Every 3 Months	NA
2. Reactor Mode Switch - Shutdown Position	Every Refueling Outage[a]	NA

(a) Not required to be performed until 1 hour after the reactor mode switch is placed in the shutdown position.

(b) Neutron detectors are excluded.

(c) Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

Proposed

Bases

3.2.E and 4.2.E

Control Rod Block Actuation

And related Technical Specification Bases:

3.3 – Control Rod System

3.11 – Reactor Fuel Assemblies

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

BACKGROUND

Control rods provide the primary means for control of reactivity changes. Control rod block instrumentation includes channel sensors, logic circuitry, switches, and relays that are designed to backup administrative controls on control rod movement. During shutdown conditions, control rod blocks from the Reactor Mode Switch—Shutdown Position Function ensure that all control rods remain inserted to prevent inadvertent criticalities.

The purpose of the RBM (Ref.1) is to limit control rod withdrawal if localized neutron flux exceeds a predetermined setpoint during control rod manipulations. The RBM supplies a trip signal to the Reactor Manual Control System (RMCS) to appropriately inhibit control rod withdrawal during power operation above the 30% RATED THERMAL POWER setpoint when a non-peripheral control rod (except control rod 35-34) is selected. The RBM has two channels, either of which can initiate a control rod block when the channel output exceeds the control rod block setpoint. One RBM channel inputs into one RMCS rod block circuit and the other RBM channel inputs into the second RMCS rod block circuit. A rod block in either RMCS circuit will provide a control rod block to all control rods. The RBM channel signal is generated by averaging a set of local power range monitor (LPRM) signals. One RBM channel averages the signals from LPRM detectors at the A and C positions in the assigned LPRM assemblies, while the other RBM channel averages the signals from LPRM detectors at the B and D positions. Assignment of LPRMs to be used in RBM averaging is controlled by the selection of control rods. The RBM is automatically bypassed and the output set to zero if a peripheral rod (or control rod 35-34) is selected or the APRM used to normalize the RBM reading is at < 30% RATED THERMAL POWER. If any LPRM detector assigned to an RBM is bypassed, the computed average signal is automatically adjusted to compensate for the number of LPRM input signals. The minimum number of LPRM inputs required for each RBM channel to prevent an instrument inoperative trip is four when using four LPRM strings, three when using three LPRM strings, and two when using two LPRM strings. Each RBM also receives a recirculation loop flow signal from the associated flow converter.

When a control rod is selected, the gain of each RBM channel output is normalized to a reference APRM. The gain setting is held constant during the movement of that particular control rod to provide an indication of the change in the relative local power level. If the indicated power increases above the preset limit, a rod block will occur. In addition, to preclude rod movement with an inoperable RBM, a downscale trip and an inoperable trip are provided.

With the reactor mode switch in the shutdown position, a control rod withdrawal block is applied to all control rods to ensure that the shutdown condition is maintained (Ref. 2). This Trip Function prevents inadvertent criticality as the result of a control rod withdrawal during COLD SHUTDOWN and HOT SHUTDOWN or during a Refueling Outage when the reactor mode switch is required to be in the shutdown position. The reactor mode switch has two channels, each inputting into a separate RMCS rod block circuit. A rod block in either RMCS circuit will provide a control rod block to all control rods.

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.a, 1.b, 1.c Rod Block Monitor

The RBM is not specifically credited in any accident or transient analysis, but it is retained for overall redundancy and diversity as required by the NRC approved licensing basis. The Trip Settings are based on providing operational flexibility in the MELLLA region.

Two channels of each of the RBM Trip Functions are required to be operable, with their trip setpoints within the calculational as-found tolerances specified in plant procedures, as applicable, to ensure that no single instrument failure can preclude a rod block from these Trip Functions. In addition, to provide adequate coverage of the entire core, LPRM inputs for each RBM channel are required from greater than or equal to half the total number of inputs from any LPRM level. The upper limit of the RBM Upscale (Flow Bias) Trip Function is clamped to provide protection at greater than 100% rated core flow. This clamped value is cycle-specific and is included in the Core Operating Limits Report. Trip Settings are specified for RBM Upscale (Flow Bias) and RBM Downscale Trip Functions. The terms for the Trip Setting of the RBM Upscale (Flow Bias) Trip Function are defined as follows: W is percent of rated two loop drive flow where 100% rated drive flow is that flow equivalent to 48 X 10^6 lbs/hr core flow; and ΔW is the difference between two loop and single loop drive flow a the same core flow (this difference must be accounted for during single loop operation). $\Delta W = 0$ for two loop operation and $\Delta W = 8\%$ for single loop operation.

Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.5. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

2. Reactor Mode Switch – Shutdown Position

During HOT SHUTDOWN and COLD SHUTDOWN, and during Refueling Outages when the reactor mode switch is in the shutdown position, the core is assumed to be subcritical; therefore, no positive reactivity insertion events are analyzed. The Reactor Mode Switch–Shutdown Position control rod withdrawal block ensures that the reactor remains subcritical by blocking control rod withdrawal, thereby preserving the assumptions of the safety analysis.

The Reactor Mode Switch–Shutdown Position Trip Function satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

Two channels are required to be operable to ensure that no single channel failure will preclude a rod block when required. There is no Trip Setting for this Trip Function since the channels are mechanically actuated based solely on reactor mode switch position. During shutdown conditions (HOT SHUTDOWN and COLD SHUTDOWN, and Refueling Outages when the reactor mode switch is in the shutdown position), no positive reactivity insertion events are analyzed because assumptions are that control rod withdrawal blocks are provided to prevent criticality. Therefore, when the reactor mode switch is in the shutdown position, the control rod withdrawal block is required to be operable. With the reactor mode switch in the refueling position, the refuel position one-rod-out interlock provides the required control rod withdrawal blocks.

ACTIONS

Table 3.2.5 ACTION Note 1

With one RBM Trip Function 1.a, 1.b, or 1.c channel inoperable, the remaining operable channel is adequate to perform the control rod block function; however, overall reliability is reduced because a single failure in the remaining operable RBM channel can result in no control rod block capability for the RBM. For this reason, Table 3.2.5 ACTION Note 1.a requires restoration of the inoperable channel to operable status. The Completion Time of 24 hours is based on the low probability of an event occurring coincident with a failure in the remaining operable channel.

If the Table 3.2.5 ACTION Note 1.a required action is not met and the associated Completion Time has expired, the inoperable channel must be placed in trip within 1 hour. If both RBM Trip Function 1.a, 1.b, or 1.c channels are inoperable, the RBM is not capable of performing its intended function; thus, one channel must also be placed in trip. This initiates a control rod withdrawal block, thereby ensuring that the RBM function is met. The 1 hour Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities and is acceptable because it minimizes risk while allowing time for restoration or tripping of inoperable channels.

Table 3.2.5 ACTION Note 2

With one Reactor Mode Switch–Shutdown Position control rod withdrawal block channel inoperable, the remaining operable channel is adequate to perform the

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

ACTIONS (continued)

control rod withdrawal block function. However, since the required actions of Table 3.2.5 ACTION Note 2 are consistent with the normal action of an operable Reactor Mode Switch–Shutdown Position Trip Function (i.e., maintaining all control rods inserted), there is no distinction between having one or two channels inoperable.

In both cases (one or both channels inoperable), suspending all control rod withdrawal and initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies will ensure that the core is subcritical with adequate Shutdown Margin ensured by Specification 3.3.A.1. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are therefore not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.E.1

As indicated in Surveillance Requirement 4.2.E.1, control rod block instrumentation shall be functionally tested and calibrated as indicated in Table 4.2.5. Table 4.2.5 identifies, for each Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.E.1 also indicates that when an RBM channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains control rod block capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Ref. 4) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that a control rod block will be initiated when necessary.

Table 4.2.5, Functional Test

For Trip Functions 1.a, 1.b, and 1.c, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. The Functional Test of the RBM channels includes the Reactor Manual Control "Select Relay Matrix" System input. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The Frequency of "Every 3 Months" is based on the reliability analysis of Reference 5.

For Trip Function 2, a Functional Test is performed to ensure that the entire channel will perform the intended function. The Functional Test for the Reactor Mode Switch–Shutdown Position Trip Function is performed by attempting to withdraw any control rod with the reactor mode switch in the

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

SURVEILLANCE REQUIREMENTS (continued)

shutdown position and verifying a control rod block occurs. As noted in Table 4.2.5 Footnote (a), the Surveillance is not required to be performed until 1 hour after the reactor mode switch is in the shutdown position, since testing of this interlock with the reactor mode switch in any other position cannot be performed without using jumpers, lifted leads, or movable links. This allows entry into the HOT SHUTDOWN and COLD SHUTDOWN Modes if the "Every Refueling Outage" Frequency is not met. The 1 hour allowance is based on operating experience and in consideration of providing a reasonable time in which to complete the Surveillance Requirement. The Frequency of "Every Refueling Outage" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.2.5, Calibration

For Trip Functions 1.a and 1.b, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

The RBM is automatically bypassed when power is below a specified value or if a peripheral control rod is selected. The power level is determined from the APRM signals input to each RBM channel. The automatic bypass setpoint must be verified periodically to be ≤ 30% RATED THERMAL POWER. As a result, the Instrument Calibration of Trip Function 1.a must also include calibration of the RBM Reference Downscale function (i.e., RBM Upscale (Flow Bias) Trip Function is not bypassed when > 30% RATED THERMAL POWER), as noted in Footnote (c). In addition, it must also be verified that the RBM is not bypassed when a control rod that is not a peripheral control rod is selected (only one non-peripheral control rod is required to be verified). If any bypass setpoint is nonconservative, then the affected RBM channel is considered inoperable. Alternatively, the APRM channel can be placed in the conservative condition to enable the RBM. If placed in this condition, the Surveillance Requirement is met and the RBM channel is not considered inoperable.

As noted in Footnote (b), neutron detectors are excluded from the Surveillance because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 7 day heat balance calibration and the 2000 MWD/T LPRM calibration against the Traversing Incore Probe System of the Reactor Protection System Technical Specification.

BASES: 3.2.E/4.2.E CONTROL ROD BLOCK ACTUATION

REFERENCES

1. UFSAR, Section 7.5.8.

2. UFSAR, Section 7.7.4.3.2.

3. UFSAR, Section 14.5.3.1.

4. GENE-770-06-1-A, "Addendum to Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications," December 1992.

5. NEDC-30851-P-A, Supplement 1, "Technical Specification Improvement Analysis for BWR Control Rod Block Instrumentation," October 1988.

Current

Technical Specifications

Markups

3.2.E and 4.2.E

Control Rod Block Actuation

And related Technical Specifications:

3.3 – Control Rod System

3.11 – Reactor Fuel Assemblies

A.1

3.2 LIMITING CONDITIONS FOR OPERATION	4.2 SURVEILLANCE REQUIREMENTS
D. Off-Gas System Isolation During reactor power operation, the instrumentation that initiates isolation of the off-gas system shall be operable in accordance with Table 3.2.4.	D. Off-Gas System Isolation Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.4. A.2
E. Control Rod Block Actuation A.3 During reactor power operation, ~~the instrumentation that initiates control rod block~~ THE CONTROL ROD BLOCK INSTRUMENTATION FOR EACH TRIP FUNCTION IN TABLE 3.2.5 shall be operable in accordance with Table 3.2.5.	E. Control Rod Block Actuation 1. THE CONTROL ROD BLOCK ~~Instrumentation and logic systems~~ ~~shall be~~ functionally tested and calibrated as indicated in Table 4.2.5. A.4
F. Mechanical Vacuum Pump Isolation Instrumentation When the reactor is in the RUN or STARTUP/HOT STANDBY Mode and the mechanical vacuum pump is in service, four (4) channels of the High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be operable, except as provided below. 1. With one or more channels inoperable, within 12 hours: a. Restore the inoperable channel(s) to operable status; or b. Place the inoperable channel(s) or associated trip system in the trip condition (not applicable if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve).	F. Mechanical Vacuum Pump Isolation Instrumentation The High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be checked, functionally tested and calibrated as indicated in Surveillance Requirements 4.2.F.1, 2, 3, 4 and 5. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required actions may be delayed for up to six (6) hours provided the associated trip function maintains mechanical vacuum pump isolation capability. 1. Perform an instrument check once each day. 2. Perform an instrument functional test once every three (3) months.

<MOVE TO SEPARATE PAGE>

A.5 WHEN A ROD BLOCK MONITOR CHANNEL IS PLACED IN AN INOPERABLE STATUS SOLELY FOR PERFORMANCE OF REQUIRED SURVEILLANCES, ENTRY INTO ASSOCIATED LIMITING CONDITIONS FOR OPERATION AND REQUIRED ACTIONS MAY BE DELAYED FOR UP TO 6 HOURS PROVIDED THE ASSOCIATED TRIP FUNCTION MAINTAINS CONTROL ROD BLOCK INITIATION CAPABILITY.

A.1

VYNPS

TABLE 3.2.5

CONTROL ROD BLOCK INSTRUMENTATION

	Required Channels		Trip Function	Modes in Which Function Must be Operable: Refuel	Startup	Run	Trip Setting
	A.6		Rod Block Monitor ~~(RBM A/B)~~ LA.1			A.3	
1.a	(Notes ~~9~~ ~~and 10~~)	2	a. Upscale (Flow Bias) ~~(Note 7)~~ A.3			X	≤0.66(W-ΔW)+N with a maximum as defined in the COLR ~~(Note 5)~~ LA.3
1.b	A.5	2	b. Downscale ~~(Note 7)~~ LA.2			X	≥2/125 Full Scale
1.c		2	c. Inop ~~(Note 7)~~			X	
2	(Note ~~12~~) A.6	2	Reactor Mode Switch - Shutdown Position ~~(Note 12)~~ A.3				
	~~(Note 8)~~	~~1~~	~~Trip System~~	~~X~~	~~X~~	~~X~~	A.4

ACTION

TABLE 3.2.5 NOTES

1. ~~Deleted.~~

2. ~~Deleted.~~

3. ~~Deleted.~~

4. ~~Deleted.~~

LA.3

TABLE 3.2.5 FUNCTION 1.a TRIP SETTING

5. ~~"W" is percent rated two loop drive flow where 100% rated drive flow is that flow equivalent to 48 x 10^6 lbs/hr core flow. Refer to the Core Operating Limits Report for acceptable values for N. ΔW is the difference between the two loop and single loop drive flow at the same core flow. This difference must be accounted for during single loop operation.~~ ΔW = 0 for two recirculation loop operation and = 8% for single loop operation.

6. ~~Not used.~~

A.3

7. The trip may be bypassed when the reactor power is <30% of Rated Thermal Power. ~~An RBM channel will be considered inoperable if there are less than half the total number of normal inputs from any LPRM level.~~

LA.2

8. ~~With the number of operable channels less than the required number, place the inoperable channel in the tripped condition within one hour.~~

A.4

ACTION NOTE 1

9. With one or two RBM channels inoperable~~:~~, take all of the applicable Actions in Notes 1.a and 1.b below.

~~a. Deleted.~~

ACTION NOTE 1.a

b. If one RBM channel is inoperable, restore the inoperable channel to operable status within 24 hours; and

ACTION NOTE 1.b

c. If the required ~~a~~Action and associated completion time of Note ~~9.b~~ 1.a above is not met, or if two RBM channels are inoperable, place one RBM channel in the tripped condition within the next hour.

10. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required action notes may be delayed for up to 6 hours provided the associated Trip Function maintains Control Rod Block initiation capability.

A.5

11. ~~Deleted.~~

12. Required to be operable when the reactor mode switch is in the shutdown position.

A.3

ACTION NOTE 2

13. With one or more Reactor Mode Switch - Shutdown Position channels inoperable, immediately suspend control rod withdrawal and immediately initiate actionS to fully insert all insertable control rods in core cells containing one or more fuel assemblies.

A.1

TABLE 4.2.5

MINIMUM TESTS AND CALIBRATION FREQUENCIES

CONTROL ROD BLOCK INSTRUMENTATION

	Trip Function	Functional Test	Calibration
	Rod Block Monitor (RBM)		(2) L.2
1.a	a. Upscale (Flow Bias)	Every Three Months (Note 4)	Every Three Months (Note 13) LA.4
1.b	b. Downscale	Every Three Months (Note 4) A.8	Every Three Months (2) L.2
1.c	c. Inop	Every Three Months	
	Trip System Logic	Once/Operating Cycle	Once/Operating Cycle (Note 3) A.7 A.4
2.	Reactor Mode Switch - Shutdown Position	Every Refueling Outage (Note 12)	

(2) NEUTRON DETECTORS ARE EXCLUDED L.2

A.1

TABLE 4.2 NOTES

1. Not used.

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.9

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system. A.7

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.8

5. Deleted.

6. Deleted.

7. Deleted.

8. Functional tests and calibrations are not required when systems are not required to be operable.

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

A.9

A.4

TABLE 4.2.5 FOOTNOTE (1)

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage. A.1

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power). LA.4

PERFORMED

M.1

Proposed

Technical Specifications

3.2.F and 4.2.F

Mechanical Vacuum Pump Isolation Instrumentation

3.2 LIMITING CONDITIONS FOR OPERATION

F. Mechanical Vacuum Pump Isolation Instrumentation

1. When the reactor is in the RUN or STARTUP/HOT STANDBY Mode and the mechanical vacuum pump is in service, 4 channels of the High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be operable.

4.2 SURVEILLANCE REQUIREMENTS

F. Mechanical Vacuum Pump Isolation Instrumentation

1. The High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be checked, functionally tested and calibrated as indicated in Surveillance Requirements 4.2.F.1.a, b, c, d and e.

   When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains mechanical vacuum pump isolation capability.

   a. Perform an Instrument Check once each day.

   b. Perform an Instrument Functional Test once every 3 months.

   c. Perform an Instrument Calibration, except for radiation detectors, using a current source once every 3 months. The Trip Setting shall be $\leq$ 3.0 X background at rated thermal power.

   d. Perform an Instrument Calibration using a radiation source once each Refueling Outage.

   e. Perform a Logic System Functional Test, including mechanical vacuum pump isolation valve, once every Operating Cycle.

3.2 LIMITING CONDITIONS FOR OPERATION	4.2 SURVEILLANCE REQUIREMENTS

2. If Specification 3.2.F.1 is not met, take all of the applicable Actions in Specifications 3.2.F.2.a and 2.b below.

    a. With one or more channels inoperable:

        1) Restore any inoperable channel to operable status within 12 hours; or

        2) Place any inoperable channel or associated trip system in the trip condition within 12 hours (not applicable if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve).

    b. If the required Action and associated completion time of Specification 3.2.F.2.a above is not met, or if mechanical vacuum pump isolation capability is not maintained:

        1) Isolate the mechanical vacuum pump within 12 hours; or

        2) Isolate the main steam lines within 12 hours; or

        3) Place the reactor in the SHUTDOWN Mode within 12 hours.

Proposed

Bases

3.2.F and 4.2.F

Mechanical Vacuum Pump Isolation
Instrumentation

BASES: 3.2.F/4.2.F MECHANICAL VACUUM PUMP ISOLATION

BACKGROUND

The mechanical vacuum pump isolation instrumentation initiates an isolation of the mechanical vacuum pump following events in which main steam radiation monitors exceed a predetermined value. Tripping and isolating the mechanical vacuum pumps limits control room and offsite doses in the event of a control rod drop accident (CRDA).

The mechanical vacuum pump isolation instrumentation includes sensors, relays and switches that are necessary to cause initiation of mechanical vacuum pump isolation. The channels include electronic equipment that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs an isolation signal to the mechanical vacuum pump isolation logic.

The isolation logic consists of two independent trip systems, with two channels of the High Main Steam Line Radiation Trip Function in each trip system. Each trip system is a one-out-of-two logic for this Trip Function. Thus, either channel of the High Main Steam Line Radiation Trip Function in a trip system is needed to trip the trip system. The outputs of the channels in a trip system are arranged in a logic so that both trip systems must trip to result in an isolation signal.

The mechanical vacuum pump isolation valve is also associated with this Trip Function.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The mechanical vacuum pump isolation is assumed in the safety analysis for the CRDA. The mechanical vacuum pump isolation instrumentation initiates an isolation of the mechanical vacuum pump to limit control room and offsite doses resulting from fuel cladding failure in a CRDA.

The mechanical vacuum pump isolation instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

The operability of the mechanical vacuum pump isolation instrumentation is dependent on the operability of the four High Main Steam Line Radiation Trip Function instrumentation channels with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Surveillance Requirement 4.2.F.1.c as required by the CRDA analysis. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions. The High Main Steam Line Radiation Trip Setting was chosen to be as low enough to ensure that control room and offsite dose limits are not exceeded in the event of a CRDA, but high enough to avoid spurious isolation due to nitrogen-16 spikes, instrument instabilities, and other operational occurrences. Channel operability also includes the mechanical vacuum pump isolation valve.

BASES: 3.2.F/4.2.F MECHANICAL VACUUM PUMP ISOLATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The mechanical vacuum pump isolation is required to be operable in RUN and STARTUP/HOT STANDBY when the mechanical vacuum pump is in service to mitigate the consequences of a postulated CRDA. In this condition, fission products released during a CRDA could be discharged directly to the environment. Therefore, the mechanical vacuum pump isolation is necessary to assure conformance with the radiological evaluation of the CRDA. In other Modes or conditions, the consequences of a control rod drop are insignificant, and are not expected to result in any fuel damage or fission product releases. When the mechanical vacuum pump is not in operation in RUN and STARTUP/HOT STANDBY, fission product releases via this pathway would not occur.

ACTIONS

Specification 3.2.F.2.a

With one or more High Main Steam Line Radiation Trip Function channels inoperable, but with mechanical vacuum pump isolation capability maintained (refer to Specification 3.2.F.2.b Bases), the mechanical vacuum pump isolation instrumentation is capable of performing the intended function. However, the reliability and redundancy of the mechanical vacuum pump isolation instrumentation is reduced, such that a single failure in one of the remaining channels could result in the inability of the mechanical vacuum pump isolation instrumentation to perform the intended function. Therefore, only a limited time is allowed to restore the inoperable channels to operable status. Because of the low probability of an extensive number of inoperabilities affecting multiple channels, and the low probability of an event requiring the initiation of mechanical vacuum pump isolation, 12 hours has been shown to be acceptable (Ref. 1) to permit restoration of any inoperable channel to operable status. Alternately, the inoperable channel or associated trip system may be placed in trip, since this would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. As noted, placing the channel in trip with no further restrictions is not allowed if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve, since this may not adequately compensate for the inoperable mechanical vacuum pump isolation valve (e.g., the isolation valve may be inoperable such that it will not close). If it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel would result in loss of condenser vacuum), or if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve, Specification 3.2.F.2.b must be entered and its required actions taken.

Specification 3.2.F.2.b

With any required Action and associated completion time of Specification 3.2.F.2.a not met, the plant must be brought to a Mode or other specified condition in which the LCO does not apply. To achieve this status, the plant must be brought to at least SHUTDOWN within 12 hours. Alternately, the mechanical vacuum pump may be isolated since this performs the intended function of the instrumentation. An additional option is provided to isolate

BASES: 3.2.F/4.2.F MECHANICAL VACUUM PUMP ISOLATION

ACTIONS (continued)

the main steam lines, which may allow operation to continue. Isolating the main steam lines effectively provides an equivalent level of protection by precluding fission product transport to the condenser. This isolation is accomplished by isolation of all main steam lines and main steam line drains which bypass the main steam isolation valves.

Specification 3.2.F.2.b is also intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels result in the High Main Steam Line Radiation Trip Function not maintaining mechanical vacuum pump isolation capability. The High Main Steam Line Radiation Trip Function is considered to be maintaining mechanical vacuum pump isolation capability when sufficient channels are operable or in trip such that the mechanical vacuum pump isolation instruments will generate a trip signal from a valid High Main Steam Line Radiation signal, and the mechanical vacuum pump will be isolated. This requires one channel of the High Main Steam Line Radiation Trip Function in each trip system to be operable or in trip, and the mechanical vacuum pump isolation valve to be operable.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.F.1

As indicated in Surveillance Requirement 4.2.F.1, the High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be checked, functionally tested and calibrated as indicated Surveillance Requirements 4.2.F.1.a, b, c, d, and e.

Surveillance Requirement 4.2.F.1 also indicates that when a channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains mechanical vacuum pump isolation capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Ref. 1) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that a mechanical vacuum pump will isolate when necessary.

Surveillance Requirement 4.2.F.1.a, Instrument Check

Performance of an Instrument Check once each day ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based

BASES: 3.2.F/4.2.F MECHANICAL VACUUM PUMP ISOLATION

SURVEILLANCE REQUIREMENTS (continued)

on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Surveillance Requirement 4.2.F.1.b, Instrument Functional Test

An Instrument Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The Frequency of "once every 3 months" is based on the reliability analysis of Reference 1.

Surveillance Requirements 4.2.F.1.c and 4.2.F.1.d, Instrument Calibrations

An Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. Surveillance Requirement 4.2.F.1.c requires a calibration to be performed once every 3 months using a current source. This current source is provided downstream of the radiation detectors. As such, the radiation detectors are excluded from the 3 month calibration. Surveillance Requirement 4.2.F.1.d requires a calibration to be performed once each Refueling Outage using a radiation source. The radiation detectors are included in the once each Refueling Outage calibration. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

Surveillance Requirement 4.2.F.1.e, Logic System Functional Test

The Logic System Functional Test demonstrates the operability of the required trip logic for a specific channel. Actuation of the mechanical vacuum pump isolation valve is included as part of this Surveillance to provide complete testing of the assumed safety function. Therefore, if the isolation valve is incapable of actuating, the instrument channel would be inoperable. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

BASES: 3.2.F/4.2.F MECHANICAL VACUUM PUMP ISOLATION

REFERENCES

1. NEDC-30851P-A, Supplement 2, Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation, March 1989.

Current

Technical Specifications

Markups

3.2.F and 4.2.F

Mechanical Vacuum Pump Isolation
Instrumentation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

D. Off-Gas System Isolation

During reactor power operation, the instrumentation that initiates isolation of the off-gas system shall be operable in accordance with Table 3.2.4.

E. Control Rod Block Actuation

During reactor power operation the instrumentation that initiates control rod block shall be operable in accordance with Table 3.2.5.

F. Mechanical Vacuum Pump Isolation Instrumentation

1. When the reactor is in the RUN or STARTUP/HOT STANDBY Mode and the mechanical vacuum pump is in service, ~~four~~ (4) channels of the High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be operable. ~~except as provided below.~~

a ~~1~~. With one or more channels inoperable~~, within 12 hours~~:

1) ~~(a)~~ Restore the inoperable channel(s) to operable status~~; or~~

WITHIN 12 HOURS

2) ~~(b)~~ Place the inoperable channel(s) or associated trip system in the trip condition. (not applicable if the inoperable channel is the result of an inoperable mechanical vacuum pump isolation valve).

2. IF SPECIFICATION 3.2.F.1 IS NOT MET, TAKE ALL OF THE APPLICABLE ACTIONS IN SPECIFICATIONS 3.2.F.2.a AND 2.b BELOW.

4.2 SURVEILLANCE REQUIREMENTS

D. Off-Gas System Isolation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.4.

A.2

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E. Control Rod Block Actuation

Instrumentation and logic systems shall be functionally tested and calibrated as indicated in Table 4.2.5.

F. Mechanical Vacuum Pump Isolation Instrumentation

1. The High Main Steam Line Radiation Trip Function for mechanical vacuum pump isolation shall be checked, functionally tested and calibrated as indicated in Surveillance Requirements 4.2.F.1, ~~2~~ a, ~~3~~ b, ~~4~~ c, d and ~~5~~ e. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required actions may be delayed for up to ~~six~~ (6) hours provided the associated trip function maintains mechanical vacuum pump isolation capability.

a ~~2~~. Perform an instrument check once each day.

b ~~3~~. Perform an instrument functional test once every ~~three~~ (3) months.

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

b. ~~2~~. If the required ~~A~~ction and associated completion time of Specification 3.2.F.~~1~~ 2.a ABOVE is not met, ~~within the following 12 hours~~: OR IF MECHANICAL VACUUM PUMP ISOLATION CAPABILITY IS NOT MAINTAINED:

M.1

1) ~~a~~ Isolate the mechanical vacuum pump; or WITHIN 12 HOURS

2) ~~b~~ Isolate the main steam lines; or

3) ~~c~~ Place the reactor in the SHUTDOWN Mode.

4.2 SURVEILLANCE REQUIREMENTS

c ~~2~~. Perform an ~~I~~nstrument ~~C~~alibration, except for the radiation detectors, using a current source once every ~~three~~ 30 months. The ~~T~~rip ~~S~~etting shall be ≤ 3.0 ~~times~~ X background at rated thermal power.

d. ~~3~~. Perform an ~~I~~nstrument ~~C~~alibration using a radiation source once each ~~R~~efueling ~~O~~utage.

e. ~~4~~. Perform a ~~L~~ogic ~~S~~ystem ~~F~~unctional ~~T~~est, including mechanical vacuum pump isolation valve, once ~~each~~ EVERY ~~O~~perating ~~C~~ycle.

G. Post-Accident Instrumentation

During reactor power operation, the instrumentation that displays information in the Control Room necessary for the operator to initiate and control the systems used during and following a postulated accident or abnormal operating condition shall be operable in accordance with Table 3.2.6.

G. Post-Accident Instrumentation

The post-accident instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.6.

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H. Drywell to Torus ΔP Instrumentation

1. During reactor power operation, the Drywell to Torus ΔP Instrumentation (recorder #1-156-3 and instrument DPI-1-158-6) shall be operable except as specified in 3.2.H.2.

2. From and after the date that one of the Drywell to Torus ΔP instruments is made or found to be inoperable for any reason, reactor operation is permissible only during the succeeding thirty days unless the instrument is

H. Drywell to Torus ΔP Instrumentation

The Drywell to Torus ΔP Instrumentation shall be calibrated once every six months and an instrument check will be made once per shift.

A.2

Proposed

Technical Specifications

3.2.G and 4.2.G

Post-Accident Monitoring Instrumentation

3.2 LIMITING CONDITIONS FOR OPERATION

G. Post-Accident Monitoring Instrumentation

The post-accident monitoring instrumentation for each Function in Table 3.2.6 shall be operable in accordance with Table 3.2.6.

4.2 SURVEILLANCE REQUIREMENTS

G. Post-Accident Monitoring Instrumentation

1. The post-accident monitoring instrumentation shall be checked and calibrated in accordance with Table 4.2.6.

   When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours.

Table 3.2.6 (page 1 of 1)
Post-Accident Monitoring Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE
1.	Drywell Atmospheric Temperature	RUN, STARTUP/HOT STANDBY	2	Note 1
2.	Drywell Pressure	RUN, STARTUP/HOT STANDBY	2	Note 1
3.	Torus Pressure	RUN, STARTUP/HOT STANDBY	2	Note 1
4.	Torus Water Level	RUN, STARTUP/HOT STANDBY	2	Note 1
5.	Torus Water Temperature	RUN, STARTUP/HOT STANDBY	2	Note 1
6.	Reactor Pressure	RUN, STARTUP/HOT STANDBY	2	Note 1
7.	Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY	2	Note 1
8.	Torus Air Temperature	RUN, STARTUP/HOT STANDBY	2	Note 1
9.	Containment High Range Radiation Monitor	RUN, STARTUP/HOT STANDBY	2	Note 2

Table 3.2.6 ACTION Notes

1. With one or more Post-Accident Monitoring instrumentation channels, for Functions other than Function 9, inoperable, take all of the applicable Actions in Notes 1.a and 1.b below.

   a. With one or more Functions with one channel inoperable:

      1) Restore channel to operable status within 30 days; or
      2) Prepare and submit a special report to the Commission within the next 14 days, outlining the Action taken, the cause of the inoperability, and the plans and schedule for restoring the channel to operable status.

   b. With one or more Functions with two channels inoperable:

      1) Restore one required channel to operable status within 7 days; or
      2) Place the reactor in HOT SHUTDOWN within the next 12 hours.

2. With one or more Post - Accident Monitoring instrumentation Function 9 channels inoperable, take all of the applicable Actions in Notes 2.a and 2.b below.

   a. With one channel inoperable:

      1) Restore channel to operable status within 30 days; or
      2) Prepare and submit a special report to the Commission within the next 14 days, outlining the Action taken, the cause of the inoperability, and the plans and schedule for restoring the channel to operable status.

   b. With two channels inoperable:

      1) Restore one channel to operable status within 7 days; or
      2) Prepare and submit a special report to the Commission within the next 14 days, outlining the Action taken, the cause of the inoperability, and the plans and schedule for restoring the channels to operable status.

Table 4.2.6 (page 1 of 1)
Post-Accident Monitoring Instrumentation
Tests and Frequencies

	FUNCTION	CHECK	CALIBRATION
1.	Drywell Atmospheric Temperature	Once/Day	Every 6 Months
2.	Drywell Pressure	Once/Day	Once/Operating Cycle
3.	Torus Pressure	Once/Day	Once/Operating Cycle
4.	Torus Water Level	Once/Day	Once/Operating Cycle
5.	Torus Water Temperature	Once/Day	Every 6 Months
6.	Reactor Pressure	Once/Day	Once/Operating Cycle
7.	Reactor Vessel Water Level	Once/Day	Once/Operating Cycle
8.	Torus Air Temperature	Once/Day	Every 6 Months
9.	Containment High Range Radiation Monitor	Once/Day	Once/Operating Cycle

Proposed

Bases

3.2.G and 4.2.G

Post-Accident Monitoring Instrumentation

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

BACKGROUND

The primary purpose of the post-accident monitoring (PAM) instrumentation is to display, in the control room, plant variables that provide information required by the control room operators during accident situations. This information provides the necessary support for the operator to take the manual actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for Design Basis Events. The instruments that monitor these variables are designated as Type A, Category I, and non-Type A, Category I, in accordance with Regulatory Guide 1.97 (Ref. 1).

The operability of the post-accident monitoring instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following an accident. This capability is consistent with the recommendations of Reference 1.

APPLICABLE SAFETY ANALYSES

The PAM instrumentation Specification ensures the operability of Regulatory Guide 1.97, Type A variables so that the control room operating staff can:

- Perform the diagnosis specified in the Emergency Operating Procedures (EOPs). These variables are restricted to preplanned actions for the primary success path of Design Basis Accidents (DBAs), (e.g., loss of coolant accident (LOCA)), and

- Take the specified, preplanned, manually controlled actions for which no automatic control is provided, which are required for safety systems to accomplish their safety function.

The PAM instrumentation Specification also ensures operability of most Category I, non-Type A, variables so that the control room operating staff can:

- Determine whether systems important to safety are performing their intended functions;

- Determine the potential for causing a gross breach of the barriers to radioactivity release;

- Determine whether a gross breach of a barrier has occurred; and

- Initiate action necessary to protect the public and for an estimate of the magnitude of any impending threat.

The plant specific Regulatory Guide 1.97 analysis (Ref. 2) documents the process that identified Type A and Category I, non-Type A, variables.

Post-accident monitoring instrumentation that satisfies the definition of Type A in Regulatory Guide 1.97 meets Criterion 3 of 10 CFR 50.36(c)(2)(ii). Category I, non-Type A, instrumentation is retained in Technical Specifications (TS) because they are intended to assist operators in

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

APPLICABLE SAFETY ANALYSES (continued)

minimizing the consequences of accidents. Therefore, these Category I variables are important for reducing public risk.

LCO

Specification 3.2.G and Table 3.2.6 require two operable channels for each Function to ensure that no single failure prevents the operators from being presented with the information necessary to determine the status of the plant and to bring the plant to, and maintain it in, a safe condition following an accident. Furthermore, providing two channels allows an Instrument Check during the post accident phase to confirm the validity of displayed information.

The following list is a discussion of the specified instrument Functions listed in Table 3.2.6.

1. Drywell Atmospheric Temperature

Drywell atmospheric temperature is a Type A and Category I variable provided to detect a reactor coolant pressure boundary (RCPB) breach and to verify the effectiveness of Emergency Core Cooling System (ECCS) functions that operate to maintain containment integrity. Two redundant temperature signals are transmitted from separate temperature elements for each channel. The output of one of these channels is recorded on a recorder in a control room. The output of the other channel is displayed on an indicator in the control room. The drywell atmospheric temperature channels measure from 0°F to 350°F. Therefore, the PAM Specification deals specifically with this portion of the instrument channels.

2. Drywell Pressure

Drywell pressure is a Type A and Category I variable provided to detect breach of the RCPB and to verify ECCS functions that operate to maintain Reactor Coolant System (RCS) integrity. Two drywell pressure signals are transmitted from separate pressure transmitters for each channel. The output of these channels is displayed on two independent indicators in the control room. The pressure channels measure from -15 psig to 260 psig. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

3. Torus Pressure

Torus pressure is a Type A and Category I variable provided to detect a condition that could potentially lead to containment breach and to verify the effectiveness of ECCS actions taken to prevent containment breach. Two torus pressure signals are transmitted from separate pressure transmitters and displayed on two independent indicators in the control room. The range of

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

LCO (continued)

indication is - 15 psig to 65 psig. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

4. Torus Water Level

Torus water level is a Type A and Category I variable provided to detect a breach in the RCPB. This variable is also used to verify and provide long term surveillance of ECCS function. The Torus Water Level Function provides the operator with sufficient information to assess the status of both the RCPB and the water supply to the ECCS. The Torus Water Level Function channels monitor the torus water level from the bottom of the torus to 5 feet above the normal torus water level. Two torus water level signals are transmitted from separate level transmitters to two independent control room indicators in the control room. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

5. Torus Water Temperature

Torus water temperature is a Type A and Category I variable provided to detect a condition that could potentially lead to containment breach and to verify the effectiveness of ECCS actions taken to prevent containment breach. Two redundant temperature signals are transmitted from separate temperature elements for each channel. The temperature channels output to two independent control room indicators. The range of the torus water temperature channels is 0°F to 250°F. Therefore, the PAM Specification deals specifically with this portion of the instrument channels.

6. Reactor Pressure

Reactor pressure is a Type A and Category I variable provided to support monitoring of RCS integrity and to verify operation of the ECCS. Two independent pressure transmitters, with a range of 0 psig to 1500 psig, monitor pressure and provide pressure indication to the control room. The output from these channels is provided to two independent indicators in the control room. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

7. Reactor Vessel Water Level

Reactor vessel water level is a Type A and Category I variable provided to support monitoring of core cooling and to verify operation of the ECCS. Water level is measured by independent differential pressure transmitters for each channel. Each channel measures from -200 inches to + 200 inches, referenced to the top of enriched fuel. The output from these channels is provided to two independent indicators in the control room. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

LCO (continued)

8. Torus Air Temperature

Torus air temperature is a Type A and Category I variable provided to detect a RCPB breach and to verify the effectiveness of ECCS functions that operate to maintain containment integrity. Two redundant temperature signals are transmitted from separate temperature elements for each channel. The output of one of these channels is recorded on a recorder in a control room with a range of 50°F to 300°F. The output of the other channel is displayed on an indicator in the control room with a range of 0°F to 350°F. Therefore, the PAM Specification deals specifically with this portion of the instrument channels.

9. Containment High Range Radiation Monitor

Containment high range radiation is a Category 1 variable provided to monitor the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans. Two redundant radiation detectors are mounted in the drywell. Each radiation detector provides a signal to an independent monitor in the control room, which has a range from 10^0 R/hr to 10^7 R/hr. The outputs of these radiation monitors are displayed on two independent indicators located in the control room. Therefore, the PAM Specification deals specifically with this portion of the instrument channel.

APPLICABILITY

The PAM instrumentation Specification is applicable in the RUN and STARTUP/HOT STANDBY Modes. These variables are related to the diagnosis and preplanned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in the RUN and STARTUP/HOT STANDBY Modes. In other Modes and conditions, plant conditions are such that the likelihood of an event that would require PAM instrumentation is extremely low; therefore, PAM instrumentation is not required to be operable in these other Modes or conditions.

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

ACTIONS

Table 3.2.6 ACTION Note 1

Table 3.2.6 ACTION Note 1.a.1) requires that, when one or more Functions (except Function 9) have one required channel that is inoperable, the required inoperable channel must be restored to operable status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining operable channels, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval. If the inoperable channel of each affected Function has not been restored to operable status in 30 days, Table 3.2.6 ACTION Note 1.a.2) requires a special written report be submitted to the NRC within the next 14 days. The report will outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation to operable status. This action is appropriate in lieu of a shutdown requirement, since another operable channel is monitoring the Function, an alternate method of monitoring is available, and given the likelihood of plant conditions that would require information provided by this instrumentation.

Table 3.2.6 ACTION Note 1.b.1) requires that, when one or more Functions, except Function 9, have two required channels that are inoperable (i.e., two channels inoperable in the same Function), one channel in the Function should be restored to operable status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur. If at least one channel of each affected Function has not been restored to operable status in 7 days, Table 3.2.6 ACTION Note 1.b.2) requires the plant to be brought to a Mode in which the LCO does not apply. To achieve this status, the plant must be brought to at least HOT SHUTDOWN within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Table 3.2.6 ACTION Note 2

Table 3.2.6 ACTION Note 2.a.1) requires that, when Function 9 has one required channel that is inoperable, the required inoperable channel must be restored to operable status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining operable channels, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval. If the inoperable channel has not been restored to operable status in 30 days, Table 3.2.6 ACTION Note 2.a.2) requires a special written report be submitted to the NRC within the next 14 days. The report will outline the preplanned alternate

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

ACTIONS (continued)

method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation to operable status. This action is appropriate in lieu of a shutdown requirement, since another operable channel is monitoring the Function, an alternate method of monitoring is available, and given the likelihood of plant conditions that would require information provided by this instrumentation.

Table 3.2.6 ACTION Note 2.b.1) requires that, when Function 9 has two required channels that are inoperable, one channel should be restored to operable status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

Since alternate means of monitoring drywell radiation have been developed and tested, the action required by Table 3.2.6 ACTION 2.b.2), if at least one channel has not been restored to operable status within 7 days, is not to shut down the plant, but rather to submit a special written report to the NRC within the next 14 days. The report will outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the normal PAM instrumentation to operable status. The alternate means of monitoring may be temporarily installed if the normal PAM channel cannot be restored to operable status within the allotted time. The report provided to the NRC should also describe the degree to which the alternate means are equivalent to the installed PAM channels and justify the areas in which they are not equivalent.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.G.1

As indicated in Surveillance Requirement 4.2.G.1, post-accident monitoring instrumentation shall be checked and calibrated as indicated in Table 4.2.6. Table 4.2.6 identifies, for each Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.G.1 also indicates that when a channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. The 6 hour testing allowance is acceptable since it does not significantly reduce the probability of properly monitoring post-accident parameters, when necessary.

BASES: 3.2.G/4.2.G POST-ACCIDENT MONITORING INSTRUMENTATION

SURVEILLANCE REQUIREMENTS (continued)

Table 4.2.6, Check

Performance of an Instrument Check once each day ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Table 4.2.6, Calibration

An Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. The specified Instrument Calibration Frequencies are based on operating experience.

REFERENCES

1. Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," Revision 3, May 1983.

2. NRC letter, M.B. Fairtile (NRC) to L.A. Temblay (VYNPC), "Conformance to Regulatory Guide 1.97 for Vermont Yankee Nuclear Power Station," December 4, 1990.

Current

Technical Specifications

Markups

3.2.G and 4.2.G

Post-Accident Monitoring Instrumentation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

2. If the required action and associated completion time of Specification 3.2.F.1 is not met, within the following 12 hours:

   a. Isolate the mechanical vacuum pump; or

   b. Isolate the main steam lines; or

   c. Place the reactor in the SHUTDOWN Mode.

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G. Post-Accident Monitoring Instrumentation

During reactor power operation, ~~the instrumentation that displays information in the Control Room necessary for the operator to initiate and control the systems used during and following a postulated accident or abnormal operating condition~~ the post-accident monitoring instrumentation for each function in Table 3.2.6 shall be operable in accordance with Table 3.2.6.

A.5

A.7

H. Drywell to Torus ΔP Instrumentation

1. During reactor power operation, the Drywell to Torus ΔP Instrumentation (recorder #1-156-3 and instrument DPI-1-158-6) shall be operable except as specified in 3.2.H.2.

2. From and after the date that one of the Drywell to Torus ΔP instruments is made or found to be inoperable for any reason, reactor operation is permissible only during the succeeding thirty days unless the instrument is

4.2 SURVEILLANCE REQUIREMENTS

3. Perform an instrument calibration, except for the radiation detectors, using a current source once every three (3) months. The trip setting shall be ≤ 3.0 times background at rated thermal power.

4. Perform an instrument calibration using a radiation source once each refueling outage.

5. Perform a logic system functional test, including mechanical vacuum pump isolation valve, once each operating cycle.

G. Post-Accident Monitoring Instrumentation

The post-accident monitoring instrumentation shall be ~~functionally tested~~ checked and calibrated in accordance with Table 4.2.6.

A.2

A.3

H. Drywell to Torus ΔP Instrumentation

The Drywell to Torus ΔP Instrumentation shall be calibrated once every six months and an instrument check will be made once per shift.

When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed for up to 6 hours.

A.4

A.1

TABLE 3.2.6

MONITORING

LA.1

POST-ACCIDENT INSTRUMENTATION

	Minimum Number of Operable Instrument Channels ~~(Note 8)~~ A.4	Parameter	~~Type of Indication~~	~~Instrument Range~~
1.	2	Drywell Atmospheric Temperature (Notes 1 and 3)	~~Recorder #TR-16-19-45 (Blue)~~ ~~Meter #TI-16-19-30B~~	~~0-350°F~~ ~~0-350°F~~
2.	2	Drywell A.8 ~~Containment~~ Pressure (Notes 1 and 3)	~~Meter #PI-16-19-12A~~ ~~Meter #PI-16-19-12B~~	~~(-15) -(+260) psig~~ ~~(-15) -(+260) psig~~
3.	2	Torus Pressure (Notes 1 and 3)	~~Meter #PI-16-19-36A~~ ~~Meter #PI-16-19-36B~~	~~(-15) -(+65) psig~~ ~~(-15) -(+65) psig~~
4.	2	Torus Water Level (Notes 1 and 3)	~~Meter #LI-16-19-12A~~ ~~Meter #LI-16-19-12B~~	~~0-25 ft.~~ ~~0-25 ft.~~
5.	2	Torus Water Temperature (Notes 1 and 3)	~~Meter #TI-16-19-33A~~ ~~Meter #TI-16-19-33C~~	~~0-250°F~~ ~~0-250°F~~
6.	2	Reactor Pressure (Notes 1 and 3)	~~Meter #PI-2-3-56A~~ ~~Meter #PI-2-3-56B~~	~~0-1500 psig~~ ~~0-1500 psig~~
7.	2	Reactor Vessel Water Level (Notes 1 and 3)	~~Meter #LI-2-3-91A~~ ~~Meter #LI-2-3-91B~~	~~(-200)-0-(+200)"H_2O~~ ~~(-200)-0-(+200)"H_2O~~
8.	2	Torus Air Temperature (Notes 1 and 3)	~~Recorder #TR-16-19-45 (Red)~~ ~~Meter #TI-16-19-41~~	~~0-350°F~~ ~~50-300°F~~
	~~2/valve~~	~~Safety/Relief Valve Position From Pressure Switches (Notes 1 and 3)~~	~~Lights RV-2-71(A-D) From PS-2-71-(1-3)(A-D)~~	~~Closed - Open~~

R.1

A.1

VYNPS

TABLE 3.2.6
(Cont'd)

MONITORING

POST-ACCIDENT INSTRUMENTATION

Minimum Number of Operable Instrument Channels (Note 8) A.4	Parameter	Type of Indication	Instrument Range	LA.1
1/valve	Safety Valve Position From Acoustic Monitor (Note 5)	Meter ZI-2-1A/B	Closed - Open	R.1
9. 2	Containment High-Range Radiation Monitor (Note 6)	Meter RM-16-19-1A/B	1 R/hr-10^7 R/hr	LA.1
1	Stack Noble Gas Effluent (Note 7)	Meter RM-17-155	0.1 - 10^7 mR/hr	R.1

A.1

ACTION

TABLE 3.2.6 NOTES

~~Note 1~~ - Within 30 days following the loss of one indication, restore the inoperable channel to an operable status or a special report to the Commission must be prepared and submitted within the subsequent 14 days, outlining the action taken, the cause of the inoperability, and the plans and schedule for restoring the system to operable status.

TABLE 3.2.6 ACTION NOTE 1.a

~~Note 2 - Deleted~~

~~Note 3~~ - Within 7 days following the loss of both indications, restore at least one required channel to an operable status or place the reactor in a hot shutdown condition within the following 12 hours.

TABLE 3.2.6 ACTION NOTE 1.b

~~Note 4 - Deleted~~

R.1

Note 5 - From and after the date that safety valve position from the acoustic monitor is unavailable, reactor operation may continue for 30 days provided safety valve position can be determined by monitoring safety valve discharge temperature and primary containment pressure. If after 30 days the inoperable channel has not been returned to an operable status, a special report to the Commission must be prepared and submitted within the subsequent 14 days, outlining the action taken, the cause of the inoperability, and the plans and schedule for restoring the system to operable status.

If one or both parameters are not available (i.e., safety valve discharge temperature and primary containment pressure indication) with one or more safety valve position indications from the acoustic monitor unavailable, continued reactor operation is permissible during the next seven days. In this condition, if both secondary parameters are not restored to an operable status within seven days, the reactor shall be placed in a hot shutdown condition within the following 12 hours.

~~Note 6~~ - Within 30 days following the loss of one indication, or seven days following the loss of both indications, restore the inoperable channel(s) to an operable status or a special report to the Commission must be prepared and submitted within the subsequent 14 days, outlining the action taken, the cause of the inoperability, and the plans and schedule for restoring the system to operable status.

TABLE 3.2.6 ACTION NOTE 2

~~Note 7 - From and after the date that this parameter is unavailable by Control Room indication, within 72 hours ensure that local sampling capability is available. If the Control Room indication is not restored within 7 days, prepare and submit a special report to the NRC within 14 days following the event, outlining the action taken, the cause of the inoperability, and the plans and schedule for restoring the system to operable status.~~

R.1

~~Note 8~~ - When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required action notes may be delayed for up to 6 hours.

A.4

A.1

VYNPS

TABLE 4.2.6

CALIBRATION REQUIREMENTS Tests and Frequencies

POST-ACCIDENT INSTRUMENTATION MONITORING

	Parameter	Calibration	Instrument Check
1.	Drywell Atmosphere Temperature	Every 6 Months	Once Each Day
2.	~~Containment~~ Drywell Pressure	Once/Operating Cycle	Once Each Day
3.	Torus Pressure	Once/Operating Cycle	Once Each Day
4.	Torus Water Level	Once/Operating Cycle	Once Each Day
5.	Torus Water Temperature	Every 6 Months	Once Each Day
6.	Reactor Pressure	Once/Operating Cycle	Once Each Day
7.	Reactor Vessel Water Level	Once/Operating Cycle	Once Each Day
8.	Torus Air Temperature	Every 6 Months	Once Each Day
	~~Safety/Relief Valve Position~~	~~Every Refueling Outage (Note 9) (a Functional Test to be performed quarterly)~~	~~Once Each Day~~
	~~Safety Valve Position~~	~~Every Refueling Outage (Note 9) (a Functional Test to be performed quarterly)~~	~~Once Each Day~~

R.1

A.1

TABLE 4.2.6

~~CALIBRATION REQUIREMENTS~~ TESTS AND FREQUENCIES

POST-ACCIDENT MONITORING INSTRUMENTATION
(Cont'd)

	Parameter	Calibration	Instrument Check
9.	Containment High-Range Radiation Monitor	Once/Operating Cycle	Once each day
	~~Stack Noble Gas Effluent~~	~~Every Operating Cycle (a Functional Test to be performed quarterly)~~	~~Once each day~~ R.1

A.1

TABLE 4.2 NOTES

1. ~~Not used.~~

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.9

3. ~~Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system.~~ A.7

4. ~~This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel.~~ A.8

5. ~~Deleted.~~

6. ~~Deleted.~~

7. ~~Deleted.~~

8. Functional tests and calibrations are not required when systems are not required to be operable.

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

A.9

Table 4.2.5 Footnote (a)

~~12.~~ ~~Trip system logic testing is not applicable to this function.~~ A.4 If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be ~~initiated~~ within 1 hour after the reactor mode switch is placed in Shutdown ~~for the purpose of commencing a scheduled Refueling Outage.~~ A.1

~~13.~~ Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

performed

M.1

Table 4.2.5 Footnote (c)

Proposed

Technical Specifications

3.2.H and 4.2.H

Drywell to Torus ΔP Instrumentation

3.2 LIMITING CONDITIONS FOR OPERATION

H. Deleted.

I. Recirculation Pump Trip Instrumentation

The recirculation pump trip instrumentation for each Trip Function in Table 3.2.7 shall be operable in accordance with Table 3.2.7.

J. Deleted.

4.2 SURVEILLANCE REQUIREMENTS

H. Deleted.

I. Recirculation Pump Trip Instrumentation

1. The recirculation pump trip instrumentation shall be checked, functionally tested and calibrated in accordance with Table 4.2.7.

   When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operations and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains recirculation pump trip capability.

2. Perform a Logic System Functional Test, including recirculation pump trip breaker actuation, of recirculation pump trip instrumentation Trip Functions once every Operating Cycle.

J. Deleted

Current

Technical Specifications

Markups

3.2.H and 4.2.H

Drywell to Torus ΔP Instrumentation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

2. If the required action and associated completion time of Specification 3.2.F.1 is not met, within the following 12 hours:

   a. Isolate the mechanical vacuum pump; or

   b. Isolate the main steam lines; or

   c. Place the reactor in the SHUTDOWN Mode.

G. Post-Accident Instrumentation

During reactor power operation, the instrumentation that displays information in the Control Room necessary for the operator to initiate and control the systems used during and following a postulated accident or abnormal operating condition shall be operable in accordance with Table 3.2.6.

H. ~~Drywell to Torus ΔP Instrumentation~~

1. ~~During reactor power operation, the Drywell to Torus ΔP Instrumentation (recorder #1-156-3 and instrument DPI-1-158-6) shall be operable except as specified in 3.2.H.2.~~

2. ~~From and after the date that one of the Drywell to Torus ΔP instruments is made or found to be inoperable for any reason, reactor operation is permissible only during the succeeding thirty days unless the instrument is~~

4.2 SURVEILLANCE REQUIREMENTS

3. Perform an instrument calibration, except for the radiation detectors, using a current source once every three (3) months. The trip setting shall be ≤ 3.0 times background at rated thermal power.

4. Perform an instrument calibration using a radiation source once each refueling outage.

5. Perform a logic system functional test, including mechanical vacuum pump isolation valve, once each operating cycle.

G. Post-Accident Instrumentation

The post-accident instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.6.

<MOVE TO SEPARATE PAGE>

H. ~~Drywell to Torus ΔP Instrumentation~~

~~The Drywell to Torus ΔP Instrumentation shall be calibrated once every six months and an instrument check will be made once per shift.~~

R.1

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

~~sooner made operable. If both instruments are made or found to be inoperable, and indication cannot be restored within a six hour period, an orderly shutdown shall be initiated and the reactor shall be in a hot shutdown condition in six hours and a cold shutdown condition in the following eighteen hours.~~

R.1

I. Recirculation Pump Trip Instrumentation

During reactor power operation, the Recirculation Pump Trip Instrumentation shall be operable in accordance with Table 3.2.1.

J. Deleted

K. Degraded Grid Protective System

During reactor power operation, the emergency bus undervoltage instrumentation shall be operable in accordance with Table 3.2.8.

L. Reactor Core Isolation Cooling System Actuation

When the Reactor Core Isolation Cooling System is required in accordance with Specification 3.5.G, the instrumentation which initiates actuation of this system shall be operable in accordance with Table 3.2.9.

4.2 SURVEILLANCE REQUIREMENTS

I. Recirculation Pump Trip Instrumentation

The Recirculation Pump Trip Instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.1.

J. Deleted

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.8.

L. Reactor Core Isolation Cooling System Actuation

Instrumentation and Logic Systems shall be functionally tested and calibrated as indicated in Table 4.2.9.

<MOVE TO SEPARATE PAGE>

Proposed

Technical Specifications

3.2.I and 4.2.I
Recirculation Pump Trip Instrumentation

3.2 LIMITING CONDITIONS FOR OPERATION

H. Deleted.

I. Recirculation Pump Trip Instrumentation

The recirculation pump trip instrumentation for each Trip Function in Table 3.2.7 shall be operable in accordance with Table 3.2.7.

J. Deleted.

4.2 SURVEILLANCE REQUIREMENTS

H. Deleted.

I. Recirculation Pump Trip Instrumentation

1. The recirculation pump trip instrumentation shall be checked, functionally tested and calibrated in accordance with Table 4.2.7.

   When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operations and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains recirculation pump trip capability.

2. Perform a Logic System Functional Test, including recirculation pump trip breaker actuation, of recirculation pump trip instrumentation Trip Functions once every Operating Cycle.

J. Deleted

Table 3.2.7 (page 1 of 1)
Recirculation Pump Trip Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Low-Low Reactor Vessel Water Level	RUN	2	Note 1	≥ 82.5 inches
2. Time Delay	RUN	2	Note 1	≤ 10 seconds
3. High Reactor Pressure	RUN	2	Note 1	≤ 1150 psig

Table 3.2.7 ACTION Notes

1. With one or more recirculation pump trip instrumentation channels inoperable, take all of the applicable Actions in Notes 1.a, 1.b and 1.c below.

   a. With one or more Trip Functions with one or more channels inoperable:

      1) Restore any inoperable channel to operable status within 14 days; or
      2) Place any inoperable channel in trip within 14 days (not applicable for Trip Function 2 channels and not applicable if the inoperable channel is the result of an inoperable recirculation pump trip breaker).

   b. With Trip Functions 1 and 2 with recirculation pump trip capability not maintained or with Trip Function 3 with recirculation pump trip capability not maintained:

      1) Restore recirculation pump trip capability within 72 hours.

   c. With Trip Functions 1, 2 and 3 with recirculation pump trip capability not maintained:

      1) Restore recirculation pump trip capability for all but one Trip Function within 1 hour.

   If any applicable Action and associated completion time of Note 1.a, 1.b or 1.c is not met, immediately take the applicable Action of Note 2.a or 2.b.

2. a. Remove affected recirculation pump from service within the next 6 hours; or

   b. Place the plant in STARTUP/HOT STANDBY within the next 6 hours.

Table 4.2.7 (page 1 of 1)
Recirculation Pump Trip Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
2. Time Delay	NA	NA	Every 3 Months
3. High Reactor Pressure	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle

(a) Trip unit calibration only.

Proposed

Bases

3.2.I and 4.2.I

Recirculation Pump Trip Instrumentation

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

BACKGROUND

The Anticipated Transient Without Scram (ATWS) Prevention/Mitigation System initiates a Recirculation Pump Trip (RPT), adding negative reactivity, following events in which a scram does not but should occur, to lessen the effects of an ATWS event. Tripping the recirculation pumps adds negative reactivity from the increase in steam voiding in the core area as core flow decreases. When Low - Low Reactor Vessel Water Level or High Reactor Pressure setpoint is reached, the reactor recirculation motor generator (RRMG) field breakers trip.

The RPT Instrumentation (Ref. 1) of the ATWS Prevention/Mitigation System includes sensors, relays, and switches that are necessary to cause initiation of an RPT. The channels include electronic equipment (e.g., trip units) that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel output relay actuates, which then outputs an RPT signal to the trip logic.

The RPT Instrumentation consists of two independent and identical trip systems (A and B), with two channels of High Reactor Pressure and two channels of Low - Low Reactor Vessel Water Level in each trip system. Each RPT Instrumentation trip system is a two-out-of-two logic for each Trip Function. Thus, either two Low - Low Reactor Water Level or two High Reactor Pressure signals will trip a trip system. In addition, a combination of one Low - Low Reactor Vessel Water Level signal and one High Reactor Pressure signal (in the same trip system) will trip the trip system. The outputs of the channels in a trip system are combined in a logic so that either trip system will trip both recirculation pumps (by tripping the respective RRMG field breakers). Each Low - Low Reactor Vessel Water Level channel output must remain below the setpoint for approximately 10 seconds for the channel output to provide an actuation signal to the associated trip system.

There is one RRMG field breaker provided for each of the two recirculation pumps for a total of two breakers. The output of each trip system is provided to both RRMG field breakers.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The RPT Instrumentation is not assumed to mitigate any accident or transient in the safety analysis. The RPT Instrumentation initiates an RPT to aid in preserving the integrity of the fuel cladding following events in which a scram does not, but should, occur. Based on its contribution to the reduction of overall plant risk, however, the instrumentation meets Criterion 4 of 10 CFR 50.36(c)(2)(ii).

The operability of the RPT Instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Trip Settings specified in Table 3.2.7. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions. Channel operability also includes the associated recirculation pump trip breakers (i.e., RRMG field breakers).

The individual Trip Functions are required to be operable in the RUN Mode to protect against common mode failures of the Reactor Protection System by providing a diverse trip to mitigate the consequences of a postulated ATWS event. The High Reactor Pressure and Low - Low Reactor Vessel Water Level Trip Functions are required to be operable in the RUN Mode, since the reactor is producing significant power and the recirculation system could be at high flow. During this Mode, the potential exists for pressure increases or low water level, assuming an ATWS event. In the STARTUP/HOT STANDBY Mode, the reactor is at low power and the recirculation system is at low flow; thus, the potential is low for a pressure increase or low water level, assuming an ATWS event. Therefore, the RPT Instrumentation is not necessary. In HOT SHUTDOWN and COLD SHUTDOWN, the reactor is shut down with all control rods inserted; thus, an ATWS event is not significant and the possibility of a significant pressure increase or low water level is negligible. In Refuel, the one rod out interlock ensures that the reactor remains subcritical; thus, an ATWS event is not significant.

The specific Applicable Safety Analyses and LCO discussions are listed below on a Trip Function by Trip Function basis.

1, 2. Low - Low Reactor Vessel Water Level and Time Delay

Low RPV water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, RPT is initiated at low-low RPV water level to aid in maintaining level above the top of the active fuel. The reduction of core flow reduces the neutron flux and thermal power and, therefore, the rate of coolant boiloff.

Reactor vessel water level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

Four channels of Low - Low Reactor Vessel Water Level, with two channels in each trip system, are available and required to be operable to ensure that no single instrument failure can preclude an RPT from this Trip Function on a valid signal. In addition, a time delay is associated with each Low - Low Reactor Vessel Water Level channel which delays the Low - Low Reactor Vessel Water Level Trip Function channel output signal from providing input to the associated trip system. Four channels of Time Delay, with two channels in each trip system, are available and required to be operable to ensure that no single instrument failure can preclude an RPT from the Low - Low Reactor Vessel Water Level Trip Function on a valid signal.

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Low - Low Reactor Vessel Water Level Trip Setting is chosen so that RPT will not interfere with the Reactor Protection System. The Trip Setting is referenced from the top of enriched fuel. The Trip Setting of the Time Delay associated with the Low - Low Reactor Vessel Water Level Trip Function is chosen to avoid making the consequences of a loss of coolant accident more severe while ensuring the delay has an insignificant affect on the ATWS consequences.

3. High Reactor Pressure

Excessively high RPV pressure may rupture the RCPB. An increase in the RPV pressure during reactor operation compresses the steam voids and results in a positive reactivity insertion. This increases neutron flux and thermal power, which could potentially result in fuel failure and overpressurization. The High Reactor Pressure Trip Function initiates an RPT for transients that result in a pressure increase, counteracting the pressure increase by rapidly reducing core power generation. For the overpressurization event, the RPT aids in the termination of the ATWS event and, along with the safety valves, limits the peak RPV pressure to within the required limit.

The High Reactor Pressure signals are initiated from four pressure transmitters that monitor reactor pressure. Four channels of High Reactor Vessel Pressure, with two channels in each trip system, are available and are required to be operable to ensure that no single instrument failure can preclude an RPT from this Trip Function on a valid signal. The High Reactor Vessel Pressure Trip Setting is chosen to provide an adequate margin to the maximum allowable Reactor Coolant System pressure.

ACTIONS

Table 3.2.7 ACTION Note 1

For Trip Functions 1, 2, and 3, with one or more Trip Function channels inoperable, but with RPT trip capability for each Trip Function maintained (refer to next paragraph), the RPT instrumentation is capable of performing the intended function. However, the reliability and redundancy of the RPT Instrumentation is reduced, such that a single failure in the remaining trip system could result in the inability of the RPT Instrumentation to perform the intended function. Therefore, only a limited time is allowed to restore the inoperable channels to operable status. Because of the diversity of sensors available to provide trip signals, the low probability of extensive numbers of inoperabilities affecting all diverse Trip Functions, and the low probability of an event requiring the initiation of RPT, 14 days is provided to restore the inoperable channel (Table 3.2.7 ACTION Note 1.a.1)). Alternately, for Trip Functions 1 and 3, the inoperable channel may be placed in trip (Table 3.2.7 ACTION Note 1.a.2)), since this would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Inoperable channels may be placed in trip using test jacks or other permanently installed circuits. As noted in Table 3.2.7 ACTION Note 1.a.2), placing the channel in trip with no

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

ACTIONS (continued)

further restrictions is not allowed if the inoperable channel is a Trip Function 2 channel (i.e., Time Delay Trip Function) or is the result of an inoperable breaker, since this may not adequately compensate for the inoperable Trip Function 2 channel or inoperable breaker (e.g., the breaker may be inoperable such that it will not open), as applicable. If it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an RPT), or if the inoperable channel is the result of an inoperable breaker, Table 3.2.7 ACTION Note 2 must be entered and its required Actions taken.

Table 3.2.7 ACTION Note 1.b is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Trip Function result in the Trip Function 1 and 2 not maintaining RPT trip capability or Trip Function 3 not maintaining RPT trip capability. A Trip Function is considered to be maintaining RPT trip capability when sufficient channels are operable or in trip such that the RPT Instrumentation will generate a trip signal from the given Trip Function in either of the two trip systems on a valid signal, and both recirculation pumps can be tripped. For Trip Functions 1 and 2, this requires two channels of each Trip Function in the same trip system to be operable or in trip and the RRMG field breakers to be operable or in trip. For Trip Function 3, this requires two channels in the same trip system to be operable or in trip and the RRMG field breakers to be operable or in trip. The 72 hour Completion Time is sufficient for the operator to take corrective action (e.g., restoration or tripping of channels) and takes into account the likelihood of an event requiring actuation of the RPT instrumentation during this period and that Trip Functions 1 and 2 or Trip Function 3 still maintain RPT trip capability.

Table 3.2.7 ACTION Note 1.c is intended to ensure that appropriate Actions are taken if multiple, inoperable, untripped channels within Trip Functions 1, 2, and 3 result in Trip Functions 1, 2, and 3 not maintaining RPT trip capability. The description of a Trip Function maintaining RPT trip capability is discussed in the paragraph above. The 1 hour Completion Time for restoring all but one of the Trip Functions is sufficient for the operator to take corrective action and takes into account the likelihood of an event requiring actuation of the RPT Instrumentation during this period.

Table 3.2.7 ACTION Note 2

With any required Action and associated completion time not met, the plant must be brought to a Mode or other specified condition in which the LCO does not apply. To achieve this status, the plant must be brought to at least STARTUP/HOT STANDBY within 6 hours (Table 3.2.7 ACTION Note 2.b).

Alternately, the associated recirculation pump may be removed from service since this performs the intended function of the instrumentation (Table 3.2.7 ACTION Note 2.a). The allowed Completion Time of 6 hours is reasonable, based on operating experience, both to reach STARTUP/HOT STANDBY from full power conditions and to remove a recirculation pump from service in an orderly manner and without challenging plant systems.

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.I.1

As indicated in Surveillance Requirement 4.2.I.1, RPT Instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.7. Table 4.2.7 identifies, for each Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.I.1 also indicates that when a channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed for up to 6 hours provided the associated Trip Function maintains recirculation pump trip capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Ref. 2) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that recirculation pumps will trip when necessary.

Surveillance Requirement 4.2.I.2

The Logic System Functional Test demonstrates the operability of the required initiation logic and simulated automatic operation for a specific channel. A system functional test of the recirculation pump trip breakers (i.e., RRMG field breakers) is included in this Surveillance to provide complete testing of the assumed safety function. Therefore, if an RRMG field breaker is incapable of operating, the associated instrument channel(s) would be inoperable. The Frequency of "Once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.2.7, Check

Performance of an Instrument Check once per day, for Trip Functions 1 and 3, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

SURVEILLANCE REQUIREMENTS (continued)

is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

Table 4.2.7, Functional Test

For Trip Functions 1 and 3, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. For Trip Functions 1 and 3, the Frequency of "Every 3 Months" is based on the reliability analysis of Reference 2.

Table 4.2.7, Calibration

For Trip Functions 1, 2, and 3, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

For Trip Functions 1 and 3, a calibration of the trip units is required (Footnote (a)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. The channel must be declared inoperable if the trip setting is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The Frequency of every 3 months is based on the reliability analysis of Reference 2 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

REFERENCES

1. UFSAR, Section 7.18.

2. GENE-770-06-1-A, "Bases for Changes To Surveillance Test Intervals and Allowed Out-of-Service Times For Selected Instrumentation Technical Specifications," December 1992.

BASES: 3.2.I/4.2.I RECIRCULATION PUMP TRIP INSTRUMENTATION

BACKGROUND

Successful operation of the required safety functions of the Emergency Core Cooling Systems (ECCS) is dependent upon the availability of adequate power sources for energizing the various components such as pump motors, motor operated valves, and the associated control components. The Degraded Grid Protective System instrumentation monitors the 4.16 kV emergency buses. Offsite power is the preferred source of power for the 4.16 kV emergency buses. If the monitors determine that insufficient voltage is available and an ECCS initiation signal is present, the buses are disconnected from the offsite power sources and connected to the onsite diesel generator (DG) power sources.

Each 4.16 kV emergency bus has its own independent Degraded Grid Protective System instrumentation and associated trip logic. The voltage for each bus is monitored for degraded voltage.

The Degraded Bus Voltage - Voltage Trip Function is monitored by two undervoltage relays for each 4.16 kV emergency bus, whose outputs are arranged in a two-out-of-two logic configuration (Ref. 1). The Degraded Bus Voltage - Voltage Alarm Trip Function is monitored by the same undervoltage relays as the Voltage Trip Function, however the outputs are arranged in a one-out-of-two logic configuration. For the Degraded Bus Voltage - Time Delay Trip Function, one channel for each 4.16 kV emergency bus is provided and is dedicated to the DG start function. For the Degraded Bus Voltage - Alarm Time Delay Trip Function, one channel for each 4.16 kV emergency bus is also provided and is dedicated to a control room annunciator function from which manual action is taken for degraded grid protection when an accident signal is not present. The Degraded Bus Voltage - Time Delay and Alarm Time Delay Trip Functions are nominally adjusted to 10 seconds since this would be indicative of a sustained degraded voltage condition. When a Degraded Bus Voltage - Voltage Alarm Trip Function setpoint has been exceeded and persists for nominally ten seconds, either one of the two Degraded Bus Voltage - Voltage Alarm Trip Function channels on an associated 4.16 kV emergency bus will actuate a control room annunciator to alert the operator of the degraded voltage condition. If this sustained degraded voltage condition occurs coincident with a loss of coolant accident (LOCA), both of the Degraded Bus Voltage - Voltage Trip Function channels will actuate causing the associated 4.16 kV emergency bus to be disconnected from the offsite power source and connected to the DG power source. If the sustained degraded voltage condition does not exist at the time of a LOCA, the 4.16 kV emergency buses are not disconnected from the offsite power sources and the ECCS loads will start immediately from their normal supplies.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The degraded grid protection assures the ECCS loads and other assumed systems powered from the DGs are powered from the offsite power system as long as offsite power system voltage is within an acceptable value and it assures that loads are powered from the DGs when bus voltage is insufficient for continuous operation of the connected loads. The Degraded Grid Protective System instrumentation is required for Engineered Safety Features to function in any accident with a degradation or loss of offsite power. The required

Current

Technical Specifications

Markups

3.2.I and 4.2.I

Recirculation Pump Trip Instrumentation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

4.2 SURVEILLANCE REQUIREMENTS

sooner made operable. If both instruments are made or found to be inoperable, and indication cannot be restored within a six hour period, an orderly shutdown shall be initiated and the reactor shall be in a hot shutdown condition in six hours and a cold shutdown condition in the following eighteen hours.

A.2

I. Recirculation Pump Trip Instrumentation

A.3

~~During reactor power operation,~~ ~~the~~ The ~~Recirculation~~ recirculation ~~Pump~~ pump ~~Trip~~ trip ~~Instrumentation~~ instrumentation FOR EACH TRIP FUNCTION IN TABLE 3.2.7 shall be operable in accordance with Table 3.2.~~1~~ 7

I. Recirculation Pump Trip Instrumentation

A.4

1. The ~~Recirculation~~ recirculation ~~Pump~~ pump ~~Trip~~ trip ~~Instrumentation~~ instrumentation shall be CHECKED, functionally tested and calibrated in accordance with Table 4.2.~~1~~ 7

J. Deleted

K. Degraded Grid Protective System

During reactor power operation, the emergency bus undervoltage instrumentation shall be operable in accordance with Table 3.2.8.

L. Reactor Core Isolation Cooling System Actuation

When the Reactor Core Isolation Cooling System is required in accordance with Specification 3.5.G, the instrumentation which initiates actuation of this system shall be operable in accordance with Table 3.2.9.

J. Deleted

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.8.

L. Reactor Core Isolation Cooling System Actuation

Instrumentation and Logic Systems shall be functionally tested and calibrated as indicated in Table 4.2.9.

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WHEN A CHANNEL IS PLACED IN AN INOPERABLE STATUS SOLELY FOR PERFORMANCE OF REQUIRED SURVEILLANCES, ENTRY INTO ASSOCIATED LIMITING CONDITIONS FOR OPERATION AND REQUIRED ACTIONS MAY BE DELAYED FOR UP TO 6 HOURS PROVIDED THE ASSOCIATED TRIP FUNCTION MAINTAINS RECIRCULATION PUMP TRIP CAPABILITY.

A.5

A.1

TABLE 3.2.~~1~~ 7
~~(Cont'd)~~

RECIRCULATION PUMP TRIP ~~ACTUATION~~ INSTRUMENTATION

Actions when Required Channels are Inoperable

REQUIRED

LA.2

Recirculation Pump Trip ~~- A & B (Note 1)~~			
~~Minimum Number of Operable Instrument Channels per Trip System~~	Trip Function	Trip ~~Level~~ Setting	~~Required ACTION When Minimum Conditions For Operation Are Not Satisfied~~
1. 2 ~~(Note 8)~~ A.5	Low-Low Reactor Vessel Water Level ~~(LM-2-3-68 (A-D))~~	≥ 6′ 10.5″ ~~above top of enriched fuel~~ LA.3	Note ~~10~~ 1
3. 2 ~~(Note 8)~~	High Reactor Pressure ~~(PM-2-3-54 (A-D))~~ LA.1	≤ 1150 psig	Note ~~10~~ 1
2. 2 ~~(Note 8)~~	Time Delay~~s~~ ~~(2-3-68 (A-D) (X))~~	≤ 10 seconds	Note ~~10~~ 1
~~1~~	~~Trip Systems Logic~~		~~Note 2~~ L.1

A.1

Action

TABLE 3.2.1 NOTES

1. Each of the two Core Spray, LPCI and RPT, subsystems are initiated and controlled by a trip system. The subsystem "B" is identical to the subsystem "A". LA.2

2. If the minimum number of operable instrument channels are not available, the inoperable channel shall be tripped using test jacks or other permanently installed circuits. If the channel cannot be tripped by the means stated above, that channel shall be made operable within 24 hours or an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours. LA.4 L.1

3. One trip system with initiating instrumentation arranged in a one-out-of-two taken twice logic.

4. One trip system with initiating instrumentation arranged in a one-out-of-two logic.

5. If the minimum number of operable channels are not available, the system is considered inoperable and the requirements of Specification 3.5 apply. A.6

6. Any one of the two trip systems will initiate ADS. If the minimum number of operable channels in one trip system is not available, the requirements of Specification 3.5.F.2 and 3.5.F.3 shall apply. If the minimum number of operable channels is not available in both trip systems, Specifications 3.5.F.3 shall apply.

7. One trip system arranged in a two-out-of-two logic.

8. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function or redundant Trip Function maintains ECCS initiation capability or Recirculation Pump Trip capability. A.5 A.6

9. When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours.

10. With one or more channels inoperable for Core Spray and/or LPCI:

   A. Within one hour from discovery of loss of initiation capability for feature(s) in one division, declare the associated systems inoperable, and
   B. Within 24 hours, place channel in trip.
   C. If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable.

11. With one or more channels inoperable for injection permissive and/or recirculation discharge valve permissive:

   A. Within one hour from discovery of loss of initiation capability for feature(s) in one division, declare the associated systems inoperable, and
   B. Within 24 hours, restore channel to operable status.
   C. If required actions and associated completion times of actions A or B are not met, immediately declare the associated systems inoperable.

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A.1

7 ACTION

TABLE 3.2.~~1~~ NOTES (Cont'd)

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18. With one or more channels inoperable for ADS:

    A. Within one hour from discovery of loss of ADS initiation capability in one trip system, declare ADS inoperable, and
    B. Within 96 hours from discovery of an inoperable channel concurrent with HPCI or RCIC System inoperable, restore channel to operable status, and
    C. Within 8 days, restore channel to operable status.
    D. If required actions and associated completion times of actions A, B or C are not met, immediately declare ADS inoperable.

Table 3.2.7 Action Note 1 — ~~19~~. With one or more channels inoperable for Recirculation Pump Trip: M.1

Table 3.2.7 Action Note 1.c — ~~A~~ Within one hour from ~~discovery of loss of Recirculation Pump Trip capability~~ restore all but one ~~one Trip Function~~ or remove the associated

Table 3.2.7 Action Note 3 — recirculation pump from service in 6 hours or be in Startup/Hot Standby in 6 hours.

Table 3.2.7 Action Note 1.a — ~~B~~ Within 14 days from discovery of an inoperable channel, restore channel to operable status or place in trip~~,~~ and

Table 3.2.7 Action Note 1.b — ~~C~~ Within 72 hours from discovery of ~~one trip function capability~~ not maintained, restore trip function to operable status and,

Table 3.2.7 Action Notes 1 & 3 — ~~D~~ If required actions and associated completion times of actions A, B or C are not met, immediately remove the associated recirculation pump from service in 6 hours or be in Startup/Hot Standby in 6 hours.

(not applicable for Trip Function 2 channels and not applicable if inoperable channel is the result of an inoperable recirculation pump trip breaker) M.2

Trip Functions 1 and 2 with RECIRCULATION PUMP trip capability not maintained or WITH Trip function 3 with RECIRCULATION PUMP trip capability M.1

A.1

TABLE 3.2.7

(Table 3.2.7 was intentionally deleted from the Technical Specifications)

<replace with proposed Table 3.2.7>

A.1

TABLE 4.2.~~1~~ 7
~~(Cont'd)~~

~~MINIMUM~~ TESTS AND ~~CALIBRATION~~ FREQUENCIES

~~EMERGENCY CORE COOLING ACTUATION~~ INSTRUMENTATION

Recirculation Pump Trip ~~Actuation System~~

	Trip Function	Functional Test ~~(8)~~ A.8	Calibration ~~(8)~~ A.8	Instrument Check
1.	Low-Low Reactor Vessel Water Level	Every Three Months ~~(Note 4)~~ A.9	~~Once/Operating Cycle~~ Every 3 Months, (1) M.3	Once Each Day
3.	High Reactor Pressure	Every Three Months ~~(Note 4)~~	~~Once/Operating Cycle~~	Once Each Day
SR4.2.I.2	Trip System Logic	Once/Operating Cycle (including recirculation trip breaker actuation) M.4	Once/Operating Cycle A.7 M.5	--
2.	Time Delay		Every 3 Months	

(1) Trip unit calibration only M.3

A.1

TABLE 4.2.7

(Table 4.2.7 was intentionally deleted from the Technical Specifications)

{replace with proposed Table 4.2.7}

A.1

TABLE 4.2 NOTES

1. ~~Not used.~~

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.10

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system. A.7

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.9

5. ~~Deleted.~~

6. ~~Deleted.~~

7. ~~Deleted.~~

8. Functional tests and calibrations are not required when systems are not required to be operable. A.8

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage.

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power). A.10

Proposed

Technical Specifications

3.2.K and 4.2.K

Degraded Grid Protective System

3.2 LIMITING CONDITIONS FOR OPERATION

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation for each Trip Function in Table 3.2.8 shall be operable in accordance with Table 3.2.8.

4.2 SURVEILLANCE REQUIREMENTS

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.8.

Table 3.2.8 (page 1 of 1)
Degraded Grid Protective System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER BUS	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Degraded Bus Voltage				
a. Voltage	(a)	2	Note 1	≥ 3660 volts and ≤ 3740 volts
b. Time Delay	(a)	1	Note 2	≥ 9 seconds and ≤ 11 seconds
c. Voltage Alarm	(a)	2	Note 3	≥ 3660 volts and ≤ 3740 volts
d. Alarm Time Delay	(a)	1	Note 3	≥ 9 seconds and ≤ 11 seconds

(a) When the associated diesel generator is required to be operable.

Table 3.2.8 ACTION Notes

1. With one or more required Degraded Bus Voltage - Voltage Trip Function channels inoperable:

   a. Place any inoperable channel in trip within 1 hour.

   If the Action and associated completion time of Note 1.a are not met, immediately declare the associated diesel generator inoperable.

2. With one or more required Degraded Bus Voltage - Time Delay Trip Function channels inoperable:

   a. Restore any inoperable channel to operable status within 1 hour.

   If the Action and associated completion time of Note 2.a are not met, immediately declare the associated diesel generator inoperable.

3. With one or more required Degraded Bus Voltage - Voltage Alarm Trip Function channels inoperable, take all of the applicable Actions in Notes 3.a and 3.b:

   a. With one or more buses with alarm capability not maintained, restore alarm capability within 1 hour; and

   b. Restore any inoperable channel to operable status within 24 hours.

   If the Action and associated completion time of Note 3.a or 3.b are not met, initiate increased voltage monitoring of the associated 4.16kV emergency bus(es).

Table 4.2.8 (page 1 of 1)
Degraded Grid Protective System Instrumentation
Tests and Frequencies

TRIP FUNCTION	FUNCTIONAL TEST	CALIBRATION
1. Degraded Bus Voltage		
a. Voltage	(a)	Once/Operating Cycle
b. Time Delay	(a)	Once/Operating Cycle

(a) Separate Functional Tests are not required for this Trip Function. Trip Function operability is demonstrated during Trip Function Calibration and integrated ECCS tests performed once per Operating Cycle.

Proposed

Bases

3.2.K and 4.2.K

Degraded Grid Protective System

BASES: 3.2.K/4.2.K DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

channels of Degraded Grid Protective System instrumentation ensure that the ECCS and other assumed systems powered from the DGs, provide plant protection in the event of any of the Reference 2 and 3 analyzed accidents in which a loss of offsite power is assumed. The initiation of the DGs on degradation or loss of offsite power, and subsequent initiation of the ECCS, ensures that the requirements of 10 CFR 50.46 are met.

Accident analyses credit the loading of the DGs based on the loss of offsite power coincident with a loss of coolant accident (LOCA). The diesel starting and loading times have been included in the delay time associated with each safety system component requiring DG supplied power following a loss of offsite power.

The Degraded Grid Protective System instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

The operability of the Degraded Grid Protective System instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions. Each Trip Function must have the required number of operable channels in each trip system, with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with actual trip setpoints within calculational as-found tolerances provides reasonable assurance that, under worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.8. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below for the Degraded Grid Protective System instrumentation Trip Functions.

1.a, 1.b, 1.c, 1.d. Degraded Bus Voltage - Voltage, Degraded Bus Voltage - Time Delay, Degraded Bus Voltage - Voltage Alarm and Degraded Bus Voltage - Alarm Time Delay

A reduced voltage condition on a 4.16 kV emergency bus indicates that, while offsite power may not be completely lost to the respective emergency bus, available power may be insufficient for starting large ECCS motors without risking damage to the motors that could disable the ECCS function. Therefore, power supply to the bus is automatically transferred from offsite power to onsite DG power when the voltage on the bus drops below the Degraded Bus Voltage - Voltage Trip Function trip setpoint, is sustained in a degraded condition for approximately 10 seconds and a LOCA condition exists (as indicated by ECCS Low - Low Reactor Vessel Water Level or High Drywell Pressure Trip Function signals). This ensures that adequate power will be available to the required equipment.

In addition, when the voltage on the bus drops below the Degraded Bus Voltage - Voltage Alarm Trip Function trip setpoint, and is sustained in a degraded condition for approximately 10 seconds, a control room annunciator is actuated. This annunciator alerts the operator of the degraded voltage

BASES: 3.2.K/4.2.K DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

condition so that manual action can be taken for degraded grid protection when an accident signal is not present.

The Degraded Bus Voltage and Voltage Alarm Trip Settings are low enough to prevent inadvertent power supply transfer, but high enough to ensure that sufficient power is available to the required equipment. The Time Delay Trip Settings are long enough to provide time for voltage on the station emergency bus to recover from transients such as motor starts or fault clearing, but short enough to ensure that the operating equipment is not damaged by low voltage.

Two channels of Degraded Bus Voltage - Voltage Trip Function and one channel of Degraded Bus Voltage - Time Delay Trip Function per associated bus are required to be operable when the associated DG is required to be operable to ensure that no single instrument failure can preclude the DG function.

In addition, two channels of Degraded Bus Voltage - Voltage Alarm Trip Function and one channel of Degraded Bus Voltage - Alarm Time Delay Trip Function per asociated bus are required to be operable when the associated DG is required to be operable to ensure that no single instrument falure can preclude the alarm function.

ACTIONS

Table 3.2.8 ACTION Note 1

With one or more required channels of the Degraded Bus Voltage - Voltage Trip Function inoperable, the Trip Function is not capable of performing the intended function. Therefore, only 1 hour is allowed to restore the inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.8 ACTION Note 1.a. The inoperable channel may be tripped using test jacks or other permanently installed circuits. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure (within the Degraded Grid Protective System instrumentation), and allow operation to continue. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour completion time is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

If placing an inoperable channel in the tripped condition would result in an initiation, then Action Note 1.a cannot be met. If the Action and associated completion time of Table 3.2.8 ACTION Note 1.a are not met, the associated Trip Function is not capable of performing the intended function. Therefore, the associated DG(s) is declared inoperable immediately. This requires entry into the applicable LCO and required Actions of the DG Technical Specifications, which provide appropriate actions for the inoperable DG(s).

BASES: 3.2.K/4.2.K DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

ACTIONS (continued)

Table 3.2.8 ACTION Note 2

With one or more required channels of the Degraded Bus Voltage - Time Delay Trip Function inoperable, the Trip Function is not capable of performing the intended function. Therefore, only 1 hour is allowed to restore the inoperable channel to operable status (Table 3.2.8 ACTION Note 2.a). Table 3.2.8 ACTION Note 2.a. does not allow placing the channel in trip since this action would not necessarily result in a safe state for the channel in all events. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour completion time is acceptable because it minimizes risk while allowing time for restoration of channels.

If the Action and associated completion time of Table 3.2.8 ACTION Note 2.a are not met, the associated Trip Function is not capable of performing the intended function. Therefore, the associated DG(s) is declared inoperable immediately. This requires entry into applicable LCO and required Actions of the DG Technical Specifications, which provide appropriate actions for the inoperable DG(s).

Table 3.28 ACTION Note 3

With one of the required channels, for one or more buses, of the Degraded Bus Voltage - Voltage Alarm Trip Function inoperable, the Trip Function is not capable of performing the intended function assuming a single failure. Since this Trip Function is not common to RPS, 24 hours is allowed to restore the inoperable channel to operable status (Table 3.2.8 ACTION Note 3.b). With both of the required channels, for one or more buses, of the Degraded Bus Voltage - Voltage Alarm Trip Function inoperable, or with the one required channel, for one or more buses, of the Degraded Bus Voltage - Alarm Time Delay Trip Function inoperable, the Trip Function is not capable of performing the intended function. Therefore, only 1 hour is allowed to restore at least one channel of the Degraded Bus Voltage - Voltage Alarm Trip Function and the one channel of the Degraded Bus Voltage - Alarm Time Delay Trip Function to operable status (Table 3.2.8 ACTION Note 3.a). Table 3.2.8 ACTION Notes 3.a and 3.b do not allow placing an inoperable channel in trip since this action would not necessarily result in a safe state for the channel in all events. The completion times are intended to allow the operator time to evaluate and repair any discovered inoperabilities. The completion times are acceptable because they minimize risk while allowing time for restoration of channels.

If the Action and associated completion times of Table 3.2.8 ACTION Notes 3.a or 3.b are not met, the associated Trip Function may not be capable of performing the intended function. Therefore increased voltage monitoring of the associated 4.16 kV emergency bus(es) is initiated. This action will compensate for the inoperable control room annunciator function to ensure manual action is taken for degraded grid protection when an accident signal is not present.

BASES: 3.2.K/4.2.K DEGRADED GRID PROTECTIVE SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.K.1

As indicated in Surveillance Requirement 4.2.K.1, Degraded Grid Protective System instrumentation shall be functionally tested and calibrated as indicated in Table 4.2.8. Table 4.2.8 identifies, for each Trip Function, the applicable Surveillance Requirements.

Table 4.2.8, Functional Test

For Trip Functions 1.a and 1.b, as indicated in Table 4.2.8 Footnote (a), separate Functional Tests are not required since Trip Function operability is demonstrated during the Trip Function Calibration and integrated ECCS test performed once per Operating Cycle. For the Trip Function Calibration, the "once per Operating Cycle" Frequency is based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses. For the integrated ECCS test, the "once per Operating Cycle" Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the integrated ECCS test when performed at the specified Frequency.

Table 4.2.8, Calibration

For Trip Functions 1.a and 1.b, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

REFERENCES

1. UFSAR, Section 8.5.3.

2. UFSAR, Section 6.5.

3. UFSAR, Chapter 14.

Current

Technical Specifications

Markups

3.2.K and 4.2.K

Degraded Grid Protective System

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

sooner made operable. If both instruments are made or found to be inoperable, and indication cannot be restored within a six hour period, an orderly shutdown shall be initiated and the reactor shall be in a hot shutdown condition in six hours and a cold shutdown condition in the following eighteen hours.

A.2

I. Recirculation Pump Trip Instrumentation

During reactor power operation, the Recirculation Pump Trip Instrumentation shall be operable in accordance with Table 3.2.1.

J. Deleted

K. Degraded Grid Protective System

A.3 M.1

During reactor power operation, ~~the~~ emergency bus undervoltage instrumentation shall be operable in accordance with Table 3.2.8.

FOR EACH TRIP FUNCTION IN TABLE 3.2.8

L. Reactor Core Isolation Cooling System Actuation

When the Reactor Core Isolation Cooling System is required in accordance with Specification 3.5.G, the instrumentation which initiates actuation of this system shall be operable in accordance with Table 3.2.9.

4.2 SURVEILLANCE REQUIREMENTS

<MOVE TO SEPARATE PAGE>

I. Recirculation Pump Trip Instrumentation

The Recirculation Pump Trip Instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.1.

J. Deleted

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.8.

L. Reactor Core Isolation Cooling System Actuation

Instrumentation and Logic Systems shall be functionally tested and calibrated as indicated in Table 4.2.9.

<MOVE TO SEPARATE PAGE>

A.1

Degraded Grid Protective System

TABLE 3.2.8

~~EMERGENCY BUS UNDERVOLTAGE~~ INSTRUMENTATION

	REQUIRED CHANNELS PER BUS ~~Minimum Number of Operable Instruments~~	TRIP FUNCTION ~~Parameter~~	Trip Setting	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE ~~Required Action~~
1.a	2 ~~per bus~~	Degraded Bus Voltage - Voltage ~~(27/3Z, 27/3W, 27/4Z, 27/4W)~~ LA.1	~~3,700 volts ± 40 volts~~ ≥ 3660 volts and ≤ 3740 volts	Note 1
1.b	~~2~~ 1 ~~per bus~~ LC.1	Degraded Bus Voltage - Time Delay ~~(62/3W, 62/3Z, 62/4W, 62/4Z)~~ LA.1	~~10 seconds ± 1 second~~ ≥ 9 seconds and ≤ 11 seconds	Note 2
1.c	2	Degraded Bus Voltage - Voltage Alarm	≥ 3660 volts and ≤ 3740 volts	Note 3
1.d	1	Degraded Bus Voltage - Alarm Time Delay	≥ 9 seconds and ≤ 11 seconds	Note 3

<INSERT A>

TABLE 3.2.8 ACTION NOTES

1. If the minimum number of operable instrument channels are not available, the inoperable channel shall be tripped ~~using test jacks or other permanently installed circuits~~ LA.2 within one hour.

2. If the minimum number of operable instrument channels are not available, ~~reactor power operation is permissible for only 7 successive days unless the system is sooner made operable.~~ restore the inoperable channel to operable status within 1 hour. L.1

If the Action and associated completion time are not met, immediately declare the associated diesel generator inoperable. L.1 L.2

Insert A

3. With one or more required Degraded Bus Voltage - Voltage Alarm Trip Function channels inoperable, take all of the applicable Actions in Notes 3.a and 3.b:

   a. With one or more buses with alarm capability not maintained, restore alarm capability within 1 hour; and

   b. Restore the inoperable channel(s) to operable status within 24 hours.

   If the Action and associated completion time of Note 3.a or 3.b are not met, initiate increased voltage monitoring of the associated 4.16 kV emergency bus(es).

A.1

VYNPS

TABLE 4.2.8

TESTS AND FREQUENCIES

~~EMERGENCY BUS UNDERVOLTAGE~~ INSTRUMENTATION

Degraded Grid Protective SYSTEM

	Trip System	Functional Test	Calibration (8) A.4
1.a and 1.b	Degraded Bus Voltage	See Note ~~(1)~~ (1)	Once/Operating Cycle

A.1

TABLE 4.2 NOTES

1. ~~Not used.~~

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.5

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system.

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel.

5. ~~Deleted.~~

6. ~~Deleted.~~

7. ~~Deleted.~~

8. Functional tests and calibrations are not required when systems are not required to be operable. A.4

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle. A.5

FOOTNOTE (1) ~~10.~~ Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage. A.5

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power).

Proposed

Technical Specifications

3.2.L and 4.2.L

Reactor Core Isolation Cooling (RCIC)
System Actuation

3.2 LIMITING CONDITIONS FOR OPERATION

L. Reactor Core Isolation Cooling (RCIC) System Actuation

The RCIC System instrumentation for each Trip Function in Table 3.2.9 shall be operable in accordance with Table 3.2.9.

4.2 SURVEILLANCE REQUIREMENTS

L. Reactor Core Isolation Cooling (RCIC) System Actuation

1. The RCIC System instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.9.

   When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions for Operation and required Actions may be delayed as follows: (a) for up to 6 hours for Trip Function 3; and (b) for up to 6 hours for Trip Functions 1 and 2 provided the associated Trip Function maintains RCIC initiation capability.

2. Perform a Logic System Functional Test of RCIC System instrumentation Trip Functions once every Operating Cycle.

Table 3.2.9 (page 1 of 1)
Reactor Core Isolation Cooling System Instrumentation

TRIP FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	ACTIONS WHEN REQUIRED CHANNELS ARE INOPERABLE	TRIP SETTING
1. Low-Low Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY[a], HOT SHUTDOWN[a], Refuel[a]	4	Note 1	≥ 82.5 inches
2. Low Condensate Storage Tank Water Level	RUN, STARTUP/HOT STANDBY[a], HOT SHUTDOWN[a], Refuel[a]	2	Note 2	≥ 3.81%[b]
3. High Reactor Vessel Water Level	RUN, STARTUP/HOT STANDBY[a], HOT SHUTDOWN[a], Refuel[a]	2	Note 3	≤ 177.0 inches

(a) With reactor steam pressure > 150 psig.

(b) Percent of instrument span.

Table 3.2.9 ACTION Notes

1. With one or more RCIC System instrumentation Trip Function 1 channels inoperable:

   a. Declare the RCIC System inoperable within 1 hour from discovery of loss of RCIC initiation capability; and
   b. Place any inoperable channel in trip within 24 hours.

   If any applicable Action and associated completion time of Note 1.a or 1.b is not met, immediately declare the RCIC System inoperable.

2. With one or more RCIC System instrumentation Trip Function 2 channels inoperable:

   a. Declare the RCIC System inoperable within 1 hour from discovery of loss of RCIC initiation capability when RCIC System suction is aligned to the Condensate Storage Tank; and
   b. Place any inoperable channel in trip or align RCIC System suction to the suppression pool within 24 hours.

   If any applicable Action and associated completion time of Note 2.a or 2.b is not met, immediately declare the RCIC System inoperable.

3. With one or more RCIC System instrumentation Trip Function 3 channels inoperable:

   a. Restore any inoperable channel to operable status within 24 hours.

   If the Action and associated completion time of Note 3.a is not met, immediately declare the RCIC System inoperable.

Table 4.2.9 (page 1 of 1)
Reactor Core Isolation Cooling System Instrumentation
Tests and Frequencies

TRIP FUNCTION	CHECK	FUNCTIONAL TEST	CALIBRATION
1. Low-Low Reactor Vessel Water Level	Once/Day	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
2. Low Condensate Storage Tank Water Level	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle
3. High Reactor Vessel Water Level	NA	Every 3 Months	Every 3 Months[a], Once/Operating Cycle

(a) Trip unit calibration only.

Proposed

Bases

3.2.L and 4.2.L

Reactor Core Isolation Cooling (RCIC) System Actuation

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

BACKGROUND

The purpose of the RCIC System instrumentation is to initiate actions to ensure adequate core cooling when the reactor vessel is isolated from its primary heat sink (the main condenser) and normal coolant makeup flow from the Reactor Feedwater System is insufficient or unavailable, such that RCIC System initiation occurs and maintains sufficient reactor water level such that initiation of the low pressure Emergency Core Cooling Systems (ECCS) pumps does not occur. A more complete discussion of the RCIC System is provided in UFSAR, Section 4.7 (Ref. 1).

RCIC System automatic initiation occurs for conditions of Low - Low Reactor Vessel Water Level. The variable is monitored by four transmitters that are connected to four trip units. The Low - Low Reactor Vessel Water Level Trip Function is a single trip system with two trip system logics. The outputs of the trip units are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic arrangement.

The RCIC test line isolation valve is closed on a RCIC initiation signal to allow full system flow.

The RCIC System also monitors the water level in the condensate storage tank (CST) since this is the initial source of water for RCIC operation. Reactor grade water in the CST is the normal source. Upon receipt of a RCIC initiation signal, the CST suction valve is automatically signaled to open. If the water level in the CST falls below a preselected level, the RCIC suppression pool suction valves automatically open. When the suppression pool suction valves are both fully open, the RCIC CST suction valve automatically closes. Two level transmitters are used to detect low water level in the CST. Either transmitter can cause the suppression pool suction valves to open and the CST suction valve to close (one trip system arranged in a one-out-of-two logic).

The RCIC System provides makeup water to the reactor until the reactor vessel water level reaches the high water level trip (one trip system arranged in a two-out-of-two logic), at which time the RCIC steam admission valve closes. The RCIC System automatically restarts if a Low - Low Reactor Vessel Water Level signal is subsequently received.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The function of the RCIC System to provide makeup coolant to the reactor is used to respond to transient events. The RCIC System is not an Engineered Safety Feature System and no credit is taken in the safety analyses for RCIC System operation. Based on its contribution to the reduction of overall plant risk, however, the system, and therefore its instrumentation, meets Criterion 4 of 10 CFR 50.36(c)(2)(ii).

The operability of the RCIC System Instrumentation is dependent on the operability of the individual instrumentation channel Trip Functions. Each Trip Function must have the required number of operable channels with their trip setpoints within the calculational as-found tolerances specified in plant procedures. Operation with the actual trip setpoints within the calculational as-found tolerances provides reasonable assurance that, under

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

worst case design basis conditions, the associated trip will occur within the Trip Settings specified in Table 3.2.9. As a result, a channel is considered inoperable if its actual trip setpoint is not within the calculational as-found tolerances specified in plant procedures. The actual trip setpoint is calibrated consistent with applicable setpoint methodology assumptions.

The individual Trip Functions are required to be operable in the RUN Mode and in STARTUP/HOT STANDBY, HOT SHUTDOWN, and Refuel with reactor steam pressure > 150 psig since this is when RCIC is required to be operable.

The specific Applicable Safety Analyses and LCO discussions are listed below on a Trip Function by Trip Function basis.

1. Low - Low Reactor Vessel Water Level

Low reactor pressure vessel (RPV) water level indicates that normal feedwater flow is insufficient to maintain reactor vessel water level and that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, the RCIC System is initiated on a Low - Low Reactor Vessel Water Level signal to assist in maintaining water level above the top of the enriched fuel.

Low - Low Reactor Vessel Water Level signals are initiated from four level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

The Low - Low Reactor Vessel Water Level Trip Setting is chosen to be the same as the ECCS Low - Low Reactor Vessel Water Level Trip Setting (Specification 3.2.A). The Trip Setting is referenced from the top of enriched fuel.

Four channels of Low - Low Reactor Vessel Water Level Trip Function are available and are required to be operable when RCIC is required to be operable to ensure that no single instrument failure can preclude RCIC initiation.

2. Low Condensate Storage Tank Water Level

Low water level in the CST indicates the unavailability of an adequate supply of makeup water from this normal source. Normally, the suction valve between the RCIC pump and the CST is open and, upon receiving a RCIC initiation signal, water for RCIC injection would be taken from the CST. However, if the water level in the CST falls below a preselected level, the RCIC suppression pool suction valves automatically open. When the suppression pool suction valves are both fully open, the RCIC CST suction valve automatically closes. This ensures that an adequate supply of makeup water is available to the RCIC pump.

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Two level transmitters are used to detect low water level in the CST. The Low Condensate Storage Tank Water Level Trip Function Trip Setting is set high enough to ensure adequate pump suction head while water is being taken from the CST. The trip setting is presented in terms of percent instrument span.

Two channels of Low Condensate Storage Tank Water Level Trip Function are available and are required to be operable when RCIC is required to be operable to ensure that no single instrument failure can preclude RCIC swap to the suppression pool source.

3. High Reactor Vessel Water Level

High RPV water level indicates that sufficient cooling water inventory exists in the reactor vessel such that there is no danger to the fuel. Therefore, the high water level signal is used to close the RCIC steam admission valve to prevent overflow into the main steam lines (MSLs).

High Reactor Vessel Water Level signals for RCIC are initiated from two level transmitters, which sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

The High Reactor Vessel Water Level Trip Setting is high enough to preclude closing the RCIC steam admission valve during normal operation, yet low enough to trip the RCIC System to prevent reactor vessel overfill. The Trip Setting is referenced from the top of enriched fuel.

Two channels of High Reactor Vessel Water Level Trip Function are available and are required to be operable when RCIC is required to be operable.

ACTIONS

Table 3.2.9 ACTION Note 1

Table 3.2.9 ACTION Note 1.a is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels of Trip Function 1 result in a complete loss of automatic initiation capability for the RCIC System. In this case, automatic initiation capability is lost if two Trip Function 1 channels in the same trip system logic are inoperable and untripped. In this situation (loss of automatic initiation capability), the 24 hour allowance of Table 3.2.9 ACTION Note 1.b is not appropriate, and the RCIC System must be declared inoperable within 1 hour after discovery of loss of RCIC initiation capability. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.9 ACTION Note 1.a, the completion time only begins upon discovery that the RCIC System cannot be automatically initiated due to two inoperable, untripped Low -

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

ACTIONS (continued)

Low Reactor Vessel Water Level channels in the same trip system logic. The 1 hour completion time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the redundancy of sensors available to provide initiation signals and the fact that the RCIC System is not assumed in any accident or transient analysis, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 2) to permit restoration of any inoperable channel to operable status. If the inoperable channel cannot be restored to operable status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.9 ACTION Note 1.b. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue.

With any required Action and associated completion time of Table 3.2.9 ACTION Note 1.a or 1.b not met, the RCIC System may be incapable of performing the intended function, and the RCIC System must be declared inoperable immediately.

Table 3.2.9 ACTION Note 2

Table 3.2.9 ACTION 2.a is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels of Trip Function 2 result in automatic RCIC initiation (i.e., suction swap) capability being lost. In this case, automatic RCIC suction swap capability is lost if two Trip Function 2 channels are inoperable and untripped. In this situation (loss of automatic suction swap), the 24 hour allowance of Table 3.2.9 ACTION Note 2.b is not appropriate, and the RCIC System must be declared inoperable within 1 hour from discovery of loss of RCIC initiation capability when the RCIC System suction is aligned to the CST. Table 3.2.9 ACTION Note 2.a is only applicable if the RCIC System suction is not aligned to the suppression pool since, if aligned, the Trip Function is already performed. The completion time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. For Table 3.2.9 ACTION Note 2.a, the completion time only begins upon discovery that the RCIC System cannot be automatically aligned to the suppression pool due to two inoperable, untripped channels in Trip Function 2. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the redundancy of sensors available to provide initiation signals and the fact that the RCIC System is not assumed in any accident or transient analysis, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. 2) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to operable

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

ACTIONS (continued)

status within the allowable out of service time, the channel must be placed in the tripped condition per Table 3.2.9 ACTION Note 2.b, which performs the intended function of the channel (shifting the suction source to the suppression pool). Alternatively, Table 3.2.9 ACTION Note 2.b allows the manual alignment of the RCIC System suction to the suppression pool, which also performs the intended function. If either action of Table 3.2.9 ACTION Note 2.b is performed, measures should be taken to ensure that the RCIC System piping remains filled with water.

With any required Action and associated completion time of Table 3.2.9 ACTION Note 2.a or 2.b not met, the RCIC System may be incapable of performing the intended function, and the RCIC System must be declared inoperable immediately.

Table 3.2.9 ACTION Note 3

A risk based analysis was performed and determined that an allowable out of service time of 24 hours (Ref. 2) is acceptable to permit restoration of any inoperable Trip Function 3 channel to operable status (Table 3.2.9 ACTION Note 3.a). A required Action (similar to Table 3.2.9 ACTION Note 1.a) limiting the allowable out of service time, if a loss of automatic RCIC initiation capability (i.e., loss of high water level trip capability) exists, is not required. Table 3.2.9 ACTION Note 3 applies to the High Reactor Vessel Water Level Trip Function whose logic is arranged such that any inoperable channel will result in a loss of automatic RCIC initiation capability. As stated above, this loss of automatic RCIC initiation capability was analyzed and determined to be acceptable. One inoperable channel may result in a loss of high water level trip capability but will not prevent RCIC System automatic start capability. However, the Required Action does not allow placing a channel in trip since this action would not necessarily result in a safe state for the channel in all events (a failure of the remaining channel could prevent a RCIC System start).

With any required Action and associated completion time of Table 3.2.9 ACTION Note 3.a not met, the RCIC System may be incapable of performing the intended function, and the RCIC System must be declared inoperable immediately.

SURVEILLANCE REQUIREMENTS

Surveillance Requirement 4.2.L.1

As indicated in Surveillance Requirement 4.2.L.1, RCIC System instrumentation shall be checked, functionally tested and calibrated as indicated in Table 4.2.9. Table 4.2.9 identifies, for each Trip Function, the applicable Surveillance Requirements.

Surveillance Requirement 4.2.L.1 also indicates that when a channel is placed in an inoperable status solely for performance of required instrumentation Surveillances, entry into associated LCO and required Actions may be delayed

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS (continued)

as follows: (a) for up to 6 hours for Trip Function 3; and (b) for up to 6 hours for Trip Functions 1 and 2, provided the associated Trip Function maintains RCIC initiation capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to operable status or the applicable LCO entered and required Actions taken. This allowance is based on the reliability analysis (Ref. 2) assumption of the average time required to perform channel Surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RCIC System will initiate when necessary.

Surveillance Requirement 4.2.L.2

The Logic System Functional Test demonstrates the operability of the required initiation logic for a specific channel and includes simulated automatic actuation of the channel. The system functional testing performed in Surveillance Requirement 4.5.G.1 overlaps this Surveillance to provide complete testing of the safety function. The Frequency of "once every Operating Cycle" is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has demonstrated that these components will usually pass the Surveillance when performed at the specified Frequency.

Table 4.2.9, Check

Performance of an Instrument Check once per day, for Trip Function 1, ensures that a gross failure of instrumentation has not occurred. An Instrument Check is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious. An Instrument Check will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each Calibration. Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit. The Frequency is based upon operating experience that demonstrates channel failure is rare. The Instrument Check supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

BASES: 3.2.L/4.2.L REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS (continued)

Table 4.2.9, Functional Test

For Trip Functions 1, 2 and 3, a Functional Test is performed on each required channel to ensure that the channel will perform the intended function. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. For Trip Functions 1, 2 and 3, the Frequency of "Every 3 Months" is based on the reliability analysis of Reference 2.

Table 4.2.9, Calibration

For Trip Functions 1, 2, and 3, an Instrument Calibration is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. An Instrument Calibration leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. The specified Instrument Calibration Frequencies are based upon the time interval assumptions for calibration used in the determination of the magnitude of equipment drift in the associated setpoint analyses.

For Trip Functions 1 and 3, a calibration of the trip units is required (Footnote (a)) once every 3 months. Calibration of the trip units provides a check of the actual setpoints. The channel must be declared inoperable if the trip setting is discovered to be less conservative than the calculational as-found tolerances specified in plant procedures. The Frequency of every 3 months is based on the reliability analysis of Reference 2 and the time interval assumption for trip unit calibration used in the associated setpoint calculation.

REFERENCES

1. UFSAR, Section 4.7.

2. GENE-770-06-2P-A, Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications, December 1992.

Current

Technical Specifications

Markups

3.2.L and 4.2.L

Reactor Core Isolation Cooling (RCIC)
System Actuation

A.1

3.2 LIMITING CONDITIONS FOR OPERATION

sooner made operable. If both instruments are made or found to be inoperable, and indication cannot be restored within a six hour period, an orderly shutdown shall be initiated and the reactor shall be in a hot shutdown condition in six hours and a cold shutdown condition in the following eighteen hours.

A.2

I. Recirculation Pump Trip Instrumentation

During reactor power operation, the Recirculation Pump Trip Instrumentation shall be operable in accordance with Table 3.2.1.

J. Deleted

K. Degraded Grid Protective System

During reactor power operation, the emergency bus undervoltage instrumentation shall be operable in accordance with Table 3.2.8.

(RCIC)

L. Reactor Core Isolation Cooling System Actuation

A.3

When the Reactor Core Isolation Cooling System is required in accordance with Specification 3.5.G, ~~the~~ RCIC SYSTEM instrumentation ~~which initiates actuation of this system~~ shall be operable in accordance with Table 3.2.9.

FOR EACH TRIP FUNCTION IN TABLE 3.2.9

4.2 SURVEILLANCE REQUIREMENTS

<MOVE TO SEPARATE PAGE>

I. Recirculation Pump Trip Instrumentation

The Recirculation Pump Trip Instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.1.

J. Deleted

K. Degraded Grid Protective System

The emergency bus undervoltage instrumentation shall be functionally tested and calibrated in accordance with Table 4.2.8.

L. Reactor Core Isolation Cooling System Actuation

RCIC SYSTEM

1. ~~Instrumentation and Logic Systems~~ shall be CHECKED, functionally tested and calibrated as indicated in Table 4.2.9.

A.4

A.5

WHEN A CHANNEL IS PLACED IN AN INOPERABLE STATUS SOLELY FOR PERFORMANCE OF REQUIRED SURVEILLANCES, ENTRY INTO ASSOCIATED LIMITING CONDITIONS FOR OPERATION AND REQUIRED ACTIONS MAY BE DELAYED AS FOLLOWS: (a) FOR UP TO 6 HOURS FOR TRIP FUNCTION 3; AND (b) FOR UP TO 6 HOURS FOR TRIP FUNCTIONS 1 AND 2 PROVIDED THE ASSOCIATED TRIP FUNCTION MAINTAINS RCIC INITIATION CAPABILITY.

A.6

A.1

REQUIRED CHANNELS ARE INOPERABLE

TABLE 3.2.9

REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION INSTRUMENTATION

REQUIRED

	Minimum Number of Operable Instrument Channels per ~~Trip System~~ Function	Trip Function	Trip ~~Level~~ Setting	~~Required~~ ACTIONS When Minimum Conditions For Operation Are Not Satisfied
1	4 ~~2~~ (Notes 1, 5) A.6	Low-Low Reactor Vessel Water Level (LT-2-3-72(A-D)(M)) LA.1	>82.5" (Above Top of Enriched Fuel) LA.3	Note ~~6~~ 1
2	2 (Notes 2, 5)	Low Condensate Storage Tank Water Level (LT-107-12A7B(M)) LA.1	~~>3%~~ 3.81% (a) M.2	Note ~~8~~ 2
3	2 (Notes 3, 5) LA.2	High Reactor Vessel Water Level (LT-2-3-72C/D(S2)) LA.1	<177" (Above Top of Enriched Fuel) LA.3	Note ~~9~~ 3
	~~1~~	~~Trip System Logic~~	~~--~~	~~Note 4~~ L.1

(a) PERCENT OF INSTRUMENT SPAN.

A.1

TABLE 3.2.9 ACTION NOTES

~~1. One trip system with initiating instrumentation arranged in a one-out-of-two taken twice logic.~~

~~2. One trip system with initiating instrumentation arranged in a one-out-of-two logic.~~

~~3. One trip system arranged in a two-out-of-two logic.~~

LA.2

~~4. If the minimum number of operable channels are not available, the system is considered inoperable and the requirements of Specification 3.5 apply.~~

L.1

~~5.~~ When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours provided the associated Trip Function maintains RCIC initiation capability.

~~6.~~ When a channel is placed in an inoperable status solely for performance of required surveillances, entry into associated Limiting Conditions For Operation and required ACTIONS may be delayed for up to 6 hours.

A.6

Table 3.2.9 Action Note 1

~~7.~~ With one or more channels inoperable for RCIC:

a ~~A~~. Within one hour from discovery of loss of system initiation capability, declare the RCIC system inoperable, and

b ~~B~~. Within 24 hours, place channel in trip.

~~C~~. If required actions and associated completion times of actions A or B are not met, immediately declare the RCIC system inoperable.

Table 3.2.9 Action Note 2

~~8.~~ With one or more channels inoperable for RCIC:

a ~~A~~. Within one hour from discovery of loss of system initiation capability while suction is aligned to the CST, declare the RCIC system inoperable, and

b ~~B~~. Within 24 hours, place channel in trip or align suction for the RCIC system to the suppression pool.

~~C~~. If required actions and associated completion times of actions A or B are not met, immediately declare the RCIC system inoperable.

Table 3.2.9 Action Note 3

~~9.~~ With one or more channels inoperable for RCIC:

~~A~~. Within 24 hours, restore channel to operable status.

~~B~~. If required action and associated completion time of action A is not met, immediately declare the RCIC system inoperable.

A.1

TABLE 4.2.9

MINIMUM TESTS AND CALIBRATION FREQUENCIES

REACTOR CORE ISOLATION COOLING SYSTEM ACTUATION INSTRUMENTATION

	Trip Function	Functional Test (8) A.7	Calibration (8) A.7	~~Instrument~~ Check
1.	Low-Low Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle Every 3 Months(1) M.1	Once each day
2.	Low Condensate Storage Tank Water Level	Every Three Months	Once/Operating Cycle	--
3.	High Reactor Vessel Water Level	Every Three Months	Once/Operating Cycle	--
SR 4.2.1.2	Trip System Logic	Once/Operating Cycle	~~Once/Operating Cycle (Note 3)~~ A.8	-- A.4

(1) Trip unit calibration only. M.1

A.1

TABLE 4.2 NOTES

1. Not used

2. During each refueling outage, simulated automatic actuation which opens all pilot valves shall be performed such that each trip system logic can be verified independent of its redundant counterpart. A.9

3. Trip system logic calibration shall include only time delay relays and timers necessary for proper functioning of the trip system. A.8

4. This instrumentation is excepted from functional test definition. The functional test will consist of injecting a simulated electrical signal into the measurement channel. A.9

5. Deleted.

6. Deleted.

7. Deleted.

8. Functional tests and calibrations are not required when systems are not required to be operable. A.7

9. The thermocouples associated with safety/relief valves and safety valve position, that may be used for back-up position indication, shall be verified to be operable every operating cycle.

10. Separate functional tests are not required for this instrumentation. The calibration and integrated ECCS tests which are performed once per operating cycle will adequately demonstrate proper equipment operation.

11. Trip system logic functional tests will include verification of operation of all automatic initiation inhibit switches by monitoring relay contact movement. Verification that the manual inhibit switches prevent opening all relief valves will be accomplished in conjunction with Section 4.5.F.1.

12. Trip system logic testing is not applicable to this function. If the required surveillance frequency (every Refueling Outage) is not met, functional testing of the Reactor Mode Switch-Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in Shutdown for the purpose of commencing a scheduled Refueling Outage.

13. Includes calibration of the RBM Reference Downscale function (i.e., RBM upscale function is not bypassed when >30% Rated Thermal Power). A.9

Proposed

Technical Specifications Bases

3.1/4.1 and 3.2/4.2

Reactor Protection System Bases
and
Protective Instrument System Bases

BASES:

2.1 FUEL CLADDING INTEGRITY

A. Trip Settings

The bases for individual trip settings of Section 2.1 are discussed in the Bases for Specifications 3.1.A, 3.2.A and 3.2.B.

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Current Technical Specifications Bases

Markups

3.1/4.1 and 3.2/4.2

Reactor Protection System Bases
and
Protective Instrument System Bases

A.1

BASES:

2.1 FUEL CLADDING INTEGRITY

A. Trip Settings

of Section 2.1

the Bases for Specifications 3.1.A, 3.2.A, and 3.2.B.

The bases for individual trip settings are discussed in ~~the following paragraphs.~~

1. Neutron Flux Trip Settings

a. APRM Flux Scram Allowable Value (Run Mode)

The average power range monitoring (APRM) system, which is calibrated using heat balance data taken during steady state conditions, reads in percent of rated thermal power (1593 MWt). Because fission chambers provide the basic input signals, the APRM system responds directly to average neutron flux. During transients, the instantaneous rate of heat transfer from the fuel (reactor thermal power) is less than the instantaneous neutron flux due to the time constant of the fuel. Therefore, during abnormal operational transients, the thermal power of the fuel will be less than that indicated by the neutron flux at the scram setting. Analyses are performed to demonstrate that the APRM flux scram over the range of settings from a maximum of 120% to the minimum flow biased setting provide protection from the fuel safety limit for all abnormal operational transients including those that may result in a thermal hydraulic instability.

An increase in the APRM scram trip setting would decrease the margin present before the fuel cladding integrity Safety Limit is reached. The APRM scram trip setting was determined by an analysis of margins required to provide a reasonable range for maneuvering during operation. Reducing this operating margin would increase the frequency of spurious scrams which have an adverse effect on reactor safety because of the resulting thermal stresses. Thus, the APRM scram trip setting was selected because it provides adequate margin for the fuel cladding integrity Safety Limit yet allows operating margin that reduces the possibility of unnecessary scrams. The relationship between recirculation drive flow and reactor core flow is non-linear at low core flows. Due to stability concerns, separate APRM flow biased scram trip setting equations are provided for low core flows.

The APRM flow biased flux scram Allowable Value is the limiting value that the trip setpoint may have when tested periodically, beyond which appropriate action shall be taken. For Vermont Yankee, the periodic testing is defined as the calibration. The actual scram trip is conservatively set in relation to the Allowable Value to ensure operability between periodic testing. For single recirculation loop operation, the APRM flux scram trip setting is reduced in accordance with the analysis presented in NEDO-30060, February 1983. This adjustment accounts for the difference between the single loop and two loop drive flow at the same core flow, and ensures that the margin of safety is not reduced during single loop operation. The single loop

BASES: 2.1 (Cont'd)

operation equations are based on a bounding (maximum) difference between two loop and single loop drive flow at the same core flow of 8%.

Analyses of the limiting transients show that no scram adjustment is required to assure fuel cladding integrity when the transient is initiated from the operating limit MCPR defined in the Core Operating Limits Report.

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BASES: 2.1 (Cont'd)

Flux Scram Trip Setting (Refuel or Startup and Hot Standby Mode)

For operation in the startup mode while the reactor is at low pressure, the reduced APRM scram setting to 15% of rated power provides adequate thermal margin between the setpoint and the safety limit, 25% of the rated. (During an outage when it is necessary to check refuel interlocks, the mode switch must be moved to the startup position. Since the APRM reduced scram may be inoperable at that time due to the disconnection of the LPRMs, it is required that the IRM scram and the SRM scram in noncoincidence be in effect. This will ensure that adequate thermal margin is maintained between the setpoint and the safety limit.) The margin is adequate to accommodate anticipated maneuvers associated with station startup. Effects of increasing pressure at zero or low void content are minor, cold water from sources available during startup is not much colder than that already in the system, temperature coefficients are small, and control rod patterns are constrained to be uniform by operating procedures backed up by the rod worth minimizer. Worth of individual rods is very low in a uniform rod pattern. Thus, of all possible sources of reactivity input, uniform control rod withdrawal is the most probable cause of significant power rise. Because the flux distribution associated with uniform rod withdrawals does not involve high local peaks, and because several rods must be moved to change power by a significant percentage of rated power, the rate of power rise is very slow. Generally, the heat flux is in near equilibrium with the fission rate. In an assumed uniform rod withdrawal approach to the scram level, the rate of power rise is no more than 5% of rated power per minute, and the APRM system would be more than adequate to assure a scram before the power could exceed the safety limit. The reduced APRM scram remains active until the mode switch is placed in the RUN position. This switch can occur when reactor pressure is greater than 800 psig.

The IRM system consists of 6 chambers, 3 in each of the reactor protection system logic channels. The IRM is a 5-decade instrument, which covers the range of power level between that covered by the SRM and the APRM. The 5 decades are covered by the IRM by means of a range switch and the 5 decades are broken down into 10 ranges, each being one-half of a decade in size. The IRM scram trip setting of 120/125 of full scale is active in each range of the IRM. For example, if the instrument were on range 1, the scram setting would be a 120/125 of full scale for that range; likewise, if the instrument were on range 5, the scram would be 120/125 of full scale on that range. Thus, as the IRM is ranged up to accommodate the increase in power level, the scram trip setting is also ranged up. The most significant sources of reactivity change during the power increase are due to control rod withdrawal. For in-sequence control rod withdrawal, the rate of change of power is slow enough due to the physical limitation of withdrawing control rods, that heat flux is in equilibrium with the neutron flux and an IRM scram would result in a reactor shutdown well before any safety limit is exceeded.

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BASES: 2.1 (Cont'd)

In order to ensure that the IRM provided adequate protection against the single rod withdrawal error, a range of rod withdrawal accidents was analyzed. This analysis included starting the accident at various power levels. The most severe case involves an initial condition in which the reactor is just subcritical and the IRM system is not yet on scale. This condition exists at quarter rod density. Additional conservatism was taken in this analysis by assuming that the IRM channel closest to the withdrawn rod is bypassed. The results of this analysis show that the reactor is scrammed and peak power limited to one percent of rated power, thus maintaining MCPR above the fuel cladding integrity safety limit. Based on the above analysis, the IRM provides protection against local control rod withdrawal errors and continuous withdrawal of control rods in sequence.

B. Deleted

C. <u>Reactor Low Water Level Scram</u>

The reactor low water level scram is set at a point which will prevent reactor operation with the steam separators uncovered, thus limiting carry under to the recirculation loops. In addition, the safety limit is based on a water level below the scram point and therefore this setting is provided.

D. <u>Reactor Low Water Level ECCS Initiation Trip Point</u>

The core standby cooling subsystems are designed to provide sufficient cooling to the core to dissipate the energy associated with the loss-of-coolant accident and to limit fuel clad temperature to well below the clad melting temperature, and to limit clad metal-water reaction to less than 1%, to assure that core geometry remains intact.

The design of the ECCS components to meet the above criteria was dependent on three previously set parameters: the maximum break size, the low water level scram setpoint, and the ECCS initiation setpoint. To lower the ECCS initiation setpoint would now prevent the ECCS components from meeting their design criteria. To raise the ECCS initiation setpoint would be in a safe direction, but it would reduce the margin established to prevent actuation of the ECCS during normal operation or during normally expected transients.

A.1

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BASES: 2.1 (Cont'd)

E. Turbine Stop Valve Closure Scram Trip Setting

The turbine stop valve closure scram trip anticipates the pressure, neutron flux and heat flux increase that could result from rapid closure of the turbine stop valves. With a scram trip setting of $\leq$10% of valve closure from full open, the resultant increase in surface heat flux is limited such that MCPR remains above the fuel cladding integrity safety limit even during the worst case transient that assumes the turbine bypass is closed. This scram signal may be bypassed at $\leq$30% of reactor Rated Thermal Power.

F. Turbine Control Valve Fast Closure Scram

The control valve fast closure scram is provided to limit the rapid increase in pressure and neutron flux resulting from fast closure of the turbine control valves due to a load rejection coincident with failure of the bypass system. This transient is less severe than the turbine stop valve closure with failure of the bypass valves and therefore adequate margin exists. This scram signal may be bypassed at $\leq$30% of reactor Rated Thermal Power.

G. Main Steam Line Isolation Valve Closure Scram

The isolation scram anticipates the pressure and flux transients which occur during an isolation event and the loss of inventory during a pipe break. This action minimizes the effect of this event on the fuel and pressure vessel.

H. Reactor Coolant Low Pressure Initiation of Main Steam Isolation Valve Closure

The low pressure isolation of the main steam lines at 800 psig is provided to give protection against rapid reactor depressurization and the resulting rapid cooldown of the vessel. Advantage is taken of the scram feature which occurs when the main steam line isolation valves are closed, to provide the reactor shutdown so that high power operation at low reactor pressure does not occur. Operation of the reactor at pressures lower than 800 psig requires that the reactor mode switch be in the startup position where protection of the fuel cladding integrity safety limit is provided by the IRM high neutron flux scram.

Thus, the combination of main steam line low pressure isolation and isolation valve closure scram assures the availability of neutron scram protection over the entire range of applicability of the fuel cladding integrity safety limit.

A.1

BASES:

3.1 Reactor Protection System

The reactor protection system automatically initiates a reactor scram to:

1. preserve the integrity of the fuel barrier;
2. preserve the integrity of the primary system barrier; and
3. minimize the energy which must be absorbed, and prevent criticality following a loss of coolant accident.

This specification provides the limiting conditions for operation necessary to preserve the ability of the system to tolerate single failures and still perform its intended function even during periods when instrument channels may be out of service because of maintenance, testing, or calibration. The basis for the allowable out-of-service times is provided in GE Topical Report NEDC-30851P-A, "Technical Specification Improvement Analysis for BWR Reactor Protection System," March 1988.

The reactor protection system is of the dual channel type. The system is made up of two independent logic channels, each having three subsystems of tripping devices. One of the three subsystems has inputs from the manual scram push buttons and the reactor mode switch. Each of the two remaining subsystems has an input from at least one independent sensor monitoring each of the critical parameters. The outputs of these subsystems are combined in a 1 out of 2 logic; i.e., an input signal on either one or both of the subsystems will cause a trip system trip. The outputs of the trip systems are arranged so that a trip on both logic channels is required to produce a reactor scram.

The required conditions when the minimum instrument logic conditions are not met are chosen so as to bring station operation promptly to such a condition that the particular protection instrument is not required; or the station is placed in the protection or safe condition that the instrument initiates. This is accomplished in a normal manner without subjecting the plant to abnormal operating conditions.

When the minimum requirements for the number of operable or operating trip system and instrumentation channels are satisfied, the effectiveness of the protection system is preserved; i.e., the system can tolerate a single failure and still perform its intended function of scramming the reactor.

Three APRM instrument channels are provided for each protection trip system to provide for high neutron flux protection. APRM's A and E operate contacts in a trip subsystem, and APRM's C and E operate contacts in the other trip subsystem. APRM's B, D, and F are arranged similarly in the other protection trip system. Each protection trip system has one more APRM than is necessary to meet the minimum number required. This allows the bypassing of one APRM per protection trip system for maintenance, testing, or calibration without changing the minimum number of channels required for inputs to each trip system. Additional IRM channels have also been provided to allow bypassing of one such channel. For a description of the Neutron Monitoring Systems, see FSAR Section 7.5.

The bases for the scram settings for the IRM, APRM, high reactor pressure, reactor low water level, turbine control valve fast closure, and turbine stop valve closure are discussed in Specification 2.1.

A.1

BASES: 3.1 (Cont'd)

Instrumentation is provided to detect a loss-of-coolant accident and initiate the core standby cooling equipment. This instrumentation is a backup to the water level instrumentation which is discussed in Specification 3.2.

The Control Rod Drive Scram System is designed so that all of the water that is discharged from the reactor by the scram can be accommodated in the discharge piping. This discharge piping is divided into two sections. One section services the control rod drives on the north side of the reactor, the other serves the control rod drives of the south side. A part of the piping in each section is an instrument volume which accommodates in excess of 21 gallons of water and is at the low point in the piping. No credit was taken for this volume in the design of the discharge piping as concerns the amount of water which must be accommodated during a scram. During normal operation, the discharge volume is empty; however, should it fill with water, the water discharged to the piping from the reactor could not be accommodated, which would result in slow scram times or partial or no control rod insertion. To preclude this occurrence, level instrumentation has been provided for the instrument volume which scram the reactor when the volume of water reaches 21 gallons. As indicated above, there is sufficient volume in the piping to accommodate the scram without impairment of the scram times or amount of insertion of the control rods. This function shuts the reactor down while sufficient volume remains to accommodate the discharged water, and precludes the situation in which a scram would be required but not be able to perform its function adequately. The present design of the Scram Discharge System is in concert with the BWR Owner's Group criteria, which have previously been endorsed by the NRC in their generic "Safety Evaluation Report (SER) for Scram Discharge Systems", dated December 1, 1980.

Loss of condenser vacuum occurs when the condenser can no longer handle the heat input. Loss of condenser vacuum initiates a closure of the turbine stop valves and turbine bypass valves which eliminates the heat input to the condenser. Closure of the turbine stop and bypass valves causes a pressure transient, neutron flux rise, and an increase in surface heat flux. To prevent the clad safety limit from being exceeded if this occurs, a reactor scram occurs on turbine stop valve closure. The turbine stop valve closure scram function alone is adequate to prevent the clad safety limit from being exceeded in the event of a turbine trip transient without bypass.

Turbine stop valve (TSV) closure and turbine control valve (TCV) fast closure scram signals may be bypassed at $\leq$30% of reactor Rated Thermal Power since, at low thermal power levels, the margins to fuel thermal-hydraulic limits and reactor primary coolant boundary pressure limits are large and an immediate scram is not necessary. This bypass function is normally accomplished automatically by pressure switches sensing turbine first stage pressure. The turbine first stage pressure setpoint controlling the bypass of the scram signals on TCV fast closure and TSV closure is derived from analysis of reactor pressurization transients. Certain operational factors, such as turbine bypass valves open, can influence the relationship between turbine first stage pressure and reactor Rated Thermal Power. However, above 30% of reactor Rated Thermal Power, these scram functions must be enabled.

BASES: 3.1 (Cont'd)

The main steam line isolation valve closure scram is set to scram when the isolation valves are 10 percent closed from full open in 3-out-of-4 lines. This scram anticipates the pressure and flux transient, which would occur when the valves close. By scramming at this setting, the resultant transient is insignificant.

A reactor mode switch is provided which actuates or bypasses the various scram functions appropriate to the particular plant operating status.

The manual scram function is active in all modes, thus providing for manual means of rapidly inserting control rods during all modes of reactor operation.

The IRM system provides protection against short reactor periods and, in conjunction with the reduced APRM system provides protection against excessive power levels in the startup and intermediate power ranges. A source range monitor (SRM) system is also provided to supply additional neutron level information during startup and can provide scram function with selected shorting links removed during refueling. Thus, the IRM and the reduced APRM are normally required in the startup mode and may be required in the refuel mode. During some refueling activities which require the mode switch in startup; it is allowable to disconnect the LPRMs to protect them from damage during under vessel work. In lieu of the protection provided by the reduced APRM scram, both the IRM scram and the SRM scram in noncoincidence are used to provide neutron monitoring protection against excessive power levels. In the power range, the normal APRM system provides required protection. Thus, the IRM system and 15% APRM scram are not required in the run mode.

If an unsafe failure is detected during surveillance testing, it is desirable to determine as soon as possible if other failures of a similar type have occurred and whether the particular function involved is still operable or capable of meeting the single failure criteria. To meet the requirements of Table 3.1.1, it is necessary that all instrument channels in one trip system be operable to permit testing in the other trip system.

Thus, when failures are detected in the first trip system tested, they would have to be repaired before testing of the other system could begin. In the majority of cases, repairs or replacement can be accomplished quickly. If repair or replacement cannot be completed in a reasonable time, operation could continue with one tripped system until the surveillance testing deadline.

A.1

BASES: 3.1 (Cont'd)

The requirement to have all scram functions, except those listed in Table 3.1.1, operable in the "Refuel" mode is to assure that shifting to this mode during reactor operation does not diminish the need for the reactor protection system.

The ability to bypass one instrument channel when necessary to complete surveillance testing will preclude continued operation with scram functions which may be either unable to meet the single failure criteria or completely inoperable. It also eliminates the need for an unnecessary shutdown if the remaining channels and subsystems are found to be operable. The conditions under which the bypass is permitted require an immediate determination that the particular function is operable. However, during the time a bypass is applied, the function will not meet the single failure criteria; therefore, it is prudent to limit the time the bypass is in effect by requiring that surveillance testing proceed on a continuous basis and that the bypass be removed as soon as testing is completed.

Sluggish indicator response during the perturbation test will be indicative of a plugged instrument line or closed instrument valves. This test assures the operability of the reactor pressure sensors as well as the reactor level sensors since both parameters are monitored through the same instrument lines.

The independence of the safety system circuitry is determined by operation of the scram test switch. Operation of this switch during the refueling outage and following maintenance on these circuits will assure their continued independence.

A.1

BASES: 4.1 REACTOR PROTECTION SYSTEM

A. The scram sensor channels listed in Tables 4.1.1 and 4.1.2 are divided into three groups: A, B and C. Sensors that make up Group A are the on-off type and will be tested and calibrated at the indicated intervals.

Group B devices utilize an analog sensor followed by an amplifier and bistable trip circuit. This type of equipment incorporates control room mounted indicators and annunciator alarms. A failure in the sensor or amplifier may be detected by an alarm or by an operator who observes that one indicator does not track the others in similar channels. The bistable trip circuit failures are detected by the periodic testing.

Group C devices are active only during a given portion of the operating cycle. For example, the IRM is active during start-up and inactive during full-power operation. Testing of these instruments is only meaningful within a reasonable period prior to their use.

The basis for a three-month functional test interval for group (A) and (B) sensors is provided in NEDC-30851P-A, "Technical Specification Improvement Analysis for BWR Reactor Protection Systems," March 1988.

SRM/IRM/APRM overlap Surveillances are established to ensure that no gaps in neutron flux indication exist from subcritical to power operation for monitoring core reactivity status.

The overlap between SRMs and IRMs is required to be demonstrated to ensure that reactor power will not be increased into a neutron flux region without adequate indication. This is required prior to withdrawing SRMs from the fully inserted position since indication is being transitioned from the SRMs to the IRMs.

The overlap between IRMs and APRMs is of concern when reducing power into the IRM range. On power increases, the system design will prevent further increases (by initiating a rod block) if adequate overlap is not maintained. Overlap between IRMs and APRMs exists when sufficient IRMs and APRMs concurrently have onscale readings such that the transition between the RUN and STARTUP/HOT STANDBY Modes can be made without either APRM downscale rod block, or IRM upscale rod block. Overlap between SRMs and IRMs similarly exists when, prior to withdrawing the SRMs from the fully inserted position, IRMs are above mid-scale on range 1 before SRMs have reached the upscale rod block.

As noted, IRM/APRM overlap is only required to be met during entry into STARTUP/HOT STANDBY Mode from the Run Mode. That is, after the overlap requirement has been met and indication has transitioned to the IRMs, maintaining overlap is not required (APRMs may be reading downscale once in the STARTUP/HOT STANDBY Mode).

If overlap for a group of channels is not demonstrated (e.g., IRM/APRM overlap), the reason for the failure of the Surveillance should be determined and the appropriate channel(s) declared inoperable. Only those appropriate channels that are required in the current condition should be declared inoperable.

A.1

BASES: 4.1 (Cont'd)

The calibration of the APRM High Flux Flow Bias trip units provides a check of the actual trip setpoints. If the trip setting is found to be less conservative than accounted for in the appropriate setpoint calculation, but is not beyond the Allowable Value specified in Table 3.1.1, the channel performance is still within the requirements of the plant safety analysis. However, if the trip setting is found to be less conservative than the Allowable Value specified in Table 3.1.1, the channel should be declared inoperable. Under these conditions, the setpoint should be readjusted to be equal to or more conservative than accounted for in the appropriate setpoint calculation. The specified trip unit calibration frequency (i.e., every 3 months) is consistent with the assumptions of the VYNPS setpoint methodology and the reliability analysis of NEDC-30851-P-A, "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.

LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the APRM System. The 2,000 megawatt-days per short ton (MWD/T) frequency is based on operating experience with LPRM sensitivity changes, and that the resulting nodal power uncertainty, combined with other identified uncertainties, remains less than the total uncertainty (i.e., 8.7%) allowed by the GETAB safety limit analysis.

4.1

BASES:

3.2 PROTECTIVE INSTRUMENTATION

In addition to reactor protection instrumentation which initiates a reactor scram, station protective instrumentation has been provided which initiates action to mitigate the consequences of accidents which are beyond the reactor operator's ability to control, or terminate a single operator error before it results in serious consequences. This set of Specifications provides the limiting conditions of operation for the primary system isolation function and initiation of the core standby cooling and standby gas treatment systems. The objectives of the Specifications are (i) to assure the effectiveness of any component of such systems even during periods when portions of such systems are out of service for maintenance, testing, or calibration, and (ii) to prescribe the trip settings required to assure adequate performance. This set of Specifications also provides the limiting conditions of operation for the control rod block system and surveillance instrumentation.

Isolation valves are installed in those lines that penetrate the primary containment and must be isolated during a loss-of-coolant accident so that the radiation dose limits are not exceeded during an accident condition. Actuation of these valves is initiated by protective instrumentation shown in Table 3.2.2 which senses the conditions for which isolation is required. Such instrumentation must be available whenever primary containment integrity is required. The objective is to isolate the primary containment so that the limits of 10CFR50.67 are not exceeded during an accident. The objective of the low turbine condenser vacuum trip is to minimize the radioactive effluent releases to as low as practical in case of a main condenser failure. Subsequent releases would continue until operator action was taken to isolate the main condenser unless the main steam line isolation valves were closed automatically on low condenser vacuum. The manual bypass is required to permit initial startup of the reactor during low power operation.

The instrumentation which initiates primary system isolation is connected in a dual channel arrangement. Thus, the discussion given in the bases for Specification 3.1 is applicable here.

The low reactor water level instrumentation is set to trip when reactor water level is 127" above the top of the enriched fuel. This trip initiates closure of Group 2 and 3 primary containment isolation valves. For a trip setting of 127" above the top of the enriched fuel, the valves will be closed before perforation of the clad occurs even for the maximum break and, therefore, the setting is adequate.

The top of the enriched fuel (351.5" from vessel bottom) is designated as a common reference level for all reactor water level instrumentation. The intent is to minimize the potential for operator confusion which may result from different scale references.

The low-low reactor water level instrumentation is set to trip when reactor water level is 82.5" H_2O indicated on the reactor water level instrumentation above the top of the enriched fuel. This trip initiates closure of the Group 1 primary containment isolation valves and also activates the ECCS and RCIC System and starts the standby diesel generator system. This trip setting level was chosen to be low enough to prevent spurious operation, but high enough to initiate ECCS operation and primary system isolation so that no melting of the fuel cladding will occur, and so that post-accident cooling can be accomplished and the limits of 10CFR50.67 will not be violated.

A.1

BASES: 3.2 (Cont'd)

For the complete circumferential break of 28-inch recirculation line and with the trip setting given above, ECCS initiation and primary system isolation are initiated in time to meet the above criteria. The instrumentation also covers the full range of spectrum breaks and meets the above criteria.

The high drywell pressure instrumentation is a backup to the water level instrumentation, and in addition to initiating ECCS, it causes isolation of Group 2, 3, and 4 isolation valves. For the complete circumferential break discussed above, this instrumentation will initiate ECCS operation at about the same time as the low-low water level instrumentation, thus, the results given above are applicable here also. Certain isolation valves including the TIP blocking valves, CAD inlet and outlet, drywell vent, purge and sump valves are isolated on high drywell pressure. However, since high drywell pressure could occur as the result of non-safety-related causes, such as not venting the drywell during startup, complete system isolation is not desirable for these conditions and only certain valves are required to close. The water level instrumentation initiates protection for the full spectrum of loss of coolant accidents and causes a trip of certain primary system isolation valves.

Venturis are provided in the main steam lines as a means of measuring steam flow and also limiting the loss of mass inventory from the vessel during a steam line break accident. In addition to monitoring steam flow, instrumentation is provided which causes a trip of Group 1 isolation valves. The primary function of the instrumentation is to detect a break in the main steam line, thus only Group 1 valves are closed. For the worst case accident, main steam line break outside the drywell, this trip setting of 140 percent of rated steam flow in conjunction with the flow limiters and main steam line valve closure limit the mass inventory loss such that fuel is not uncovered, cladding temperatures remain less than 1295°F and release of radioactivity to the environs is well below 10CFR50.67.

Temperature monitoring instrumentation is provided in the main steam line tunnel to detect leaks in this area. Trips are provided on this instrumentation and when exceeded cause closure of Group 1 isolation valves. Its setting of ambient plus 95°F is low enough to detect leaks of the order of 5 to 10 gpm; thus, it is capable of covering the entire spectrum of breaks. For large breaks, it is a backup to high steam flow instrumentation discussed above, and for small breaks, with the resultant small release of radioactivity, gives isolation before the limits of 10CFR50.67 are exceeded.

Isolation of the condenser mechanical vacuum pump (MVP) is assumed in the safety analysis for the control rod drop accident (CRDA). The MVP isolation instrumentation initiates closure of the MVP suction isolation valve following events in which main steam line radiation monitors exceed a predetermined value. A High Main Steam Line Radiation Monitor trip setting for MVP isolation of ≤ 3 times background at rated thermal power (RTP) is as low as practicable without consideration of spurious trips from nitrogen-16 spikes, instrument instabilities and other operational occurrences. Isolating the condenser MVP limits the release of fission products in the event of a CRDA.

Pressure instrumentation is provided which trips when main steam line pressure drops below 800 psig. A trip of this instrumentation results in closure of Group 1 isolation valves. In the refuel, shutdown, and startup modes, this trip function is provided when main steam line flow exceeds 40% of rated capacity. This function is provided primarily to provide protection against a pressure regulator malfunction which would cause the

A.1

BASES: 3.2 (Cont'd)

control and/or bypass valves to open, resulting in a rapid depressurization and cooldown of the reactor vessel. The 800 psig trip setpoint limits the depressurization such that no excessive vessel thermal stress occurs as a result of a pressure regulator malfunction. This setpoint was selected far enough below normal main steam line pressures to avoid spurious primary containment isolations.

Low condenser vacuum has been added as a trip of the Group 1 isolation valves to prevent release of radioactive gases from the primary coolant through condenser. The setpoint of 12 inches of mercury absolute was selected to provide sufficient margin to assure retention capability in the condenser when gas flow is stopped and sufficient margin below normal operating values.

The HPCI and/or RCIC high flow and temperature instrumentation is provided to detect a break in the HPCI and/or RCIC piping. The HPCI and RCIC steam supply pressure instrumentation is provided to isolate the systems when pressure may be too low to continue operation. These isolations are for equipment protection. However, they also provide a diverse signal to indicate a possible system break. These instruments are included in Technical Specifications because of the potential for possible system initiation failure if not properly tested. Tripping of this instrumentation results in actuation of HPCI and/or RCIC isolation valves, i.e., Group 6 valves. A time delay has been incorporated into the RCIC steam flow trip logic to prevent the system from inadvertently isolating due to pressure spikes which may occur on startup. The trip settings are such that core uncovering is prevented and fission product release is within limits.

The instrumentation which initiates ECCS action is arranged in a dual channel system. Permanently installed circuits and equipment may be used to trip instrument channels. In the nonfail safe systems which require energizing the circuitry, tripping an instrument channel may take the form of providing the required relay function by use of permanently installed circuits. This is accomplished in some cases by closing logic circuits with the aid of the permanently installed test jacks or other circuitry which would be installed for this purpose.

The Rod Block Monitor (RBM) control rod block functions are no longer credited in the Rod Withdrawal Error (RWE) Analysis. The RBM setpoints are based on providing operational flexibility in the MELLLA region.

For single recirculation loop operation, the RBM trip setting is reduced in accordance with the analysis presented in NEDO-30060, February 1983. This adjustment accounts for the difference between the single loop and two loop drive flow at the same core flow, and ensures that the margin of safety is not reduced during single loop operation.

During hot shutdown, cold shutdown, and refueling when the reactor mode switch is required to be in the shutdown position, the core is assumed to be subcritical with sufficient shutdown margin; therefore, no positive reactivity insertion events are analyzed. The Reactor Mode Switch-Shutdown Position control rod withdrawal block, required to be operable with the mode switch in the shutdown position, ensures that the reactor remains subcritical by blocking control rod withdrawal, thereby preserving the assumptions of the safety analysis. Two channels are required to be

A.1

BASES: 3.2 (Cont'd)

operable to ensure that no single channel failure will preclude a rod block when required. There is no trip setting for this function since the channels are mechanically actuated based solely on reactor mode switch position. During refueling with the reactor mode switch in the refueling position, the refuel position one-rod-out interlock provides the required control rod withdrawal blocks.

To prevent excessive clad temperatures for the small pipe break, the HPCI or Automatic Depressurization System must function since, for these breaks, reactor pressure does not decrease rapidly enough to allow either core spray or LPCI to operate in time. For a break or other event occurring outside the drywell, the Automatic Depressurization System is initiated on low-low reactor water level only after a time delay. The arrangement of the tripping contacts is such as to provide this function when necessary and minimize spurious operation. The trip settings given in the Specification are adequate to ensure the above criteria are met. The Specification preserves the effectiveness of the system during periods of maintenance, testing, or calibration, and also minimizes the risk of inadvertent operation; i.e., only one instrument channel out of service.

The ADS is provided with inhibit switches to manually prevent automatic initiation during events where actuation would be undesirable, such as certain ATWS events. The system is also provided with an Appendix R inhibit switch to prevent inadvertent actuation of ADS during a fire which requires evacuation of the Control Room.

Four radiation monitors are provided which initiate isolation of the reactor building and operation of the standby gas treatment system. The monitors are located in the reactor building ventilation duct and on the refueling floor. Any one upscale trip or two downscale trips of either set of monitors will cause the desired action. Trip settings for the monitors on the refueling floor are based upon initiating normal ventilation isolation and standby gas treatment system operation so that none of the activity released during the refueling accident leave the Reactor Building via the normal ventilation stack but that all activity is processed by the standby gas treatment system. Trip settings for the monitors in the ventilation duct are based upon initiation of the normal ventilation isolation and standby gas treatment system operation at a radiation level equivalent to the maximum site boundary dose rate of 500 mrem/year as set forth in the Offsite Dose Calculation Manual. The monitoring system in the plant stack represents a backup to this system to limit gross radioactivity releases to the environs.

The purpose of isolating the mechanical vacuum pump line is to limit release of radioactivity from the main condenser. During an accident, fission products would be transported from the reactor through the main steam line to the main condenser. The fission product radioactivity would be sensed by the main steam line radiation monitors which initiate isolation.

A.1

BASES: 3.2 (Cont'd)

Specification 3.2.G requires that the post-accident monitoring (PAM) instrumentation of Table 3.2.6 be operable during reactor power operation. PAM instrumentation is not required to be operable during shutdown and refueling conditions when the likelihood of an event that would require PAM instrumentation is extremely low. The primary purpose of the PAM instrumentation is to display plant variables that provide information required by the control room operators during accident situations. This information provides the necessary support for the operator to take the manual actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for design basis accidents. The operability of the PAM instrumentation ensures that there is sufficient information available on selected plant parameters to monitor and assess plant status and behavior following an accident. This capability is consistent with the recommendations of Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident."

In most cases, Table 3.2.6 requires a minimum of two operable channels to ensure that the operators are provided the information necessary to determine the status of the plant and to bring the plant to, and maintain it in, a safe condition following an accident. For the majority of parameters monitored, when one of the required channels is inoperable, the required inoperable channel must be restored to operable status within 30 days. The 30-day completion time is based on operating experience and takes into account the remaining operable channel (or in the case of a parameter that has only one required channel, an alternate means to monitor the parameter), the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the low probability of an event requiring PAM instrumentation during this interval.

If a PAM instrument channel has not been restored to an operable status within the specified interval, the required action is to prepare a written report to be submitted to the NRC within the following 14 days. When a special written report is required in accordance with the provisions of Table 3.2.6, the report will outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation to an operable status. This action is appropriate in lieu of a shutdown requirement, since alternative actions are identified before loss of functional capability, and given the likelihood of plant conditions that would require information provided by this instrumentation.

For the majority of PAM instrumentation, when two required channels are inoperable (or in the case of a parameter that is monitored by only one channel, the channel and an alternate means are inoperable), one channel (or the required alternate means) should be restored to an operable status within seven days. The completion time of seven days is based on the relatively low probability of an event requiring PAM instrumentation and the normal availability of alternate means to obtain the required information. Where specified, continuous operation with two required channels inoperable (or one channel and the required alternate means inoperable) is not acceptable after seven days. Therefore, restoration of one inoperable channel limits the risk that the PAM function will be in a degraded condition should an accident occur.

A.1

BASES: 3.2 (Cont'd)

For the majority of PAM instrumentation in Table 3.2.6, if two of the required channels (one required channel per valve and alternate means for safety valve position indication) remain inoperable beyond the allowed interval, actions must be taken to place the reactor in a mode or condition in which the limiting condition for operation does not apply. To achieve this status, the reactor must be brought to at least hot shutdown within 12 hours. The allowed completion time is reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. It is not necessary to bring the reactor to cold shutdown since plant conditions during hot shutdown are such that the likelihood of an accident that would require PAM instrumentation is extremely low.

The Degraded Grid Protective System has been installed to assure that safety-related electrical equipment will not be subjected to sustained degraded voltage. This system incorporates voltage relays on 4160 Volt Emergency Buses 3 and 4 which are set to actuate at the minimum voltage required to prevent damage of safety-related equipment.

If Degraded Grid conditions exist for 10 seconds, either relay will actuate an alarm to alert operators of this condition. Based upon an assessment of these conditions the operator may choose to manually disconnect the off-site power. In addition, if an ESF signal is initiated in conjunction with low voltage below the relay setpoint for 10 seconds, the off-site power will be automatically disconnected.

The Reactor Core Isolation Cooling (RCIC) System provides makeup water to the reactor vessel during shutdown and isolation to supplement or replace the normal makeup sources without the use of the Emergency Core Cooling Systems. The RCIC System is initiated automatically upon receipt of a reactor vessel low-low water level signal. Reactor vessel high water level signal results in shutdown of the RCIC System. However, the system will restart on a subsequent reactor vessel low-low water level signal. The RCIC System is normally lined up to take suction from the condensate storage tank. Suction will automatically switch over from the condensate storage tank to the suppression pool on low condensate storage tank level.

Upon receipt of a LOCA initiation signal, if normal AC power is available, all RHR pumps and both Core Spray pumps start simultaneously with no intentional time delay. If normal AC power is not available, RHR pumps A and D start immediately on restoration of power, RHR pumps B and C start within 3 to 5 seconds of restoration of power and both Core Spray pumps start within 8 to 10 seconds of restoration of power. The purpose of these time delays is to stagger the start of the RHR and Core Spray pumps on the associated Division 1 and Division 2 Buses, thus limiting the starting transients on the 4.16 kV emergency buses. The time delay functions are only necessary when power is being supplied from the standby power sources (EDGs). The time delays remain in the pump start logic at all times as the time delay relay contact is in parallel with the Auxiliary Power Monitor relay contact. Either contact closure will initiate pump start. Thus, the time delays do not affect low pressure ECCS pump operation with normal AC power available. With normal AC power not available, the pump start relays which would have started the B and C RHR pumps and both Core Spray pumps are blocked by the Auxiliary Power Monitor contacts and the pump start time delay relays become the controlling devices.

A.1

BASES:

4.2 PROTECTIVE INSTRUMENTATION

The Protective Instrumentation Systems covered by this Specification are listed in Table 4.2. Most of these protective systems are composed of two or more independent and redundant subsystems which are combined in a dual-channel arrangement. Each of these subsystems contains an arrangement of electrical relays which operate to initiate the required system protective action.

The relays in a subsystem are actuated by a number of means, including manually-operated switches, process-operated switches (sensors), bistable devices operated by analog sensor signals, timers, limit switches, and other relays. In most cases, final subsystem relay actuation is obtained by satisfying the logic conditions established by a number of these relay contacts in a logic array. When a subsystem is actuated, the final subsystem relay(s) can operate protective equipment, such as valves and pumps, and can perform other protective actions, such as tripping the main turbine generator unit.

With the dual-channel arrangement of these subsystems, the single failure of a ready circuit can be tolerated because the redundant subsystem or system (in the case of high pressure coolant injection) will then initiate the necessary protective action. If a failure in one of these circuits occurs in such a way that an action is taken, the operator is immediately alerted to the failure. If the failure occurs and causes no action, it could then remain undetected, causing a loss of the redundancy in the dual-channel arrangement. Losses in redundancy of this nature are found by periodically testing the relay circuits and contacts in the subsystems to assure that they are operating properly.

The surveillance test interval for the instrumentation channel functional tests are once/three months for most instrumentation. The allowable out-of-service times and surveillance interval is based on the following NRC approved licensing topical reports:

1. GE Topical Report NEDC-30851P-A, "Technical Specification Improvement Analysis for BWR Reactor Protection System," March 1988.

2. GE Topical Report NEDC-30851P-A, Supplement 1 "Technical Specification Improvement Analysis for BWR Control Rod Block Instrumentation," October 1988.

3. GE Topical Report NEDC-30851P-A, Supplement 2 "Technical Specification Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," March 1989.

4. GE Topical Report NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," July 1990.

5. GE Topical Report NEDC-30936P-A, Parts 1 and 2, "BWR Owners Group Technical Specification Improvement Methodology (With Demonstration for BWR ECCS Actuation Instrumentation)," December 1988.

6. GE Topical Report GENE-770-06-1-A, "Bases for Changes to Surveillance Test Intervals and Allowed Out-Of-Service Times For Selected Instrumentation Technical Specifications," December 1992.

7. GE Topical Report GENE-770-06-2-A, "Addendum to Bases for Changes to Surveillance Test Intervals and Allowed Out-Of-Service Times For Selected Instrumentation Technical Specifications," December 1992.

A.1

BASES:

4.2 PROTECTIVE INSTRUMENTATION (Cont'd)

Since logic circuit tests may result in the actuation of plant equipment, testing of this nature is generally performed during a refueling outage. In this way, the testing of equipment should not jeopardize plant operation.

These surveillance requirements provide a periodic testing program for protective instrumentation to demonstrate that systems and components function satisfactorily and include schedules for performing functional tests, calibrations, and logic system functional tests. The testing of a subsystem includes a functional test of each relay wherever practicable. The testing of each relay includes all circuitry necessary to make the relay operate, and also the proper functioning of the relay contacts. Testing of the automatic initiation inhibit switches verifies the proper operability of the switches and relay contacts. Functional testing of the inaccessible temperature switches associated with the isolation systems is accomplished remotely by application of a heat source to individual switches.

All subsystems are functionally tested, calibrated, and operated in their entirety.

A channel functional test is performed for the Reactor Mode Switch - Shutdown Position function to ensure that the entire channel will perform the intended function. The surveillance is only required to be performed once per operating cycle during refueling. The Refueling Outage frequeency is based on the need to perform this surveillance under the conditions that apply during a plant outage. Operating experience has shown that this surveillance frequency is adequate to ensure functional operability. Note 12 of Table 4.2.5 specifies that if the surveillance frequency of every Refueling Outage is not met, functional testing of the Reactor Mode Switch - Shutdown Position function shall be initiated within 1 hour after the reactor mode switch is placed in the Shutdown position for the purpose of commencing a scheduled Refueling Outage. This allows entry into the Shutdown mode when the surveillance requirement is not met.

ATTACHMENT 3 TO BVY 05-068

CALCULATION NUMBER VYC-0723 REVISION 3, CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING, WITH CALCULATION CHANGE NOTICES CCN-01 THROUGH CCN-04, AND TECHNICAL EVALUATION NO. TE-2001-048, TABLE 1, CST LEVEL AND VOLUME

ENTERGY NUCLEAR OPERATIONS, INC.
VERMONT YANKEE NUCLEAR POWER STATION
DOCKET NO. 50-271

Sect: 28
Attach:
A - 2
B - 2
C - 7
D - 43
E - 7
F - 5
G - 13
H - 2
I - 2
J - 5
K - 15
L - 19
M - 48
N - 6
O - 9
P - 35
248 - Total Pages

ORIGINAL: PAGE 1 of 12 PAGES
Rev. 1: PAGE 1 of 12 PAGES
Rev. 2: PAGE 1 of 12 PAGES
Rev. 3: PAGE 1 of 28 PAGES

QA RECORD?

X YES

___ NO

RECORD TYPE NO. 09.C16.004

Safety Class/P.O. NO. (if applicable) SC2 / SCE

YANKEE ATOMIC ELECTRIC COMPANY CALCULATION/ANALYSIS FOR

TITLE CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING

PLANT VERMONT YANKEE CYCLE 20

CALCULATION NUMBER VYC-723

THIS REVISION IS A MAJOR RE-WRITE

	PREPARED BY/DATE	REVIEWED BY/DATE	APPROVED BY/DATE	SUPERSEDES CALC./REV. NO.
ORIGINAL	George J. Hengerle 4/28/89	Roger T. Vibert 5/12/89	Richard G. January 6/9/89	N/A
1	Stuart J. Joseph 1/22/90	Roger T. Vibert 1/29/90	Roger T. Vibert 1/29/90	Original
2	George J. Hengerle 2/29/96	Louis Casey 2/29/96	Roger T. Vibert 3/1/96	1
3	Brian F. Davidson 11/21/98	Michael Anderson 11-23-98 for Mike Anderson RTV 11-23-98	11-23-98 George Hengerle	2

KEYWORDS: Instrument Uncertainty, HPCI, CST, RG 1.97

COMPUTER CODES: None

EQUIP/TAG NOs.: LT-107-5A & B, LSL-107-5A & B, LI-107-5, LR-23-73, ES-16-19-43, ES-1-156-5, ERFIS PTID F004

SYSTEMS: High Pressure Coolant Injection (HPCI), Condensate Demineralized Water Transfer System

REFERENCES: See Section 6.0

FORM WE-103-1
Revision 5

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History of Revisions

Rev. No.	Approval Date	Reason & Description of Change
ORIGINAL	6/9/89	Initial Issue
1	1/29/90	Revised calculation to remove consideration for seismic effect for alarm units (Attach.VIII), revised for new EQ Manual Rev. and OP-4363 Rev., and correct minor administrative errors.
2	3/1/96	Revised setpoint, improved error determination methodology, and resolution of CST issues. Develop and capture bases for TS suction transfer requirement, 10,000 usable gallons at suction transfer, and 75,000 gallons available in CST.
3		**Major Re-write:** Revise method and format to comply with VY Uncertainty and Setpoint Design Guide and to support implementation of Improved Technical Specifications (ITS). Prior revisions of VYC-723 developed and documented the bases for the Technical Specification suction transfer requirement of ≥ 3%, minimum 10,000 gallon usable volume at suction transfer, and Technical Specification requirement for minimum available volume of 75,000 gallons in CST. Revision 3 will remove these bases due to their subsequent evaluation and incorporation into VYC-1844 Rev. 0. Due to the extent of input/output and format changes, this revision is a major re-write and revision bars are not used.

1. PURPOSE

1.1. Calculation Objectives

This calculation has been developed in support of the Vermont Yankee Setpoints program and covers instrument loops LT-107-5A and LT-107-5B in the Condensate and Demineralized Water Transfer System and has the following major objectives:

1. Document the instrument loop functions and the basis for the setpoint(s).
2. Establish the total loop uncertainty for each output function and verify consistency with the design basis.
3. Calculate the limiting setpoints and Allowable Value (AV) for inclusion in the Improved Technical Specifications (ITS) if applicable.
4. Evaluate the adequacy of the existing setpoint and calibration limits.
5. Provide as-found and as-left tolerances for use in instrument calibration and functional test procedures. Determine Measuring and Test Equipment selection requirements. Verify and document process corrections, instrument scaling, and calibration methods.
6. VYDEP-15 requires that applicable operating procedures, alarm responses, and standard, off-normal, and emergency operating procedures be included in the evaluation. This requirement is accomplished by the inter-departmental review which supplements the WE-103 review process.

1.2. System & Components

This calculation applies to the Condensate Storage Tank Level Monitoring Loops which provide automatic HPCI suction transfer as well as Post Accident Monitoring level indication. The specific components addressed are as listed in Table 1 below.

Table 1
Component Identification

Tag Number	Manufacturer	Model	Rack/Cabinet	Description (MPAC)	SYS	Flow Diagram	CWD (B-191301)
LT-107-5A	GE	50-555111ADAA3AEB	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LT-107-5B	GE	50-555111ADAA3PBI	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LSL-107-5A LSL-107-5B	GE	50-560321AAAC1	CRP 9-20	HPCI CST LEVEL SWITCH	107	G-191176 Sheet 1	Sheet 1229A
LI-107-5	GE	180	CRP 9-6	CONDENSATE STORAGE TANK LEVEL INDICATOR	107	G-191176 Sheet 1	Sheet 1229A
ES-16-19-43	GE	50-570062FAAC1	CRP 9-20	ATMOS CONT SYS AND PRIM LEAK DET POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229
ES-1-156-5	GE	50-570062FAAC1	CRP 9-20	ATMOSPHERIC CONTROL SYSTEM POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229B
LR-23-73	Foxboro	N-E274-S2RA6	CRP 9-3	CST LEVEL RECORDER (GREEN PEN)	HPCI	G-191169 Sheet 1	Sheet 1229A

1.3. Instrument Loop Functions

The high pressure coolant injection (HPCI) system provides emergency core cooling in the event of a small line break in the nuclear system that does not result in rapid depressurization of the reactor vessel simultaneous with a loss of normal auxiliary power. The HPCI System permits the reactor to be shutdown while maintaining sufficient reactor vessel water inventory until the reactor pressure drops sufficiently to enable low pressure injection systems to be placed in operation. The HPCI turbine-driven pump is designed to supply make-up water into the vessel at the rate of 4250 gpm over a reactor pressure range of 1135 to 165 psia.

The Condensate Storage Tank is the initial source of water volume for the HPCI pump. When level has decreased to a low level setpoint, HPCI suction is transferred to the suppression chamber. These channels provide the indication and trip actuations associated with these functions.

Attachment A sheets 1 and 2 are simplified loop diagrams of the instruments and components described in Table 1 and below.

1.3.1. Normal Operations

These loops continuously monitor and display Condensate Storage Tank (CST) water level on indicator LI-107-5 at Control Room Panel 9-6, on recorder LR-23-73 at Control Room Panel 9-3, and at ERFIS point F004. These loops have no automatic function during normal operations. Both the indicator and recorder, at CRP 9-6 and 9-3 respectively, are used to satisfy daily channel check requirements of TS 3.5.E.1.b under AP-0150 [Ref. 6.13 and Attach. M]. A low level alarm setpoint of LSL-107-5A/B provides annunciation at 9-3-T-9 of a loss of loop power (CST/TORUS LVL INST PWR TRBL).

The ERFIS F004 indication loop provides Non-Nuclear Safety level indication and is not credited for any required plant normal or accident indication function. This loop will be evaluated for normal conditions only.

1.3.2. Functions During Accident/ Post-Accident/EOP conditions

During a small break Loss Of Coolant Accident, CST water level indication is provided at Control Room Panel 9-3 [REF 6.27.2]. At a pre-determined low level setpoint, the alarm unit(s) trip to cause HPCI suction to transfer to the suppression chamber as well as actuating HPCI CST LEVEL LO alarm 9-3-S-4.

This loop is credited with satisfying the Post-Accident Monitoring requirements of RG 1.97 [REF. 6.6] variable D2 for CST level indication "from top to bottom". This indication is classified and committed as category 3 [Ref. 6.6].

The ERFIS indication loop is not required to function under accident or post-accident conditions.

From review of the above possible environmental conditions, the most restrictive environmental conditions under which the loops are expected to function is a non-harsh environment (mild) with a seismic event. This environmental condition is considered to be the bounding (enveloping) condition for determining the accident (as well as post-accident and EOP) total loop uncertainty. Although Seismic qualification is not required for variable D2 channel equipment (Attachment M page 37), the indication loop will be conservatively evaluated to include seismic effects.

2. METHODS AND ASSUMPTIONS

2.1. Methods

This calculation has been prepared in accordance with the "Vermont Yankee Instrument Uncertainty and Setpoint Design Guide" [REF. 6.1], WE-103, Yankee Nuclear Services Engineering Instruction, "Engineering Calculations and Analysis." [REF. 6.4], and Design Engineering Procedure VYDEP-15, "Calculations," [REF. 6.5]. This calculation is performed using the Class 1 graded approach since the trip function performed by these loops ensures a continuous HPCI suction and its failure to actuate at the correct level could result in failure of the HPCI system to supply makeup water to the reactor.

Calculation of the CST level indication loop and level recording loop functions could be performed using the Class 2 approach because these loops provide no automatic function and provide indication to support operator actions and post accident monitoring. However, for simplicity, the Class 1 approach will be used throughout. Standard methods employed in this calculation are explained in the Design Guide, special techniques and criteria are explained below.

2.2. Criteria

2.2.1. Special Criteria

The Indicator, Recorder, and ERFIS loops evaluated under this calculation are functionally tested and calibration checked as loops [Ref. 6.12] by applying pressures to the transmitter, and then verifying the output indication is within tolerance.

The alarm units are functionally tested and calibration checked as individual components only. Since the transmitters are functionally tested and calibration checked as both modules and as part of the above mentioned loops, they will be evaluated for both situations under this calculation.

2.2.2. Software Criteria

Calculations in Attachment D (Mathsoft MathCad 7 Professional) were manually verified using a hand calculator in accordance with WE-108 (Computer Codes). No errors were found in the manual verification of the calculations performed.

MathCad 7 stores numbers with a 15-digit accuracy, all calculation outputs displayed within the calculation are rounded from the values stored in MathCad 7. Rounding errors induced by MathCad 7 are assumed to be negligible.

Computer specifications:
Gateway 2000 G6-233 – Serial number 0008583505 (12/4/97)
Intel Pentium II, 233 MHz w/ MMX Technology
96 MB RAM
Integral Math Co-Processor

Software specifications:
Microsoft® Windows® 95
Microsoft® Word Version 97 SR-1
Mathsoft MathCad 7 Professional

2.3. Assumptions

2.3.1. Calibration of instruments is assumed to be at a temperature within the ranges shown in the following table. The control room reference temperatures are per the design guide [Ref. 6.1]. The Condensate Storage Tank is located outside and the level transmitters are located on rack RK-25-66 inside an insulated and un-heated room attached to the side of the CST. The expected temperature extremes for the CST instrument room are based on discussions with the E&C System Engineer and the Setpoint Project Site Representative (Attachment N). The normal ambient temperature extremes expected are as listed in Table 2.

Table 2
Normal Area Temperatures

Plant Area	Minimum	Maximum
Condensate Storage Tank - Instrument Rack 25-66	55 °F	85 °F
Control Room – All areas	60 °F	80 °F

2.3.2. CST water minimum temperature is maintained ≥ 50 °F (as read on TI-107-3) per VY Procedure AP-0150, Auxiliary Operator Round Sheet TB/OUT, page 5 of 7 (Attachment M). The tank is heated by auxiliary steam heating coils. As a conservative value for minimum temperature, the assumed value of 40°F from FSAR section 14.5.2 will be used [Ref. 6.2].

CST water maximum temperature is assumed equal to the maximum ambient temperature of 100 °F as identified in FSAR section 2.3.5 and on HPCI Process Diagram 5920-0784 [Ref. 6.29.1].

2.3.3. The calibration interval is assumed to occur once every quarter or 114 days (91.2 days + 25%).

2.3.4. The transmitter loops are calibrated quarterly and the test equipment temperatures will be bounded by the ambient temperatures extremes listed in Table 2 above. For the test equipment uncertainty evaluations performed under VYC-1758 [Ref. 6.9, Attachment K], the RB RHR Crnr Rm 232' environment conservatively bounds the environment to be expected at the CST instrument room, and will therefore be used as representative of the CST instrument room.

2.3.5. The temperature variation within a cabinet is the same as the variation of the room in which it is located. The temperature difference between the room and the cabinet is therefore constant. Calibration data are assumed collected with the equipment at the operating temperature of the cabinet.

2.3.6. Review of the Vermont Yankee Environmental Qualification Program Manual [Ref. 6.7] indicates that none of the loop components covered by this calculation is environmentally qualified and are therefore only expected to operate under mild conditions, and negligible radiation exposure. Other than the pressure transmitters located at the tank enclosure, all loop components are located in the control room.

2.3.7. Calibration Tolerance is an output of this calculation, and will be based on the accuracy of the devices. The existing calibration tolerances shown in Tables 5 through 10 are for information only.

2.3.8. Published vendor specification data are assumed at a 2 sigma level probability with a confidence that the error will reflect the actual error 95% of the time (95/95).

2.3.9. During instrument calibration, it is assumed full traverse testing is performed on all instruments.

2.3.10. GE specification 198 4532K16-300B [Ref. 6.21 and Attachment E] does not provide performance specifications on effects due to seismic acceleration or due to power supply voltage variations for the 50-555 transmitters.

An allowance of 0.5% span is assumed for seismic effect (SE) based on similarity of design and construction with GE/MAC 551-E transmitters.

An allowance of 0.1% of span over a 20 volt variation for power supply voltage effect (VE) is assumed based on similarity with GE/MAC 551-E transmitters.

Analyzed Drift (DA) for the transmitter module is evaluated to be 0.649% for quarterly calibrations with no bias effects. The 0% point is chosen because this drift term is used for evaluation of the trip point which is at 5.25% span. The transmitter Analyzed Drift evaluation is included as Attachment P.

With no specification for deadband, deadband is assumed to be negligible

2.3.11. GE specification 198 4532K20-001D [Ref. 6.22 and Attachment F] does not provide performance specifications on effects due to seismic acceleration for the 50-560 Alarm Units.

The alarm unit is completely solid state with the exception of the alarm relays. Although the alarm contacts may "chatter" during a seismic event, no lasting effect on the accuracy and operation of the solid-state circuitry will be assumed. Therefore, it is assumed that the seismic effect (SE) on the Alarm Units' setpoint accuracy is negligible.

2.3.12. The GE 180 panel indicator LI-107-5 is not required to function during a seismic event, however, it is required to provide post accident indication of CST level. GE does not provide specifications for seismic effects. Both the GE 180 edgewise indicator and the Sigma Instruments Model 1151 have D'Arsonval movements, 4.5 inch scale length, vertical/horizontal orientation options, and case dimensions of 1.75" x 5.625" x 5.0" [Ref. 6.23 and Attachment G]. For both instruments, the DC performance specifications are identical with regard to accuracy, repeatability, overload, response time, and shock, and are nearly identical for temperature range (-4 to 150 °F for GE 180 and –4 to 122 °F for Sigma). The Sigma model 1151 has been seismically qualified to accelerations greater than those required for Vermont Yankee Control Room equipment. Seismic testing for the 1151 is documented in Test Report # SBI-3 [Ref. 6.31 and Attachment G]; the results indicate that the worst case seismic effect on the six (6) 1151 indicators tested was 0.8% full scale and the average effect of the other five instruments was 0.24%. Based on the above discussion, seismic effect is considered insignificant when compared to reference accuracy (1.5%) and repeatability (2%), and will be assumed equal to 0%.

2.3.13. Foxboro specification PSS 9-7C1A [Ref. 6.20 and Attachment H] does not provide performance specifications on effects due to seismic acceleration for the N-E27R Recorders. The recorder specification included in Attachment H indicates that the SPEC 200 displays (N-E27R recorder) are qualified to IEEE-344 1975 standards. Therefore, with the absence of a specific seismic effect term, and since the recorder is an electro-mechanical device, the seismic effect (SE) will be conservatively assumed equal to the chart paper reference accuracy, or ± 0.75%.

2.3.14. The Analyzed Drift term for the LSL-107-5A & B CST Level Switch Loops is derived from VYC-1608 Rev. 0 [REF. 6.8]. Specifically, the Analyzed Drift term is derived from drift data analyzed for the OP-4363 CST Level Loop Calibration TS Switch & Alarm – For HPCI. The CST Level Loop Calibration TS Switch & Alarm loop Analyzed Drift (ADR) is calculated based on the following considerations:

a) The analyzed drift data shows the setpoint drift ADR to be 0.3640%.

b) From review of this drift analysis and the associated histogram, it is concluded that the data is bounded by a normal distribution. As indicated in the time dependency discussion, the OP-4363 CST Level Loop Calibration TS Switch & Alarm – For HPCI (Attachment L), there is a time dependency indicated. However, the Significance F is greater than 0.05, indicating no correlation between drift magnitude and time interval [Ref. 6.11]. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 78-day ADR term.

c) The average drift value for this group is -0.0105%. Since this is less than 0.01% ($N \leq 120$ and $STDEV \geq 0.10\%$), this term is negligible and hence no bias effects are considered [REF. 6.11].

d) The alarm loop ADR value for the operating cycle is calculated directly as follows:

$$ADR_{114\text{-Days}} = ADR_{78\text{-Days}} = \pm 0.3640\%$$

2.3.15. The Analyzed Drift term for the LI-107-5 indication loop is derived from VYC-1608 Rev. 0 [REF. 6.8]. Specifically, the Analyzed Drift term is derived from drift data analyzed for OP-4363 CST Level Indicator Loop – For HPCI at either the 0%, 50%, or 100% point, whichever value is most conservative with respect to drift magnitude and time dependency. The CST Level Indicator Loop Analyzed Drift (ADR) is calculated based on the following considerations:

a) The analyzed drift data shows the 50% point to be the largest value at 1.9932% with the 0% value at 1.7281% and the 100% value at 1.2911%. The 50% analyzed drift value will be used as a conservative drift value for the entire indication range.

b) From review of this drift analysis and the histograms, it is concluded that the drift data is bounded by a normal distribution for the 0%, 50%, and 100% point data. As indicated in the time dependency discussion for the OP-4363 CST Level Indicator Loop – For HPCI Loops (Attachment L), the Significance F for all three points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 83-day ADR term..

c) The average drift value for this group (50% calibration point) is -0.1081%. Since this is less than 0.16% (N ≤ 40 and STDEV ≥ 0.5%), this term is negligible and hence no bias effects are considered [REF. 6.11].

d) The indication loop ADR value for the operating cycle is calculated directly as follows:

$$ADR_{114\text{-Days}} = ADR_{83\text{-Days}} = \pm 1.9932\%$$

2.3.16. The Analyzed Drift term for the LR-23-73 Recorder Loop is derived from VYC-1608 Rev. 0 [REF. 6.8]. Specifically, the Analyzed Drift term is derived from drift data analyzed for the OP-4363 CST Level Recorder Loop – For HPCI. The CST Level Recorder Loop Analyzed Drift (ADR) at either the 0%, 50%, or 100% point (whichever value is most conservative with respective to drift magnitude and time dependency) is calculated based on the following considerations:

a) The analyzed drift data shows the 100% point to be the largest value at 0.9709% with the 0% value at 0.7734%, and the 50% point at 0.6140%. The 100% analyzed drift value is largest, and will be used as a conservative drift value.

b) From review of this drift analysis and the histograms, the data exhibits a near-normal distribution for all points. As indicated in the time dependency discussion for the OP-4363 CST Level Recorder Loop – For HPCI (Attachment L), some time dependency is exhibited at the 50% and 100% points. However, the Significance F at all points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 83-day ADR term.

c) The average drift value for this group is –0.0270% at the 0% and 100% points with –0.0405% at the 50% point. Since these are all less than 0.08% (N ≤ 40 and STDEV ≥ 0.25%), this term is negligible and hence no bias effects are considered [REF. 6.11].

d) The recorder loop ADR value for the operating cycle is calculated directly as follows:

$$ADR_{114\text{-Days}} = ADR_{83\text{-Days}} = \pm 0.9709\%$$

2.3.17. The Analyzed Drift term for the ERFIS Computer Point Loop is derived from VYC-1608 Rev. 0 [REF. 6.8]. Specifically, the Analyzed Drift term is derived from drift data analyzed for the OP-4363 CST Level Computer Point Loop. The CST Level Computer Point Loop Analyzed Drift (ADR) at either the 0%, 50%, or 100% point (whichever value is most conservative with respective to drift magnitude and time dependency) is calculated based on the following

considerations:

a) The analyzed drift data shows the 50% point to be the largest value at 1.2237% with the 0% value at 1.0625%, and the 100% point at 1.0604%. The 50% analyzed drift value is largest, and will be used as a conservative drift value.

b) From review of this drift analysis and the histograms, the data exhibits a near-normal distribution for all points. As indicated in the time dependency discussion for the OP-4363 CST Level Computer Point Loop (Attachment L), some time dependency is exhibited at the 100% point. However, the Significance F at all points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 82-day ADR term.

c) The average drift value for this group is –0.2293% at the 100% point, -0.2163% at the 50% point, and –0.1580% at the 0% point. Since these values are all more than 0.08% ($N \leq 40$ and $STDEV \geq 0.25\%$), this term must be considered as a significant bias term [REF. 6.11].

$ADR_{bias} = -0.2293\%$

d) The ERFIS loop ADR value for the operating cycle is calculated directly as follows:

$ADR_{114\text{-}Days} = ADR_{82\text{-}Days} = \pm 1.2237\%$

2.3.18. Given that Analyzed Drift (ADR) data is available for each of the loops and components evaluated under this calculation, and given that these loops and components will be evaluated for mild environmental conditions for the Control Room and CST (i.e. normal conditions), then it is assumed that the Analyzed Drift (ADR) term for each includes the Temperature Effect (TE), Readability (RD), M&TE Uncertainty (MTE), Barometric Pressure Effect (PB), Power Supply Voltage Effect (VE), Humidity Effect (HE), and Radiation Effect (RE) for each of the associated loop components [Ref. 6.1 section 3.6.5] under both normal and accident conditions.

3. INPUT DATA

Data used to calculate loop uncertainties, process corrections, setpoints, and decision points are tabulated below with the applicable reference or basis noted.

3.1. Process and Loop Data

Process data used to evaluate process corrections, decision points, and setpoint limitations are tabulated below with the applicable references.

Table 3
Process/Loop Inputs

Basis	Description	Data
Ref. 6.2 Section 14.5.2.3 & Assumpt. 2.3.2 Ref. 6.2 section 2.3.5 & Ref. 6.29.1	CST Water Temperature Minimum CST Water Temperature Maximum	40 °F 100 °F
Ref. 6.10 (Attachment C)	Process Limit (ITS/CTS) – Critical height submergence (Vortexing) 10,000 gallon reserve	≥ 28.2" above CST[1] bottom 20.0 " above CST bottom 8.2" above critical height
TS 3.2.A & Table 3.2.1 Ref. 6.10 (Attachment C)	Technical Specification Limit (CTS)	Low CST Water Level Trip (HPCI auto suction transfer) ≥ 3% CST Volume
VYC-723 Rev. 2 Attach. IX (Attachment B)	Lowest point credited for HPCI Suction	11.25" above CST bottom
Ref. 6.30.2 VYC-723 Rev. 2 (Attach. B) Ref. 6.30.2	Reference Elevation; floor at rack 25-66 Transmitter Center Line Transmitter Sensing Tap Elevation	El. 252' 6" El. 253' 8" El. 254'
Ref. 6.3 Table 4.2.1	Calibration Test Interval	Every 3 months (114 days)

3.2. **Environmental Conditions**

The following information provides the environmental conditions expected for the components located at the Condensate Storage Tank and in the Main Control Room.

Table 4
Environmental Input Data

Basis	Description	Data
Ref. 6.2 Table 2.3.2	CST Area Ambient Temperature Extremes	-33 to 100°F
Assumption 2.3.1	CST Rack 25-66 Normal Ambient Temperature	55 to 85°F
Assumption 2.3.6	CST Rack 25-66 Accident Ambient Temp.	55 to 85°F
Assumption 2.2.1	Control Room Normal Temperature	60 to 80°F
Assumption 2.2.1	Control Room Accident Temperature	60 to 80°F

[1] This limit includes consideration for the 10,000 gallon inventory requirements and the TS Limit of ≥ 3%. Critical height of submergence prevents introduction of air into HPCI suction prior to completion of transfer to suppression pool; includes consideration for CST Vortexing based on HPCI flow [See Attachment C].

3.3. Transmitter LT-107-5A and LT-107-5B Data

Table 5
Transmitter Input Data

Basis	Description	Data
Ref. 6.21 & Attachment E	Minimum span Maximum span (URL) Zero Suppr./Elevation Pressure Rating Over-Pressure Protect. Output signal Power Supply Test Jacks Damping	0 to 170 inches water 0 to 850 inches water 0% to 80% of range (URL) 2000 psig Either direction to full pressure rating 10 to 50 mAdc into 0 to 500Ω load 52.5 (± 5%) volts DC Built in (10 to 50 mV full scale, 1mV per mA) Adjustable – 4 positions
Ref. 6.21 & Attachment E	Ambient temperature Maximum fluid temp. Vibration Shock Humidity	-20°F to +185°F 250°F Up to 1G in any direction for 25 to 120 Hz Up to 0.03 inches peak-to-peak amplitude for 0-25 Hz Will not be damaged by shocks up to 100G, any direction Not affected by MIL-E-5272 test (24-hour cycle, 68°F to 158°F at 100% relative humidity)
Ref. 6.23 & Attachment E Assump. 2.3.10 Assump. 2.3.10	Accuracy Temperature effect Static Pressure effect Rated drift Power Supply Effect Deadband	± 0.4% span (incl. Linearity, hysteresis, and repeatability) ± 1% span/100°F ΔT at 100% to 50% span ± 1% to ± 2% span/100°F at 49% to 20% span ± 0.4% span/500 psi at 100% to 50% span ± 0.4% to ± 1% span/100°F at 49% to 20% span None given 0.1% span for 20 volt variation Negligible
Ref. 6.12 Ref. 6.12	Existing Input Span Existing Output span Existing Cal Tolerance	4.0 to 394.0 inches water 10.00 to 50.00 madc ± 0.2 mV
Assump. 2.3.6	Radiation effect	N/A
Assump. 2.3.10	Seismic Effect	± 0.5% span
Assump. 2.3.10	Analyzed Drift (DA)	0.649%

3.4. Alarm Unit LSL-107-5A and LSL-107-5B Data

Table 6
Alarm Unit Input Data

Basis	Description	Data
Ref. 6.22 Ref. 6.12 Ref. 6.22 Ref. 6.12	Input Span Existing Calibrated Input Span Output Existing calibration tolerance	10.0 to 50.0 mAdc 10.0 to 50.0 mVdc[2] (0 to 390 inches) Relay contact – rated at 2 amps (120 VAC, 60 Hz) resistive load 2 amps (28 Vdc) resistive load ± 0.2 mV
Ref. 6.22	Power requirements Power consumption	120 VAC, 60 Hz 2 watts (single), 4 watts (dual alarm)
Ref. 6.22 Assumpt. 2.3.18 Ref. 6.22 Assumption 2.3.11	Accuracy Accuracy (dial only) Repeatability Deadband (Alarm Reset) Ambient Temperature Range Temperature effect Response Time Drift rating Radiation Effect Seismic Effect	± 0.5% span ± 2.5% span ± 0.1% span 1.0% standard 40°F to 120°F (140°F intermittently) Negligible 100 milliseconds None given N/A Negligible
Assumption 2.3.14	CST Level Alarm/Trip Analyzed Drift (DA)	± 0.3640% Span

[2] 10 to 50 mVdc as measured at transmitter output test terminals; 10 to 50 mAdc through 1Ω resistor.

3.5. Indicator LI-107-5 Data

Table 7
Indicator Input Data

Basis	Description	Data
Ref. 6.12	Input Span	10.0 to 50.0 mAdc
Ref. 6.12	Calibrated Span	10.0 to 50.0 mVdc[3]
Ref. 6.12 Walkdown & Attachment N	Output Scale Indication Minor Scale Division Readability (1/2 of minor division)	0-100% 2% 1%
Ref. 6.23	Operating Temperature Range	-4°F to 150°F
Ref. 6.12	Existing Loop/Component Calibration Tolerance	± 2.5%[4]
Ref. 6.23	Accuracy Repeatability	± 1.5% FS ± 2.0% FS
Assumpt. 2.3.12	Seismic Effect	± 0.0% FS
Assump. 2.3.15	CST Level Indication Loop Analyzed Drift (DA)	± 1.9932% CS

[3] Measured as 10 to 50 mVdc at the transmitter output test terminals.
[4] + 2.5%, -0% at 0% point and –2.5%, +0% at 100% point..

3.6. Recorder LR-23-73 Data

Table 8
Recorder Input Data

Basis	Description	Data
Ref. 6.20	Input Span	1 to 5 Vdc
Ref. 6.12	Calibrated Span	10.0 to 50.0 mVdc[5]
Ref. 6.12 Attachment N	Output Scale Indication Minor Scale Division Readability (1/2 of minor division)	0-100% 1% 0.5%
Ref. 6.20	Operating Temperature Range	40°F to 120°F
Attachment H	Ambient Temperature Effect	± 0.5% span max zero/span shift per 50°F within 40 to 120°F band
Attachment H	Humidity Effect	± 0.3% span on indicator or pen position
Attachment H	Power Supply Voltage Effect	± 0.1% span for a +10, -15% change in AC voltage within normal operating range
Ref. 6.12	Existing Loop/Component Calibration Tolerance	± 1.0%[6]
Ref. 6.20 & Attachment H	Accuracy (chart paper) Accuracy (indicating scale) Repeatability	± 0.75% span ± 0.5% span ± 0.4% span
Assumpt. 2.3.13	Seismic Effect	± 0.75% span
Assump. 2.3.16	CST Level Recorder Loop Analyzed Drift (DA)	± 0.9709% span

5 Measured as 10 to 50 mVdc at the transmitter output test terminals. 10 to 50 mAdc through 100Ω.

6 + 1.0%, -0% at 0% point and –1.0%, +0% at 100% point..

3.7. Power Supply ES-16-19-43 & ES-1-156-5 Data

Table 9
Power Supply Input Data

Basis	Description	Data
Ref. 6.24 & Attachment I	Output voltage Output current	52.5 ± 8% Vdc (52.5 ± 4.2 Vdc) 0 to 50 mA for up to 5 transmitters
Ref. 6.24 & Attachment I	Source voltage range 120 cps Ripple Operating Temperature Range	107-127 vac (50-60Hz) ± 0.03% rms 40°F to 120°F

3.8. ERFIS Computer Point F004 Input Data

Table 10
ERFIS Computer Point Input Data

Basis	Description	Data
Attachment J ↓	ITG-9500 Input Channels Per Rack Input Types and Ranges Overrange/underrange Gain Accuracy (30 day) Gain Accuracy (1 year) Input Power Requirements Operating Temperature Humidity Drift	16 ± 160, ± 80, ± 40, ± 20 mVdc 1% 0.01% rdg + 0.01% FSR max at 25°C 0.05% FSR, 0-60°C 104-125 volts AC, < 20 watts 0 to 55°C (32 to 130°F) 0 to 95% (non-condensing) Not specified
Attachment J	Accuracy[7] $= \pm \frac{(0.05\% \text{x} 80\text{mV})}{(80\text{mV} - 16\text{mV})}$	± 0.0625%
Ref. 6.25 & Att. J	Input Span	16 to 80 mVdc[8]
Ref. 6.12	Indication span	0 to 477.1 KGAL
Ref. 6.8 & Att. L	Resolution	0.01 KGAL
Ref. 6.12	Calibration Input Span	10 to 50 mVdc[9]
Ref. 6.12	Existing Loop/Component Calib. Tol.	± 2.6 KGAL (0.545% span)
Assumption 2.3.17	ERFIS Loop Analyzed Drift Bias (DA_{bias})	- 0.2293% Span
Assumpt. 2.3.17	ERFIS Loop Analyzed Drift (DA)	± 1.2237% Span

[7] Accuracy of Analog to Digital converter.
[8] 10 to 50 mAdc through 160Ω personality module.
[9] Measured as 10 to 50 mVdc at the transmitter output test terminals. 10 to 50 mAdc through 100Ω.

3.9. Calibration M&TE Input Data

Table 11
Calibration M&TE Input Data

Basis	Description	Range	Resolution	Accuracy (% Rdg or Span)	Accuracy (Calibr. Units)
Attachment K	HP 34401A DMM	100 mVdc	0.0001 mVdc	0.0216% rdg @ 50 mVdc	0.010817 mVdc
Attachment K	HP 3466 DMM	200 mVdc	0.01 mVdc	0.1095% rdg @ 50 mVdc	0.0547 mVdc
Attachment K	Heise 901B	0 – 400" H_2O	0.01 "H_2O	0.1449% span	0.5797" H_2O
Attach. K & M	Heise 901B	0 – 1000" H_2O	0.1 "H_2O	0.1452% span	1.4524" H_2O
Attach. K & M	Heise CMM	0 – 800" H_2O	1.0 "H_2O	0.1616% span	1.2925" H_2O
Attach. K & M	Heise CMM	0 – 830" H_2O	1.0 "H_2O	0.1613% span	1.3391" H_2O
Attach. K & M	Heise 730A-03	-100 – 860" H_2O	0.1 "H_2O	0.1691% span	1.6236" H_2O

4. CALCULATION DETAIL

The detailed calculation of loop uncertainties, setpoints, testing tolerances, and margins have been performed using MathCad and are documented as Attachment D.

5. RESULTS AND CONCLUSIONS

5.1. Total Loop Uncertainty

Total Loop Uncertainties (TLU) have been evaluated for the HPCI CST Level indication, trip, recorder, and ERFIS Loops and the results are presented in Table 12 below.

Table 12
Total Loop Uncertainty

Loop	TLU Normal	TLU Normal	TLU Accident	TLU Accident
	± % CS	± Cal Units	± % CS	± Cal Units
LT-107-5A/B / LSL-107-5A/B Trip	1.075 ✓	0.430 mVdc ✓	1.190 ✓	0.476 mVdc ✓
LT-107-5A / LI-107-5 Indicator	3.371 ✓	3.371% ✓	3.414 ✓	3.414% ✓
LT-107-5B / LR-23-73 Recorder	1.984 ✓	1.984% ✓	2.237 ✓	2.237% ✓
LT-107-5A / ERFIS F004	2.163 ✓	10.318 Kgal ✓	N/A	N/A

5.2. Setpoint Evaluation

5.2.1. Current Low Level Suction Transfer setpoint

As evaluated in Attachment D, section 5.2, the existing Low Level suction transfer setpoint of 12.1 mVdc cannot be supported based on the new requirements for critical height of submergence of the HPCI suction. The revised Process Limit of ≥ 28.2" from CST bottom [Ref. 6.10 and Attachment C] includes consideration for the TS requirement that the setpoint be ≥ 3% and that there be 10,000 gallons reserve at the suction transfer point. See Table 13 below.

5.2.2. Revised Low Level Suction Transfer setpoint

A revised setpoint is evaluated in Attachment D, section 5.3; the proposed setpoint of 12.2 mVdc decreasing supports the requirements for critical height of submergence of the HPCI suction + 10,000 gallon reserve and has adequate margin from LSP to SP. See Table 13 below.

Table 13
Setpoint Results

Loop	Existing Setpoint (12.1 mV) ✓		Revised Setpoint (12.2 mV) ✓	
	Inches[10]	Inches[11]	Inches[10]	Inches[11]
Process Limit (PL)	≥ 28.2 ✓	≥ 20.2 ✓	≥ 28.2 ✓	≥ 20.2 ✓
Accident Uncertainty (U_{a12})	4.643 ✓	4.643 ✓	4.643 ✓	4.643 ✓
Limiting Setpoint (LSP)	32.843 ✓	24.843 ✓	32.843 ✓	24.843 ✓
Setpoint (SP)	32.475 ✓	24.475 ✓	33.45 ✓	25.45 ✓
Margin (M_1)	-0.368 ✓	-0.368 ✓	0.607 ✓	0.607 ✓

5.3. Calibration and Test Results

In order to support and implement the results of this calculation, the loop instruments are to be calibrated at nine points based on the following ranges :

[10] Referenced to tank bottom.
[11] As sensed by transmitter; level above transmitter tap (0") plus 4" static head.

Table 14
Module Calibration Ranges

Description	Value	Units
Transmitter input range	4 to 394	Inches H_2O
Transmitter output range	10.0 to 50.0	mVdc[12]
Indicator input range	10.0 to 50.0	mAdc
Indicator output range	0 to 100	%
Alarm Unit input range	1.0 to 5.0	Vdc
Alarm Unit Lo Setpoint (CST LEVEL LO)	12.2 decr	mVdc
Alarm Unit Lo-Lo Setpoint (INST PWR TRBL)	10.2 decr	mVdc
Recorder input range	1 to 5	Vdc
Recorder output indication range	0 to 100	%
Computer input range	16 to 80	mVdc[13]
Computer output indication range	0 to 477.1	Kgal

Test as-found tolerances (FT) and as-left tolerances (CT) are shown below.

Table 15
Module Calibration Tolerances

Device	Tag No.	As Found (FT)[14]		As Left (CT)	
		± % CS	± Cal Units	± % CS	± Cal Units
Transmitter	LT-107-5A & B	0.80	0.32 mVdc	0.50	0.20 mVdc
Alarm Unit	LSL-107-5A & B[15]	0.60	0.24 mVdc	0.50	0.20 mVdc
Indicator	LI-107-5	N/A	N/A	2.0	2.0 %
Recorder	LR-23-73	N/A	N/A	1.0	1.0 %
Computer Point	F004	N/A	N/A	0.545	2.6 Kgal

12 10-50 mAdc through a 1Ω transmitter test resistor.
13 10-50 mAdc through a precision 160Ω resistor.
14 Module As-Found values provided for alarm unit and transmitter because all other components are Calibration Checked as loops per Ref. 6.12; LSL-107-5A & B tested as modules only per Ref. 6.12 (Attach. M).
15 As-found and As-left tolerances apply to both setpoints of each alarm unit.

Table 16
Loop Calibration Tolerances

Loop	As Found (FT)		As Left (CT)		Cal Period
	± % CS	± Units[16]	± % CS	± Units[17]	Days
LI-107-5 Indication	2.5 ✓	2.5% ✓	2.0 ✓	2.0 % ✓	114
LR-23-73 Recorder	1.5 ✓	1.5 % ✓	1.118 ✓	1.00 % ✓	114
ERFIS F004	1.429 ✓	6.82 Kgal ✓	0.740 ✓	3.53 Kgal ✓	114

5.4. **Conclusions and Summary of Recommendations**

5.4.1. Revise plant setpoint to 12.2 mVdc decreasing per ATT D section 5.3 and Table 13. It should be noted that the setpoint is no longer based on simply being greater than or equal to 3% level as per TS Table 3.2.1. Based on tank vortexing effects evaluated under VYC-1844 Rev. 0, the limiting consideration is now based on maintaining a minimum level above the HPCI suction to prevent air entrainment due to vortexing, with the 10,000 gallon reserve requirement added. As such, the references in OP-4363 Rev. 24 page (2 of 7) and Alarm Response Sheet 9-3-S-4 to "Tech Spec Setting of ≥ 3%" and "4% (20,000 glns)" although not incorrect, should consider updating to reflect the new bases.

5.4.2. For transmitter calibrations, all of the test equipment listed in Table 11, with the exception of the Heise 730A-03 (-100 to 860"), is acceptable for use. The Heise 901B (0-400") is the preferred pressure source. OP-4363 should be revised to remove the recommendation to use the Heise 730A-03 (-100 to 860"). All calibrations should be revised to nine-point calibrations.

5.4.3. Loop calibration checks of LI-107-5 and LR-23-73 are performed at 0% and 100% with single sided tolerances which may be overly restrictive and cause unnecessary re-calibrations. Suggest revising calibration points to 10% (43 inWC) and 90% (355 inWC) and applying two-sided loop as-found tolerance as per Table 16.

5.4.4. CWD 1454 Rev 25 incorrectly identifies Annunciator 9-3-S-4 as "Low Pressure" instead of "Low Level". Revise accordingly.

5.4.5. RG 1.97 Attachment A states that variable D2 (CST) level is monitored from 0 to 35'. Based on Attachment B, this would equate to a range of 420 inches. The transmitter only monitors 390 inches span and the tank overflow is at 402".

5.4.6. G-191176 Sh 1 shows a level recorder in the LT-107-5B loop designated as LR-107-5B; this conflicts with OP-4363 and MPAC designation of LR-23-73. Revise accordingly.

[16] As-Found values adjusted for readability as required.
[17] As-Left values adjusted for readability as required.

5.4.7. G-191175 Sh. 1 shows ES-1-156-5 (C-6) with no connection to LT-107-5B loop or to LT-16-19-38B (see CWD 1229A). Revise accordingly.

5.4.8. LR-23-73 connections on G-191175 Sh. 1 (L-13) do not agree with MPAC. Show LT-16-19-38B connected to LR-23-73 via LSH-16-19-38B as does CWD 1229A. MPAC says LT-17-19-38B feeds Red pen of LR-23-73. Revise accordingly.

5.4.9. MPAC references CWD 526 for LR-23-73; cannot find any connections related to LR-23-73 on CWD 526. Revise accordingly.

5.4.10. G-191175 Sh. 1 shows ES-16-19-43 (M-1) with no connection to LT-107-5A loop. Also indicates LT-16-19-38A & 38B are both powered from ES-16-19-43, however, CWD 1229A shows only LT-16-19-38A from ES-16-19-43 and LT-16-19-38B from ES-1-156-5. Revise accordingly.

5.5. VYDEP-15 Impact Considerations

VYDEP-15 Section 2.1 [Ref. 6.5] requires that applicable alarm responses, standard and off normal operating procedures, and EOPs be included in the evaluation. This calculation will evaluate the accuracy of loop components, including indicators and recorders where applicable. The accuracy determined by this calculation will be used as an input for generic evaluations for alarm response, operating procedure, off normal operating procedure, and EOP impact. The interdepartmental review will also ensure associated procedures or operator interfaces are considered as an output of this calculation. Therefore, this calculation adequately addresses the impact to the License and Design bases of the plant as well as the impact to plant procedure and operations.

The following has been considered and is either addressed in this analysis or via the Inter-departmental review process:

FSAR changes
Technical Specifications (Custom & Improved Technical Specifications)
Procedures
Technical Programs
Prints
Related Design Basis Calculations (input/output)
Design Basis Documents
Based on the above, all impact considerations of VYDEP-15 are addressed.

6. REFERENCES

6.1. "Instrument Uncertainty and Setpoints Design Guide," Vermont Yankee, Rev. 0.

6.2. "Vermont Yankee Final Safety Analysis Report", Sections 2.3, 6.3, 6.4, 6.6, 7.4.3.2, 14.5.2, and Tables 2.3.2, 6.3.1 and 7.4.1.

6.3. "Vermont Yankee Technical Specifications", 3/4.2.A, 3.5.E.1.b, and Tables 3.2.1/4.2.1 (through amendment 150)

6.4. WE-103, Yankee Procedure, "Engineering Calculations and Analyses," Rev. 18.

6.5. VYDEP-15, Vermont Yankee Project Procedure, "Calculations," Rev. 2.

6.6. Vermont Yankee Regulatory Guide 1.97 Program Manual, Rev.0 (Attachment M).

6.7. "Vermont Yankee Environmental Qualification Program Manual," Rev. 36.

6.8. VYC-1608, "Drift Calculation For Condensate Storage Tank Level Loop Calibrations," Original (Excerpts – Attachment L).

6.9. VYC-1758, "Measuring & Test Equipment Uncertainty Calculation," Rev. 0 (Excerpts – Attachment K).

6.10. VYC-1844, "CST Vortexing Effects on level measurement," Rev. 0 (Excerpts – Attachment C).

6.11. VYI 31/97, "ISP Application of Analyzed Drift Values in Setpoint Determination, Rev. 1," Memo from G. J. Hengerle to File, dated 5/15/97.

6.12. OP-4363, "HPCI Suction Transfer on Condensate Storage Tank (CST) Low Level Functional Test and CST Level Instrumentation Calibration," Rev. 24, 2/21/97 (Excerpts – Attachment M).

6.13. AP-0150, "Conduct Of Operations And Operator Rounds", Rev. 31, 7/5/96, through DI 97-45 (Excerpts – Attachment M).

6.14. VYEM-0018, "Foxboro E-27R Series Recorder," Rev. 1, 8/10/95.

6.15. VYEM-0145, "Type 180 Meters," Rev. 2, 5/1/96.

6.16. VYEM-0176, "Gemac Instrumentation," Rev. 1, 7/8/92.

6.17. GEK 32448, Process Instrumentation Subsystem of the High Pressure Coolant Injection System, Operation & Maintenance Instructions, dated 11/70.

6.18. GE System Design Specification 22A1217, "Condensate Storage and Transfer System MPL 1-142," Rev. 1, 6/30/69.

6.19. GE System Design Specification 257HA354AE, "High Pressure Coolant Injection System – Data Sheet," Rev. 3, 6/15/70.

6.20. Foxboro Product Specification PSS 9-7C1A (Attachment H).

6.21. Product Data Sheet, GE 198 4532K16-300B, Type 555 Differential-Pressure Transmitter (Attachment E).

6.22. Product Data Sheet, GE 198 4532K20-001D, Type 560 Alarm (Attachment F).

6.23. Product Data Sheet, GE Catalog 8075 Pages 101 and 104, Type 180 Indicating Instruments (Attachment G).

6.24. Product Data Sheet, GE 198 4532K30-010, Type 570-06, 07 Isolated Power Supply (Attachment I).

6.25. VY-85, "MINI-DAS Instruction Manual For Vermont Yankee Nuclear Power Corporation Emergency Response Facility Information System (ERFIS)," Rev. 1, January 1990, (Excerpts – Attachment J).

6.26. Operator Alarm Response Sheets 3-S-4, Rev. 3, and 3-T-9, Rev. 3 (Attachment F).

6.27. Control Wiring Diagrams

6.27.1. Drawing B-191301 Sheet 62, "CRP 9-3 Annunciator," Rev. 12.

6.27.2. Drawing B-191301 Sheet 1229A, "Torus & CST Level Indication," Rev. 7.

6.27.3. Drawing B-191301 Sheet 1444, "HPCI Pump Suction From Supp. Chamber Valve V23-57," Rev. 11.

6.27.4. Drawing B-191301 Sheet 1446, "Suppression Pool Upstream Isol. Valve V23-58," Rev. 10.

6.27.5. Drawing B-191301 Sheet 1450, "HPCI Logic System (SH.2)," Rev. 18.

6.27.6. Drawing B-191301 Sheet 1450A, "HPCI Suction Valve Logic," Rev. 6.

6.27.7. Drawing B-191301 Sheet 1454, "HPCI System Annunciator," Rev. 25.

6.28. Flow Diagrams

6.28.1. Dwg. G-191169 Sh 1 of 2,"High Pressure Coolant Injection System," Rev. 39.

6.28.2. Dwg. G-191176 Sh 1 of 2,"Cndensate & Demineralized Water Transfer System," Rev. 36.

6.29. Vendor Drawings

6.29.1. Drawing 5920-0784, "Process Diagram, High Pressure Coolant Injection," (729E904), Rev. 5

6.29.2. Drawing 5920-6041, "Condensate Storage Tank Level Instrumentation Racks RK 25-66 & 66A," Rev. 1

6.29.3. Drawing 5920-2925, "External Connections For 555-557 XMTR," (2640K28-295), Rev. 0

6.29.4. Drawing 5920-5293, "Connection, External For 570-06 Power Supply," (2640K28-256), Rev. 0

6.30. Miscellaneous Drawings

6.30.1. Drawing G-191259, "Misc. Instrument Arrangement," Rev. 0.

6.30.2. Drawing G-191261 Sheet 65B, "Tank Level Instrument Hookups," Rev. 6.

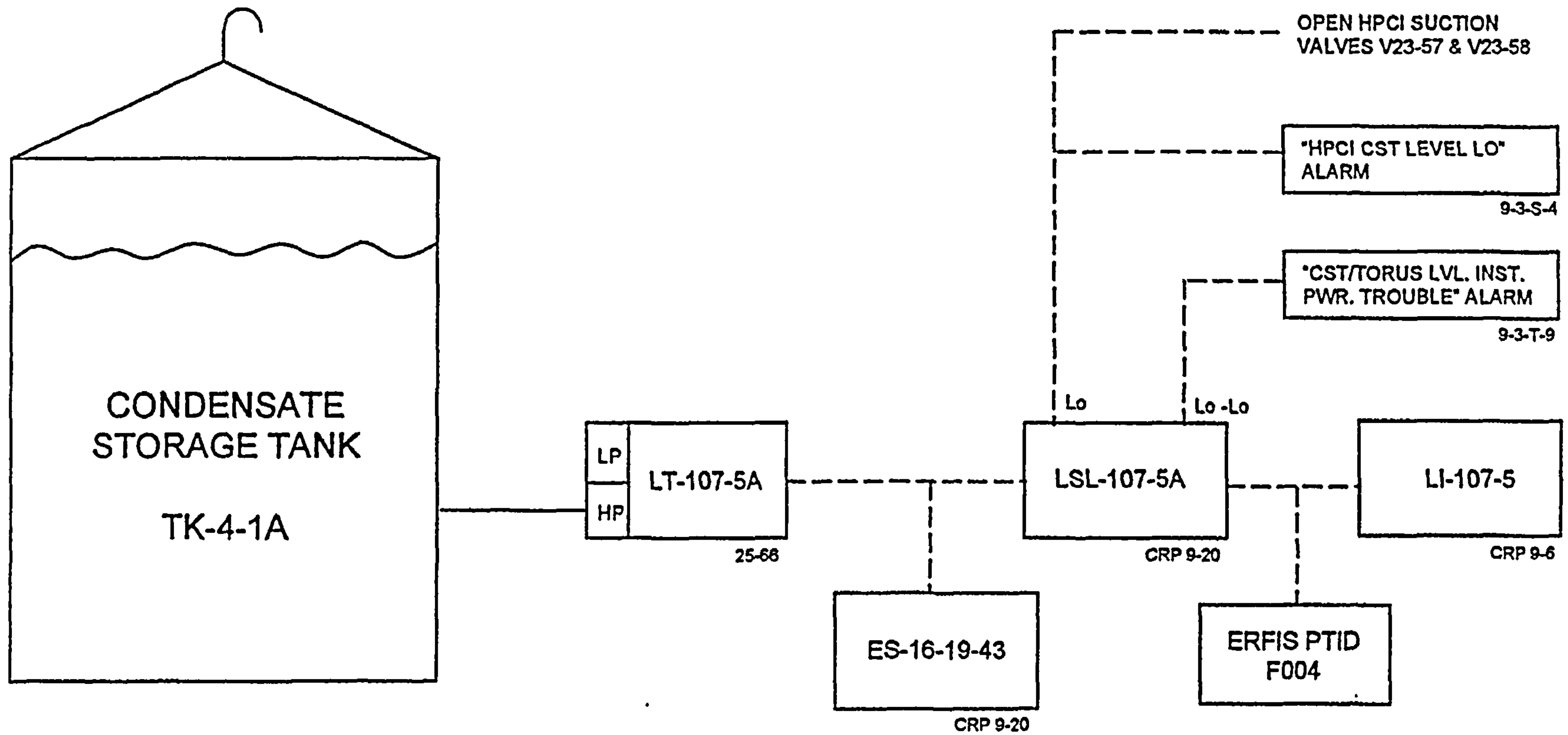
6.30.3. Drawing B-191260, Sheets 107.1, 111.6, 111.19, and 112.26, Vermont Yankee Instrument List, (Superseded by MPAC).

6.31. International Instruments Test Report #SBI-3, "Seismic Qualification Test Report for Indicating Control Instrument Model 9270 and Meter Models 1122, 1136, 1151," Rev. 1, February 10, 1976, (Excerpts – Attachment G).

6.32. "ASME Steam Tables," Thermodynamic and Transport Properties of Steam, Sixth Edition, 1993.

6.33. VYI 92/97, "Application of CT, CE and A for Single Point Devices, Rev. 1," Memo from G. J. Hengerle/R.T. Vibert to Distribution, dated 6/26/98.

CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING

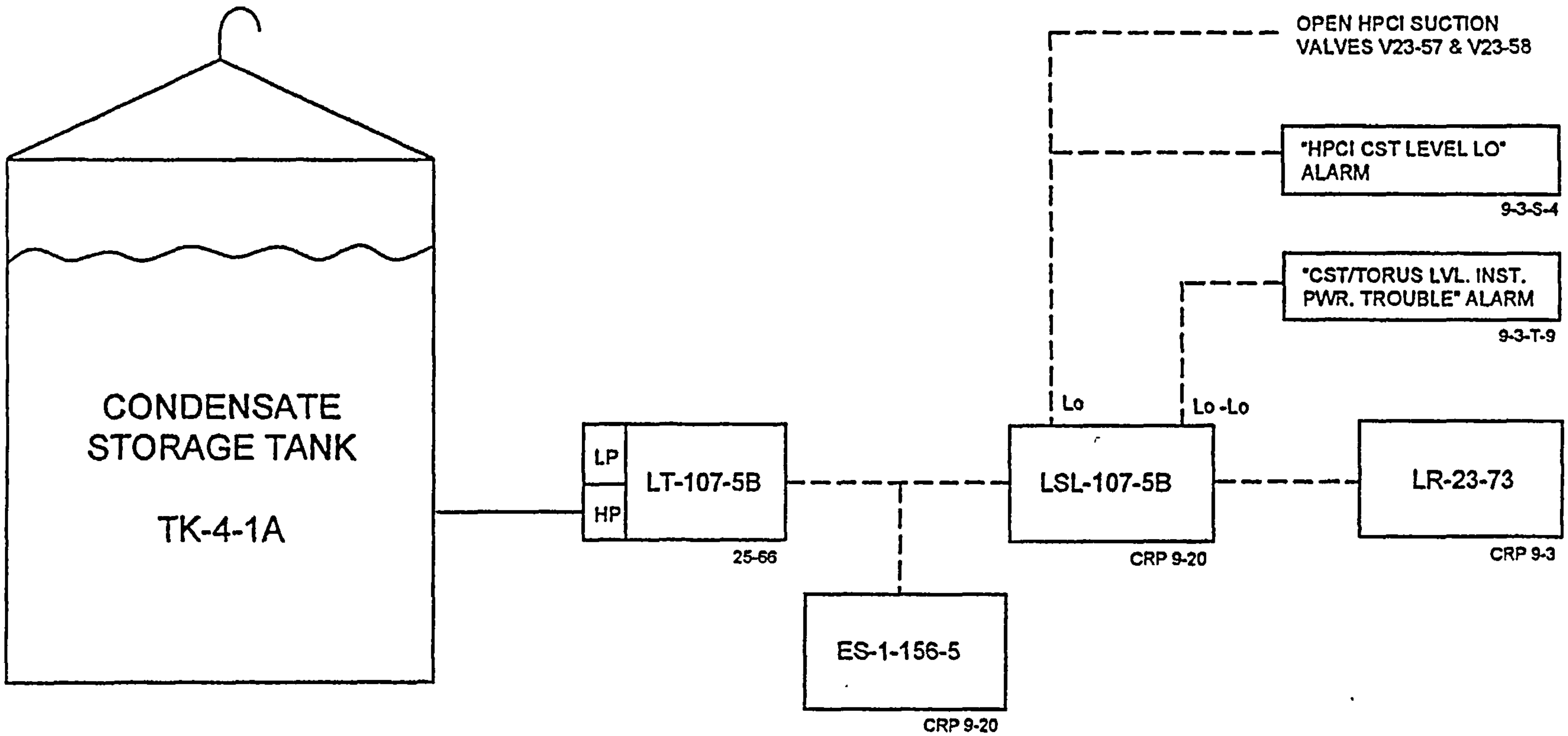


THIS FUNCTIONAL ARRANGEMENT APPLIES TO THE FOLLOWING LOOP:

LT-107-5A, LSL-107-5A, ERFIS PTID F004, LI-107-5, ES-16-19-43

VYC-723 REV. 3
ATTACHMENT A
PAGE 1 OF 2

CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING



THIS FUNCTIONAL ARRANGEMENT APPLIES TO THE FOLLOWING LOOP:

LT-107-5B, LSL-107-5B, LR-23-73, ES-1-156-5

VYC-723 REV. 3
ATTACHMENT A
PAGE 2 OF 2

VERMONT YANKEE DESIGN ENGINEERING

CALCULATION NO. VYC-723

REV. 3

ATTACHMENT B PAGE 1 OF 2 VYC-723 Revision 2 - Attachment IX

CST Level, Height, and Volumetric Evaluation							Preparer
						REFERENC	Verified
OM OF CST	253'-00" elev	0	inches			e	
OF OVERFLOW	286'-06" elev	402	inches (calculated)			f	
						f	
0% INSTR RANGE	254'-00" elev	4	inches			f	
100% INSTR RANGE		394	inches				
RADIUS OF CST	300	inches (calculated)					
piR^2	282743.28	square inches (calculated)					
TIMES 1-INCH	282743.28	cubic inches (calculated)					
CUBIC GALLONS WATER	231	cubic inch/gallon				c	
GALLONS IN 1-INCH	1223.996883	gallons/inch (calculated)					
TOTAL GALLONS IN CST	492047	gallons (calculated)					
TECH SPEC >3%	14761.40241	gallons (calculated)					
TECH SPEC HEIGHT	12.06	inches (calculated)					
ADD 4" HEAD	16.06	inches from instrument zero (calculated) = elev 255'-04"				d	
TOTAL UNCERTAINTY	8	inches				d	
MINIMUM REQUIRED SP	24.06	inches (calculated)					
V ELEV	256'-00" elev	(calculated)					
ELEV OF 14-CS-1 CL	254'-06" elev					g	
SR ELBOW CL TO FACE	14"					g	
OD OF 14-CS-1	14"					a	
BOTTOM OF SR ELBOW	253'-04" elev	(calculated)					
LOW ELEV OF 14-CS-1	253'-11" elev	THIS IS THE MINIMUM ELEVATION HPCI CAN USE (ASSUMED) (calculated)					
ELEV OF STANDPIPE	259'-03" elev	THIS IS THE TOP LEVEL CREDITED FOR RESERVE				f	
DIFF MIN LVL & STDPIPE	64	inches (calculated)					
TOTAL RESERVE VOLUME	78335.60	gallons reserve available (calculated)					
10,000 GALLON USEABLE	8.17	inches above bottom of 14-CS-1 (calculated)					
EQUIV ELEV	253'-08" elev	(calculated)					
PROPOSED SP > 253'-08", THEREFORE, OK							
References:	a. G191176 sheet 1						
	b. Pocket Guide to Flanges, Fittings, and Piping Data						
	c. Crane Technical Paper 410						
	d. VYC-723 Revision 1						
	e. B191261 sheet 65B						
	f. PDCR 77-3 (per TCON with John Lewis/VY)						
	g. G191232						

CST Volumetric Evaluation

VYC-723 Revision 2
Attachment IX

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VERMONT YANKEE DESIGN ENGINEERING
CALCULATION NO. VYC-723
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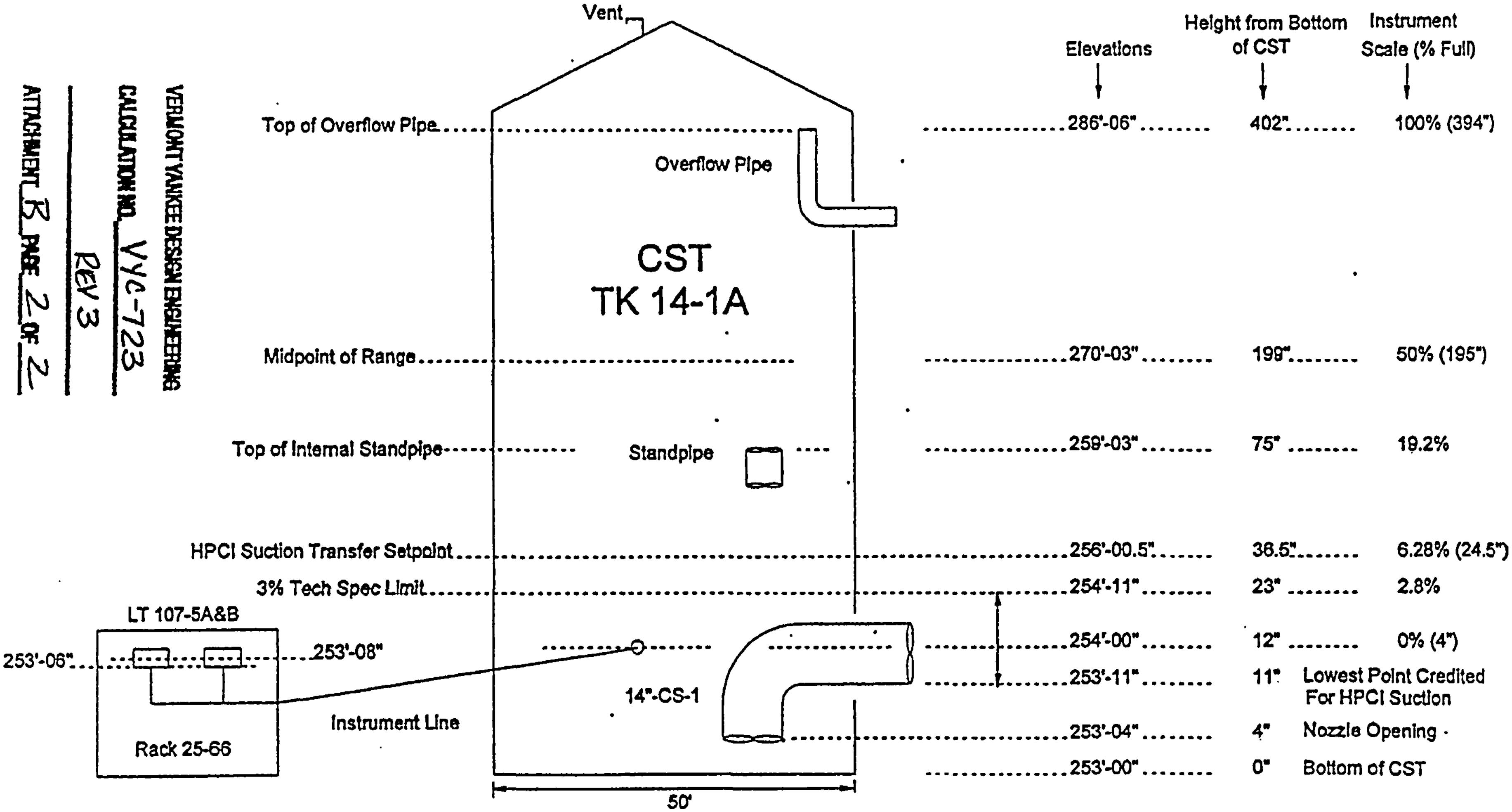
ATTACHMENT B PAGE 2 OF 2



VERMONT YANKEE DESIGN ENGINEERING

CALCULATION NO. VYC-723
REV. 3

ATTACHMENT C PAGE 1 OF 7

ORIGINAL: PAGE 1 of 39 PAGES
Rev. 1: PAGE 1 of ____ PAGES
Rev. 2: PAGE 1 of ____ PAGES
Rev. 3: PAGE 1 of ____ PAGES

QA RECORD?

X YES

RECORD TYPE NO. 13.C16.036

___ NO

Safety Class/P.O. NO.(if applicable) ________

YANKEE ATOMIC ELECTRIC COMPANY
CALCULATION/ANALYSIS FOR

TITLE HPCI and RCIC Vortex Height

PLANT Vermont Yankee CYCLE 21

CALCULATION NUMBER VYC-1844

	PREPARED BY /DATE	REVIEWED BY /DATE	APPROVED BY /DATE	SUPERSEDES CALC./REV. NO.
ORIGINAL	Mark Loeffler [signature] 11/16/98	Silok Kim [signature] 11/16/98.	[signature] 11/16/98	
	BC Slifer 11/16/98 B.C. Slifer			

KEYWORDS: Identify all acronyms. HPCI/RCIC/Vortex/Critical Submergence Condensate Storage Tank (CST)/CST/Low level setpoint/Suction Switchover

COMPUTER CODES: N/A

EQUIP/TAG NOs.: CST TK-4-1A; LT-107-5A/B (Level Transmitter); LSL-107-5A/B (Level Switch); LT-107-12A

SYSTEMS: Identify all acronyms. HPCI/RCIC/CST
- High Pressure Core Injection
- Reactor Coolant Isolation Cooling
- Condensate Storage Tank

REFERENCES: See Calculation Page 2

FORM WE-103-1
Revision 5

WE-103-24

3.0 Purpose

The purpose of this calculation is to determine the effect of vortices in the Condensate Storage Tank (CST), primarily on the automatic low CST level switchover to torus suction trip for both the High Pressure Coolant Injection system (HPCI) and Reactor Core Isolation Cooling system (RCIC) systems. This calculation is a result of commitment OE-8724 and indirectly through the issuance of ER 98-0478. It was this ER that questioned the availability of the Tech Spec required 300,000 gal. in the CST for use by the Core Spray System because unusable volume due to instrument accuracy and vortexing were not addressed. That led to questioning whether the HPCI and RCIC whose intakes are also from the CST (initially) have a similar issue when being utilized. Theoretically a vortex can form and cause air entrainment into a suction pipe when a pump takes suction from a tank or an intake structure. This can cause pump problems. The critical height of submergence is defined as the minimum tank water level above the suction inlet at which entrainment becomes significant enough to disrupt flow which can cause deterioration in pump performance. Thus, the volume below the critical height is considered unusable. Therefore it is the purpose of this calculation to determine the critical height of submergence due to vortexing (thus providing a basis for CST level trip settings) and to document that the HPCI and RCIC systems do not utilize water below that level while performing any of their respective functions. Basically, it must be shown that operation of the tank needs to be restricted to water levels greater than the critical height of submergence.

4.0 Background

The CST is a Seismic Class 2 cylindrical tank, 50' in diameter and about 36 feet tall. The 14" HPCI intake is located at the bottom side of the tank whose nozzle consists of a vertical upward intake. This is due to the downward turned elbow attached to the nozzle inside the CST. The 6" RCIC intake centerline is at the same elevation as HPCI, 18", but consists of a horizontal intake. Both the HPCI and RCIC systems have an automatic switchover from the normally aligned CST to the torus. Suction switchover will occur on low CST level, 32.2" above the CST bottom for HPCI and 31.3" for RCIC. The critical height should be below the low CST level setting (including instrument accuracy). Calculation VYC-723, Rev. 2, and VYC-706 provide the trip settings for HPCI and RCIC, respectively. VYC-723 assumed the volume below the bottom of the HPCI intake pipe is unusable. This level is at ~11" above the CST bottom. VYC-706 did not discuss vortexing. The CST has a "reserve" volume for HPCI and RCIC use only by providing internal suction standpipes to both the Core Spray and Condensate Transfer Systems (the other two systems that utilize the CST as a suction source) that terminate at the absolute elevation of ~75" above the CST bottom. All other discharge points to the CST are also above this level to avoid draining (due to a break of nonseismic piping) the CST to a level below 75".

There are numerous methodologies available to calculate the minimum submergence level associated with pumps and intake structures, primarily based on correlations of experimental data. However the problem is finding a methodology that best suits the geometric configuration or arrangement of the intake design. Numerous methods were reviewed for applicability including those from References 6, 7, 10, 22 and 23. The methodology that was chosen comes from Reference 23. An detailed explanation for this choice is contained in the calculation. Section 5.2.1 contains the HPCI evaluation and Section 5.2.2 contains the RCIC evaluation.

Please note that this calculation will now serve as the basis for the HPCI and RCIC low CST level automatic transfer function. Thus it supercedes Attachment IX of VYC-723 which calculated the HPCI suction transfer automatic setpoint. It also supercedes Attachment VIII of VYC-706 which calculated the RCIC automatic CST low level suction transfer.

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correlation can be considered applicable because it models a draining tank or what is referred to as a transient. The last correlation of Reference 22 is based on work conducted by Harvey and Kubie once again documented in the Journal of Mechanical Engieering Science. This particular work is based on experiments in very small tanks with a lot of induced swirl and vortex breakers installed. Due to the installation of vortex breakers and the large amount of swirl induced, it is unclear as to how applicable the correlations are. Neither the HPCI nor the RCIC contain vortex breakers. It also appears that during these tests, the level did not decrease or in other words the test did not model draining.

J. Kubie, as documented in Reference 23, provides a correlation for predicting the water level at which air entrainment would occur in a vertical cylindrical vessel with an axisymmetric vertical-down outlet under transient conditions (draining). J. Kubie has referenced this correlation from Lubin, B.T., and Springer, G.S., J. Fluid Mech., 29:385 (1967). This correlation is Equation 28 of Ref. 23 on page 1199. This correlation has been chosen to determine the HPCI and RCIC suction critical height because it is deemed more applicable than the others. It models the transient of draining. This method, as mentioned, utilized a vertically downward outlet but as discussed above, this is conservative because this arrangement requires the most submergence over those of a horizontal intake or vertically upward intake. This method models a axisymmetric outlet (outlet at the middle bottom of tank) whereas HPCI and RCIC outlets are on the side of the tank. This is also considered conservative. According to Reference 7, Section 4.6, "Influence of Special Geometric Conditions," the intake requiring the least submergence is one that is near the wall. Figure 4.15 of Ref. 7 shows that the greater the wall clearance the more submergence is required assuming similar conditions. To address the reviewer's comment, the following is provided. The chosen methodology of Lubin and Springer appears to model gravity draining and not draining with the help from a pump. The concern is that circulation could be worse for a pump draindown, thus making the methodology not conservative from that standpoint. However, it has been determined that the HPCI and RCIC flow from the CST is greater than the critical flow as defined by Lubin and Springer for a gravity system. Therefore, it would not matter what is downstream of the outlet and the correlation should apply. The correlation would not apply as well if the HPCI or RCIC flow were less than the critical flow.

Lubin and Springer's results are compared in Figure 13 of Reference 23 with two independent experiments with excellent results. The interesting aspect of this work shows that a draining tank requires less submergence than a tank that's level is held constant.

5.2.1 HPCI Suction Critical Submergence

Kubie states that drawdown or vortexing can be a problem for liquid flow rates above the critical flow rate, or the flow rate required for the onset of choking of the outlet orifice. Kubie uses Equation 22 of Ref. 23, page 1197, to calculate this flow rate. It will be performed here to ensure that HPCI flow is greater than the critical flow.

Q_c = critical flow rate = (gR^5)^0.5 * 5 * (C_d)^1.5

where:

C_d = the discharge coefficient = 1.0 (assumed - C_d would actually be less than 1)

Q_c = 6.73 ft^3/sec

The HPCI flow rate as calculated above is 9.95 ft^3/sec and thus greater than the critical flow.

Note that Lubin and Springer do not explicitly define units for the parameters so this calculation will use consistent units for these parameters for the calculation of the dimensionless critical height, H/R.

H/R = 0.69 * [Q/(gR^5)^0.5] ^0.4 (Eq. 28, Ref. 23)

where:

H = the critical height, ft

R = radius of the outlet, ft

Q = Outlet flowrate, ft^3/sec

g = gravitational constant, ft/sec^2

Substituting the values associated with the HPCI system to Equation 28 of Reference 23 the result is:

R = 0.5625 ft

Q = 9.95 ft^3/sec

g = 32.2 ft/sec^2

H/R = 1.53567

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Therefore the critical height of submergence or the height to prevent drawdown as termed in Ref. 23 is

H = 0.86 ft
H = 10.37 in

A memo from DE&S, Ref. 22, provided another correlation of a draining tank with no swirl, a vertical downward outlet, and an axisymmetric outlet. This equation also comes from Kubie in the Journal of Mechanical Engineering Science, Proc. Instn. Mechanical Engineers, Vol. 198A, No. 5, 1984, Kubie. J, "Axisymmetric Outflow from Large Vessels." It is provided here to show that the results are very similar to the correlation used above by Lubin and Springer.

H/D = 0.595 * Fr^(2/3)

Fr = 1.663

H/D = 0.83526

H = 11.3 inches

From the HPCI inlet at 9.625 in, the critical height of submergence is 20.0 inches above the bottom of the CST.

HPCI Critical Height of Submergence = 20.0 inches above CST Bottom

Consequence:

As discussed in the Introduction, VYC-723, Rev.2 assumed the minimum useful CST level to be the bottom of the horizontal section of the elbow intake which is per Ref. 11, ~11" above the CST bottom.
It has been determined in this calculation that the unusable CST level, or critical height of submergence is equal to 20.0 inches above the CST bottom or 8.7 inches above the value determined in VYC-723. Increasing the critical height has resulted in the following issues.

1 Elimination of 10,000 gallon switchover margin
2 Less than 75,000 gallons of required reserve volume

Resolution of Issue Number 1
The HPCI system contains an automatic low CST level suction transfer to torus setpoint. The setpoint's function is to transfer HPCI suction from the CST to the torus by opening the torus suction valves and closing the CST suction valve. The setpoint must meet two criteria, 1) Per T.S. Table 3.2.1, it must be >=3% of the CST volume, and
2) Per Reference 1, there should be 10,000 usable gallons below the actuation setpoint (Acuation can occur anywhere within the range of accuracy of this level instrumentation).

Reference 9, Rev.2, has calculated the nominal setpoint for at what level this should occur. As with most setpoints, there is inaccuracy associated with the instruments and so the following range was calculated by Ref. 9.

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	Height Above the Bottom of CST
Instrument High	40.2 in
Nominal Setpoint	32.2 in
Instrument Low	24.2 in

The chosen applicable critical height of submergence is at 20.0 inches above the CST bottom.
The critical height appears to be slightly below the Instrument Low Level setting by 4.2 inches.

In order to meet the 10,000 gallon reserve requirement, this calculation must supply a process setting whose instrument low level is 10,000 gallons above 20.0 inches. Per Ref. 9, there is 1224 gal/in of CST.

Height of 10,000 gallons in the CST = 10000 gal / 1224 gal/in
= 8.2 inches

Therefore the setting should be 8.2 inches above the vortex height of 20.0 inches or 28.2 inches above the bottom of the CST. If this is to be the lowest point at which a transfer can take place then the nominal setting should be above that by the amount of instrument accuracy as found per Ref. 9, for trip loop 107-5A/B

Per Ref. 9, the span of the HPCI/CST Loop level 107-5A/B is 390 inches. At 1224 gal/in, this would be equal to 477360 gallons. Three percent of that would be 14320.8 gallons or 11.7 inches above the instrument tap or 23.36 inches above the CST bottom. Setting the minimum actuation level at 28.2 inches would meet the T.S. >=3% requirement.

Minimum CST Low Level Automatic HPCI Suction Transfer Setpoint = 28.2 inches above CST bottom.
Without Instrument Uncertainty

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Resolution of Issue No. 2

The total CST reserve storage requirement to contain 75,000 gallons appears in the HPCI and RCIC data sheet, the FSAR, and Technical Specification 3.5.E.1. A detailed evaluation of this reserve follows.

Section 4.7.5, pg.4.7-3, of the FSAR states,

"Except for HPCIS, other systems which use the same reservoir for condensate and which could jeopardize the availability of this quantity have their suctions located so that 75,000 gallons are reserved for RCIC and HPCI; also, a low level alarm from the condensate storage tank is provided in the main control room. The alarm is energized and automatic transfer of pump suction to the torus is initiated when the level in the storage volume falls to the minimum required to meet the design requirements of the RCICS."

Section 11.8 of the FSAR, pg. 11.8-5, also describes the operating volume requirement of the CST as the sum of one waste tank volume, plus a volume equal to an 8-hour supply for makeup to the reactor in hot standby via either RCIC or HPCI or both when the reactor is above 300 F, and 10% of the above. The FSAR further states in this section, "so that the 8-hour supply... will always be available, all other suction pipes are terminated at a level above that required for the 8-hour supply." This infers that only the 8-hour requirement must be available below the CST internal standpipe. Support for this conclusion is provided in GE calculation DBD-004-GE-001 (Attachment 5). Per this calculation, providing 8 hours of hot-standby operation is the basis for 75,000 gallons. This conservative calculation actually calculated 65,000 gallons but said to use 75,000 gallons for conservatism. Memorandum VYS-114/97 calculations show that the 8-hour supply at hot shutdown equates to actually 56,571 gallons.

In addition, Technical Specification 3.5.E.1 requires that the CST contain at least 75,000 gallons of water whenever the irradiated fuel is in the reactor and reactor pressure is greater than 150 psig and prior to reactor startup from a cold condition. This requirement remains unaffected by the increase in unusable volume. Every shift, per AP0152, "Shift Turnover," the CST level is verified to be between 30% and 90%, using LI-107-5 on panel 9-6. The least therefore would be 30% of span or 117" above the level tap. Taking the 19.89" of indicator inaccuracy per Ref. 9, the lowest level would be approx. 97" or ~118,000 gallons.

As mentioned above, the 8-hour supply at hot standby equates to 56571 gallons of water. This is equivalent to 46.2 inches of CST height at 1224.0 gal per inch. If this height of required volume is subtracted from the absolute height of the standpipe or 74.66 inches, the water level at the end of the 8-hour period can be determined. The result would be 28.4 inches above the CST bottom. Fortunately, the critical height at the maximum flow is ~ 20.0 inches above the CST bottom. Thus HPCI meets the intent of the 75,000 gallon requirement because the critical height is below the level that is attained at the end of the 8-hour period of Hot Standby. This means that no air-entrainment would occur within the 8-hour period.

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6.0 Results and Consiusions

HPCI

The calculated critical height of submergence for HPCI suction is 20.0 inches above the CST bottom. It has been determined that for the HPCI suction from the CST, the critical height of submergence or the height at which air is entrained, is below the lower most possible actuation point for auto suction transfer. The setpoint is per Ref. 9 at 32.2" above CST bottom. The low range of this setpoint is at 24.2". The HPCI submergence height is 20.0 inches. Therefore, the potential for air entrainment before the suction transfer takes place is not a concern. However, the requirement to maintain 10,000 gallons of usable volume below the trip is not being met when the lower setpoint is 24.16 inches above the CST bottom. Therefore it is recommended, per the HPCI vortex evaluation of this calculation, the minimum acuation point for the automatic suction transfer from the CST to the Torus should be above 28.2 inches above CST bottom. Accuracy of trip Loop 107-5A/B will be added to this lower setpoint in order to get the nominal setting. The accuracy of this instrument loop is calculated in VYC-723.

It has also been concluded that with a critical height of 20.0 inches above the CST bottom, the HPCI system meets the intent of the 75,000 gallon requirement. Ensuring the transfer function occurs above 28.2 inches above the CST bottom meets the Tech Spec requirement of placing the setpoint greater than 3% CST volume.

RCIC

The current RCIC auto switchover nominal setpoint is 31.3". The lowest level that this could occur is 24.4". The calculated critical height of submergence for RCIC suction is 24.7 inches above the CST bottom. Therefore, it has been determined that the critical height of submergence for RCIC is inside the range of the RCIC low CST auto transfer to torus setpoint (using the VYC-706, Rev.0 inaccuracy values). This means air entrainment could occur before switchover. Therefore, it is recommended to ensure switchover occurs above 26.5 inches above the CST bottom.

Instrument accuracy as calculated by VYC-706 must be added to at least this value to get the nominal setpoint for automatic suction transfer on low CST level. At that setting, RCIC meets the Tech Spec minimum setting of greater than or equal to 3% of CST volume. The setting also includes some margin for the time it takes to transfer from the CST to the torus.

With respect to the 75,000 gallon requirement, it was determined that RCIC would provide 8-hours of hot standby operation, thus meeting the intent of this requirement.

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Service: Condensate Storage Tank Level (HPCI) Monitoring

Equipment I.D. : LT-107-5A & B, LSL-107-5A & B, LI-107-5, ERFIS F004

1.0 Loop Calibration conditions

$psi := lb \cdot in^{-2}$ $\qquad inWC := \frac{1}{27.7276 \cdot psi}$

$LRL := 170 \cdot inWC$ $\qquad LRL = 170.0 \circ inWC$ $\qquad$ Transmitter Upper and Lower Range Limits

$URL := 850 \cdot inWC$ $\qquad URL = 850.0 \circ inWC$

$CS_{min} := 4 \cdot inWC$

$CS_{max} := 394 \cdot inWC$

$CS := (CS_{max} - CS_{min})$ $\qquad CS = 390.0 \circ inWC$ $\qquad$ Transmitter calibrated span in inWC from OP-4363 [Ref. 6.12]

2.0 Process Measurement Effects

The only process measurement effects associated with these channels are due to density changes over the credible range of CST fluid temperatures of 40°F to 100°F (calculation Table 3).

v = specific volume at given CST temperatures

L = height of water in CST being monitored

PM = process measurement error due to density changes

0.01605 = specific volume of water at 70°F (Ref. 6.32) and 15 psia

$v_{40} := 0.01602 \cdot ft^3 \cdot lb^{-1}$ ✓ — Specific volume at 40°F [Ref. 6.32 p. 229]

$v_{70} := 0.01605 \cdot ft^3 \cdot lb^{-1}$ ✓ — Specific volume at 70°F [Ref. 6.32 p. 229]

$v_{100} := 0.01613 \cdot ft^3 \cdot lb^{-1}$ ✓ — Specific volume at 100°F [Ref. 6.32 p. 229]

$n := 0..\,4$

$L_n := ((n \cdot 97.5) + 4) \cdot inWC$

$PM\ pos_n := L_n - \frac{v_{40}}{v_{70}} \cdot L_n$ ✓ — POSITIVE [initials] 11-23-98 ~~Negative~~ process measurement error resulting from a change in temperature from 70°F to 40°F.

$PM\ neg_n := L_n - \frac{v_{100}}{v_{70}} \cdot L_n$ ✓ — NEGATIVE [initials] 11-23-98 ~~Positive~~ process measurement error resulting from a change in temperature from 70°F to 100°F.

$\%Level_n := n \cdot 25 \cdot \%$

As indicated in Ref. 6.1, section 3.1, a negative process measurement bias error indicates sensed level is less than actual level. Conversely, a positive process measurement bias error indicates sensed level is greater than actual level. Since these errors are fixed errors, they will be algebraically added to the statistical errors.

$\%Level_n$	$PM\ neg_n$	L_n	$PM\ pos_n$
%	inWC	inWC	inWC
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

Positive and negative process measurement bias errors at 0, 25, 50, 75, and 100% level over the calibrated range of LT-107-5A/B.

3.0 Module Uncertainties

3.1 Primary Element (e_0)

There is no primary element associated with the measurement of CST level.

3.2 Transmitter LT-107-5A and LT-107-5B (Module 1 - e_1)

$CT_1 := 0.5\cdot\%\cdot CS$ — $CT_1 = 1.950 \cdot inWC$ — Calibration Tolerance in equivalent inWC

$CT_{mv} := \dfrac{CT_1\cdot 40}{CS}$ — $CT_{mv} = 0.20$ — Calibration Tolerance = 0.2 mV per Procedure OP4363, Rev. 24

$T_1 := 114\cdot day$ — T_1 = Total time interval between calibrations = 3 months + 25% = 114 days

$hC := 0\cdot inWC$ — There is no head correction associated with these instruments.

3.2.1 Uncertainty Elements

3.2.1.1 Reference Accuracy (A)

$A_1 := 0.40\cdot\%\cdot CS$ — $A_1 = 1.560 \cdot inWC$ — Accuracy includes combined effects of hysteresis, linearity and repeatability (see Table 5).

3.2.1.2 Calibration Effect (CE)

CE = CT = A
Where:
CT = Calibration tolerance of transmitters
A = Instrument Reference (vendor) accuracy

Since these transmitters will be calibrated with a full traverse increasing and decreasing, CE will equal CT (per Methodology Section 3.6.2.C).

$CT_1 = 1.950 \cdot inWC$

Design Guide section 3.6.2 recommends CT = 0.6% for GE 555 transmitters, however, since CT has been 0.5% [Ref. 6.12], CT will remain at 0.5%.

$CE_1 := CT_1$ — $CE_1 = 1.950 \cdot inWC$ — Transmitter Calibration Effect

3.2.1.3 Dead Band (DB)

$DB_1 := 0 \cdot inWC$

Deadband is not specified and assumed to be negligible [Assumption 2.3.10].

3.2.1.4 Measurement & Test Equipment (MTE)

The M&TE uncertainty should be less than or equal to the reference accuracy of the device being calibrated [Ref. 6.1]

$MTE = (m_1^2 + m_2^2)^{1/2}$

Where:

A = Accuracy of the Transmitter
CS = Calibrated span of the Transmitter
m_1, m_2 = Uncertainty of input and output test instrument in mVdc
M_1, M_2 = Uncertainty of input (M_1) and output (M_2) test equipment in inWC
MTE = M&TE uncertainty in inWC

In this section, the required accuracy of the pressure measurement is calculated based on the accuracy of the mV measurement.

Test equipment uncertainties from Table 11

$A_1 = 1.560 \cdot inWC$ — Accuracy of Transmitter = 0.40% CS

$m2_1 := 0.0547 \cdot mV$ — $m2_1 = 0.0547 \cdot mV$ — mVdc accuracy for 3466 @ 50 mVdc [Table 11]

$M2_1 := \frac{m2_1}{40 \cdot mV} \cdot CS$ — $M2_1 = 0.5333 \cdot inWC$ — Millivolt measurement uncertainty in inWC.

In order for total M&TE uncertainty (MTE) to be less than or equal to reference accuracy (A), the limiting accuracy of test gauge(s) used for the transmitter calibration are found as follows. MTE is set equal to A = 1.560 inWC.

$MTE := A_1$ — $MTE = 1.560 \cdot inWC$

$M1_1 := \sqrt{MTE^2 - M2_1^{\,2}}$ — $M1_1 = 1.466 \cdot inWC$

For this evaluation of the potential test equipment listed in Table 11, only the gauges with accuracies better than or equal to 1.466 inWC will support the requirement for M&TE uncertainty better than or equal to 0.40% span (1.560 inWC). The pressure gauge recommended for use is the Heise 901B (0-400 inWC). The Heise CMM (0-800 inWC), Heise CMM (0-830 inWC), and Heise 901B (0-1000 inWC) are also acceptable for use.

$MTE_1 := 0.0 \cdot inWC$

$MTE_1 = 0.000 \cdot inWC$

Transmitters MTE uncertainty is included in the Loop or Module Drift term (Assumption 2.3.18).

3.2.1.5 Drift (DA)

$DA_1 := 0.649 \cdot \% \cdot CS$

$DA_1 = 2.531 \cdot inWC$

Transmitter analyzed drift (Assumption 2.3.10 and Attachment P).

3.2.1.6 Temperature Effect (TE)

$TE_{n1} = TE_{a1} = 0.0\ inWC$

$TE_1 := 0.0 \cdot inWC$

$TE_1 = 0.000 \cdot inWC$

Temperature effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18). Normal ΔT of 30°F is included in Loop or module ADR since quarterly calibrations experience all conditions.

3.2.1.7 Barometric Pressure Effect (PB)

Barometric pressure effect is either the effect on the vented side of gage pressure transmitters, or the error associated with calibration of an absolute pressure transmitter using gauge pressure test instruments.

The GE 555 is a differential pressure transmitter monitoring a tank vented to atmosphere, therefore this effect is negligible per Ref. 6.1 section 3.6.8.

$PB_1 := 0 \cdot inWC$

3.2.1.8 Humidity Effect (HE)

$HE_1 := 0 \cdot inWC$

Humidity effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18)

3.2.1.9 Radiation Effect (RE)

$RE_{a1} = RE_{n1} = 0.0$ inWC

Radiation effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18)

$RE_1 := 0.0 \cdot inWC$ $\qquad$ $RE_1 = 0.000 \cdot inWC$

3.2.1.10 Seismic Effect (SE)

$SE_1 := 0.5 \cdot \% \cdot CS$ $\qquad$ $SE_1 = 1.950 \cdot inWC$ $\qquad$ Assumption 2.3.10

3.2.1.11 Process Pressure Effects (SP)

$SP_1 := 0.0 \cdot inWC$ $\qquad$ $SP_1 = 0.000 \cdot inWC$

Since the maximum pressure felt by the transmitter is 394 inWC+ ambient pressure, static pressure and over- pressure effects and corrections for this application are not applicable

3.2.1.12 Power Supply Voltage Effect (VE)

Power Supply Voltage Effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18)

$VE_1 := 0.0$ inWC $\qquad$ $VE_1 = 0.000 \cdot inWC$

3.2.2 Transmitter Total Module Uncertainty

3.2.2.1 Normal Conditions

$CE_1 = 1.950 \cdot inWC$ $\qquad$ $DB_1 = 0.000 \cdot inWC$

$$e_{n1R} := \sqrt{CE_1^{\,2} + DB_1^{\,2}}$$

Since MTE, TE, PB, HE, RE and VE are all included in the Analyzed Drift term (Assumption 2.3.18) and SP = 0.

$e_{n1R} = 1.950 \cdot inWC$

Normal transmitter module uncertainty (e_{n1R}) for calibration every 3 months (114 days)

3.2.2.2 Testing Conditions

$$e_{t1R} := \sqrt{CE_1^2 + DB_1^2}$$

Since MTE, PB, TE, HE, RE and VE are all included in the Analyzed Drift term (Assumption 2.3.18) and SP = 0.

$$e_{t1R} = 1.950 \cdot inWC$$

Testing transmitter module uncertainty (e_{t1R}) for calibration every 3 months (114 days)

3.2.2.3 Accident - LOCA (small break) with Seismic & without Radiation

$CE_1 = 1.950 \cdot inWC$ $DB_1 = 0.000 \cdot inWC$ $SE_1 = 1.950 \cdot inWC$

Since MTE, PB, TE, HE, RE and VE are all included in the Analyzed Drift term (Assumption 2.3.18), SP = 0, and mild environments.

$$e_{a1R} := \sqrt{CE_1^2 + DB_1^2 + SE_1^2}$$

$$e_{a1R} = 2.758 \cdot inWC$$

Accident transmitter module uncertainty (e_{a1R}) for calibration every 3 months (114 days)

3.3 Alarm Unit LSL-107-5A & B (Module 2 - e_2)

$CT_2 := 0.2 \cdot mV$ — $CT_2 = 0.200 \cdot mV$ — Existing Calibration Tolerance in mVdc per OP-4363 [Ref. 6.12] and Table 6.

$CT_{2\%} := \dfrac{CT_2}{40 \cdot mV}$ — $CT_{2\%} = 0.500 \cdot \%$ — Calibration Tolerance in % span

$T_2 := 114 \cdot day$ — T_2 = Total time interval between calibrations = 3 months + 25% = 114 days

3.3.1 Uncertainty Elements

3.3.1.1 Reference Accuracy (A)

$A = (AX^2 + h^2 + l^2 + r^2)^{1/2}$
Where:
A = Reference accuracy of instrument
AX = Vendor's stated basic accuracy expression
h = hysteresis
l = linearity
r = repeatability

$AX_2 := 0.500 \cdot \% \cdot CS$ $\quad l_2 := 0 \cdot \% \cdot CS$

$h_2 := 0 \cdot \% \cdot CS$ $\quad r_2 := 0.100 \cdot \% \cdot CS$

$A_2 := \sqrt{AX_2^{\,2} + h_2^{\,2} + l_2^{\,2} + r_2^{\,2}}$ — $A_2 = 1.989 \cdot inWC$ — Alarm Unit Accuracy in inWC

$A_{2\%} := \dfrac{A_2}{CS}$ — $A_{2\%} = 0.510 \cdot \%$

3.3.1.2 Calibration Effect (CE)

CE = CT = A
Where:
CT = Calibration tolerance of alarm units
A = Instrument Reference (vendor) accuracy

Since these alarm units are single point devices, CE will equal CT [Ref. 6.33].

$CT_{2mv} := 0.2 \cdot mV$ $\quad CT_{2\%} = 0.500 \cdot \%$

Existing CT is slightly smaller than A; since CT of 0.5% has been used successfully in the past [Ref. 6.12], CT will remain at 0.5%.

$CT_2 := \frac{CT_{2mv} \cdot CS}{40 \cdot mV}$ $\quad CT_2 = 1.950 \cdot inWC$ — Alarm Unit Calibration Tolerance in inWC

$CE_2 := CT_2$ $\quad CE_2 = 1.950 \cdot inWC$ — Alarm Unit Calibration Effect in inWC

3.3.1.3 Dead Band (DB)

$DB_{2reset} := 1.0 \,\% \cdot CS$ $\quad DB_{2reset} = 3.900 \cdot inWC$

$DB_2 := 0.0 \cdot inWC$ $\quad DB_2 = 0.000 \cdot inWC$

Deadband for the alarm unit is associated only with the fixed reset band of the trip setpoint [Table 6 and Attachment F].

3.3.1.4 Measurement & Test Equipment (MTE)

The M&TE uncertainty should be less than or equal to the reference accuracy of the device being calibrated [Ref. 6.1]

$MTE = (m_1^2 + m_2^2)^{1/2}$

Where:

A = Accuracy of the Alarm Unit
CS = Calibrated span of the Transmitter Unit
m_1, m_2 = Uncertainty of input and output test instrument in mVdc
M_1, M_2 = Uncertainty of input (M_1) and output (M_2) test equipment in inWC
MTE = M&TE uncertainty in inWC

In this section, the required accuracy of the mVdc measurement is evaluated.

Test equipment uncertainties from Table 11

Since the Alarm Units are calibrated as modules only, with transmitter input pressure adjusted to obtain ideal millivolt input values to the Alarm Unit, only the DMM need be considered. The accuracy of the DMM must be better than or equal to the accuracy of the Alarm Unit.

$A_{2mv} := \frac{A_2}{CS} \cdot 40 \cdot mV$ $\quad A_{2mv} = 0.204 \cdot mV$ — Accuracy of Alarm Unit = 0.510% CS

$m_1 := 0.0547 \cdot mV$ $\quad m_1 = 0.0547 \cdot mV$ — mVdc accuracy for 3466 @ 50 mVdc [Table 11]

$M_1 := \frac{m_1}{40 \cdot mV} \cdot CS$ $\quad M_1 = 0.5333 \cdot inWC$ — Millivolt measurement uncertainty in inWC.

Since either the HP 3466 or HP 34401A has better accuracy than the Alarm Unit accuracy of 0.204 mV, both are acceptable for Alarm Unit setpoint calibration.

$MTE_2 := 0.0 \cdot inWC$ | $MTE_2 = 0.000 \cdot inWC$ ✓ | Alarm Unit MTE uncertainty is included in the Alarm Unit Analyzed Drift term (Assumption 2.3.18).

3.3.1.5 Drift (DA)

$DA_2 := 0.3640 \cdot \% \cdot CS$ | $DA_2 = 1.420 \cdot inWC$ ✓ | Alarm Unit analyzed drift (Assumption 2.3.14)

3.3.1.6 Temperature Effect (TE)

$TE_{n2} = TE_{a2} = 0.0\ inWC$

Temperature effect during normal and accident conditions are the same and included in the Alarm Unit Analyzed Drift term (Assumption 2.3.18)

$TE_2 := 0.0 \cdot inWC$ | $TE_2 = 0.000 \cdot inWC$ ✓

3.3.1.7 Humidity Effect (HE)

$HE_2 := 0 \cdot inWC$ | $HE_2 = 0.000 \cdot inWC$ ✓ | Humidity effect during normal and accident conditions are the same and included in the Alarm Unit Analyzed Drift term (Assumption 2.3.18)

3.3.1.8 Radiation Effect (RE)

$RE_{a2} = RE_{n2} = 0.0\ inWC$

Radiation effect during normal and accident conditions are the same and included in the Alarm Unit Analyzed Drift term (Assumption 2.3.18)

$RE_2 := 0.0 \cdot inWC$ | $RE_2 = 0.000 \cdot inWC$ ✓

3.3.1.9 Seismic Effect (SE)

$SE_2 := 0.0 \cdot \% \cdot CS$ | $SE_2 = 0.000 \cdot inWC$ ✓ | Assumption 2.3.11

3.3.1.10 Power Supply Voltage Effect (VE)

$VE_2 := 0.0\ inWC$

$VE_2 = 0.000 \cdot inWC$ ✓

Power Supply Voltage Effect during normal and accident conditions are the same and included in the Alarm Unit Analyzed Drift term (Assumption 2.3.18)

3.3.2 Alarm Unit Total Module Uncertainty

3.3.2.1 Normal Conditions

$CE_2 = 1.950 \cdot inWC$ $DB_2 = 0.000 \cdot inWC$ $DA_2 = 1.420 \cdot inWC$

$$e_{n2R} := \sqrt{CE_2^2 + DB_2^2 + DA_2^2}$$ ✓

$e_{n2R} = 2.412 \cdot inWC$ ✓

Since MTE, TE, HE, RE and VE are all included in Alarm Unit DA term (Assumption 2.3.18).

Normal alarm unit module uncertainty (e_{n2R}) for calibration every 3 months (114 days)

3.3.2.2 Testing Conditions

$$e_{t2R} := \sqrt{CE_2^2 + DB_2^2 + DA_2^2}$$ ✓

$e_{t2R} = 2.412 \cdot inWC$ ✓

Since MTE, TE, HE, RE and VE are all included in Alarm Unit Analyzed Drift term (Assumption 2.3.18).

Testing alarm unit module uncertainty (e_{t2R}) for calibration every 3 months (114 days)

3.3.2.3 Accident - LOCA (small break) with Seismic & without Radiation

$CE_2 = 1.950 \cdot inWC$ $DB_2 = 0.000 \cdot inWC$ $SE_2 = 0.000 \cdot inWC$ $DA_2 = 1.420 \cdot inWC$

$$e_{a2R} := \sqrt{CE_2^2 + DB_2^2 + DA_2^2 + SE_2^2}$$ ✓

$e_{a2R} = 2.412 \cdot inWC$ ✓

Since MTE, TE, HE, RE and VE are all included in Alarm Unit Analyzed Drift term (Assumption 2.3.18), and with mild environments.

Accident alarm unit module uncertainty (e_{a2R}) for calibration every 3 months (114 days)

3.4 Indicator LI-107-5 (Module 3 - e_3)

$CT_{3\%} := 2.5 \cdot \%$ — $CT_{3\%} = 2.500 \cdot \%$ — Existing Calibration Tolerance in % per OP-4363 [Ref. 6.12] and Table 7.

$CT_3 := CT_{3\%} \cdot CS$ — $CT_3 = 9.750 \cdot inWC$ — Calibration Tolerance in equivalent inWC

$T_3 := 114 \cdot day$ — T_3 = Total time interval between calibrations = 3 months + 25% = 114 days

3.4.1 Uncertainty Elements

3.4.1.1 Reference Accuracy (A)

$A = (AX^2 + h^2 + l^2 + r^2)^{1/2}$

Where:
A = Reference accuracy of instrument
AX = Vendor's stated basic accuracy expression
h = hysteresis
l = linearity
r = repeatability

$AX_3 := 1.500 \cdot \% \cdot CS$ $\quad l_3 := 0 \cdot \% \cdot CS$

$h_3 := 0 \cdot \% \cdot CS$ $\quad r_3 := 2.000 \cdot \% \cdot CS$

$A_3 := \sqrt{AX_3^2 + h_3^2 + l_3^2 + r_3^2}$ — $A_3 = 9.750 \cdot inWC$ — Indicator Accuracy in equivalent inWC

$A_{3\%} := \frac{A_3}{CS}$ — $A_{3\%} = 2.500 \cdot \%$

3.4.1.2 Calibration Effect (CE)

CE = CT = A
Where:
CT = Calibration tolerance of indicator
A = Instrument Reference (vendor) accuracy

Since these indicators will be calibrated with a full traverse calibration, CE will equal CT [Ref. 6.33].

$CT_3 := 2.5 \cdot \%$	$CT_3 = 2.500 \cdot \%$	Existing CT is equal to A or 2.5%; however, readability is to 1% per Table 7. All past calibration data shows that indicator as-found has always been within 2.0% [Ref. 6.8], therefore CT will be revised to 2.0% based on indicator readability.
$CT_3 := 2.0\ \%$	$CT_3 = 2.000 \cdot \%$	
$CT_3 := CT_3 \cdot CS$	$CT_3 = 7.800 \cdot inWC$	Indicator Calibration Tolerance in inWC
$CE_3 := CT_3$	$CE_3 = 7.800 \cdot inWC$	Indicator Calibration Effect in inWC

3.4.1.3 Readability (RD) Uncertainty

$RD_{3\%} := (0.25 \cdot 2.0) \cdot \%$	$RD_{3\%} = 0.500 \cdot \%$	Readability uncertainty = 1/4 minor division; included in the Indicator Loop Drift term (Assumption 2.3.18).
$RD_3 := RD_{3\%} \cdot CS$	$RD_3 = 1.950 \cdot inWC$	

3.4.1.4 Measurement & Test Equipment (MTE)

The M&TE uncertainty should be less than or equal to the reference accuracy of the device being calibrated [Ref. 6.1]

$MTE = (m_1^2 + m_2^2)^{1/2}$

Where:

A = Accuracy of the indicator
CS = Calibrated span of the Transmitter
m_1, m_2 = Uncertainty of input and output test instrument in mVdc
M_1, M_2 = Uncertainty of input (M_1) and output (M_2) test equipment in inWC
MTE = M&TE uncertainty in inWC

In this section, the required accuracy of the mVdc measurement is evaluated.

Test equipment uncertainties from Table 11

Since the Indicator is calibrated as a loop with transmitter input pressure adjusted to obtain ideal millivolt input values to the Indicator, only the DMM need be considered. The accuracy of the DMM must be better than or equal to the accuracy of the Indicator. In this case, since the calibration tolerance is being revised to 2.0%, the M&TE should be better than or equal to 2.0% versus Accuracy of 2.5%.

$A_{3mv} := \frac{CT_3}{CS} \cdot 40 \cdot mV$	$A_{3mv} = 0.800 \cdot mV$	CT of Indicator = 2.0% CS
$m_1 := 0.0547 \cdot mV$	$m_1 = 0.0547 \cdot mV$	mVdc accuracy for 3466 @ 50 mVdc [Table 11]
$M_1 := \frac{m_1}{40 \cdot mV} \cdot CS$	$M_1 = 0.5333 \cdot inWC$	Millivolt measurement uncertainty in inWC.

Since either the HP 3466 or HP 34401A has better accuracy than the Indicator accuracy (1.0 mV) or CT (0.8 mV), both are acceptable for Indicator calibration based on transmitter output mV.

$MTE_3 := 0.0 \cdot inWC$ $MTE_3 = 0.000 \cdot inWC$ ✓ Indicator MTE uncertainty is included in the Indicator Loop Drift term (Assumption 2.3.18).

3.4.1.5 Drift (DR)

$DR_3 := 0 \cdot inWC$ $DR_3 = 0.000 \cdot inWC$ ✓ Indicator drift is included in the Indicator Loop Analyzed Drift term (Assumption 2.3.18).

3.4.1.6 Temperature Effect (TE)

$TE_{n3} = TE_{a3} = 0.0$ inWC

$TE_3 := 0.0 \cdot inWC$ $TE_3 = 0.000 \cdot inWC$ ✓ Temperature effect during normal and accident conditions are the same and included in the Indicator Loop Analyzed Drift term (Assumption 2.3.18)

3.4.1.7 Humidity Effect (HE)

$HE_3 := 0 \cdot inWC$ $HE_3 = 0.000 \cdot inWC$ ✓ Humidity effect during normal and accident conditions are the same and included in the Indicator Loop Analyzed Drift term (Assumption 2.3.18)

3.4.1.8 Radiation Effect (RE)

$RE_{a3} = RE_{n3} = 0.0$ inWC

$RE_3 := 0.0 \cdot inWC$ $RE_3 = 0.000 \cdot inWC$ ✓ Radiation effect during normal and accident conditions are the same and included in the Indicator Loop Analyzed Drift term (Assumption 2.3.18)

3.4.1.9 Seismic Effect (SE)

$SE_3 := 0.0 \cdot \% \cdot CS$ $SE_3 = 0.000 \cdot inWC$ ✓ Assumption 2.3.12

3.4.1.10 Power Supply Voltage Effect (VE)

$VE_3 := 0.0$ inWC $VE_3 = 0.000 \cdot inWC$ ✓ Power Supply Voltage Effect during normal and accident conditions are the same and included in the Indicator Loop Drift term (Assumption 2.3.18)

3.4.2 Indicator Total Module Uncertainty

3.4.2.1 Normal Conditions

$CE_3 = 7.800 \cdot inWC$

$e_{n3R} := CE_3$

Since MTE, RD, TE, HE, RE and VE are all included in Indicator Loop Drift term (Assumption 2.3.18).

$e_{n3R} = 7.800 \cdot inWC$ ✓

Normal indicator module uncertainty (e_{n3R}) for calibration every 3 months (114 days)

3.4.2.2 Testing Conditions

$CE_3 = 7.800 \cdot inWC$

$e_{t3R} := CE_3$

Since MTE, RD, TE, HE, RE and VE are all included in Indicator Loop Drift term (Assumption 2.3.18).

$e_{t3R} = 7.800 \cdot inWC$ ✓

Testing indicator module uncertainty (e_{t3R}) for calibration every 3 months (114 days)

3.4.2.3 Accident - LOCA (small break) with Seismic & without Radiation

$CE_3 = 7.800 \cdot inWC$ $\quad SE_3 = 0.000 \cdot inWC$

$e_{a3R} := \sqrt{CE_3^2 + SE_3^2}$ ✓

Since MTE, RD, TE, HE, RE and VE are all included in Indicator Loop Drift term (Assumption 2.3.18), and mild environments.

$e_{a3R} = 7.800 \cdot inWC$ ✓

Accident indicator module uncertainty (e_{a3R}) for calibration every 3 months (114 days)

3.5 Recorder LR-23-73 (Green Pen) - (Module 4 - e_4)

This section evaluates the uncertainty of the Recorder Indicator scale associated with the green pen only; the chart paper is used primarily for trending rather than as a direct indication of CST level.

$CT_{4\%} := 1.0 \cdot \%$ $\quad$ $CT_{4\%} = 1.000 \cdot \%$ ✓ $\quad$ Existing Calibration Tolerance in % per OP-4363 [Ref. 6.12] and Table 8.

$CT_4 := CT_{4\%} \cdot CS$ $\quad$ $CT_4 = 3.900 \cdot inWC$ ✓ $\quad$ Calibration Tolerance in inWC

$T_4 := 114 \cdot day$ $\quad$ T_4 = Total time interval between calibrations = 3 months + 25% = 114 days

3.5.1 Uncertainty Elements

3.5.1.1 Reference Accuracy (A)

$A = (AX^2 + h^2 + l^2 + r^2)^{1/2}$

Where:

A = Reference accuracy of instrument
AX = Vendor's stated basic accuracy expression
h = hysteresis
l = linearity
r = repeatability

$AX_4 := 0.500 \cdot \% \cdot CS$ $\quad$ $l_4 := 0 \cdot \% \cdot CS$

$h_4 := 0 \cdot \% \cdot CS$ $\quad$ $r_4 := 0.400 \cdot \% \cdot CS$

$A_4 := \sqrt{AX_4^2 + h_4^2 + l_4^2 + r_4^2}$ ✓ $\quad$ $A_4 = 2.497 \cdot inWC$ ✓ $\quad$ Recorder Indication Accuracy in inWC

$A_{4\%} := \frac{A_4}{CS}$ $\quad$ $A_{4\%} = 0.640 \cdot \%$ ✓ $\quad$ Recorder Indication Accuracy in %

3.5.1.2 Calibration Effect (CE)

CE = CT = A

Where:

CT = Calibration tolerance of recorder
A = Instrument Reference (vendor) accuracy

Since the recorder will be calibrated with a full traverse calibration, CE will equal CT [Ref. 6.33].

$CT_4 := 1.0 \cdot \%$	$CT_4 = 1.000 \cdot \%$	Existing CT is greater than A at 1.0%; however, readability is to 0.5% per Table 8. All past calibration data shows that recorder as-found has always been within 1.0% [Ref. 6.8], therefore CT will be remain at 1.0% based on test data.
$CT_4 := CT_4 \cdot CS$	$CT_4 = 3.900 \cdot inWC$	Recorder Indicator Calibration Tolerance in inWC
$CE_4 := CT_4$	$CE_4 = 3.900 \cdot inWC$	Recorder Indicator Calibration Effect in inWC

3.5.1.3 Readability (RD) Uncertainty

$RD_{4\%} := (0.25 \cdot 1.0) \cdot \%$	$RD_{4\%} = 0.250 \cdot \%$	Readability uncertainty for the recorder indicator is included in the Recorder Loop Drift term (Assumption 2.3.18).
$RD_4 := RD_{4\%} \cdot CS$	$RD_4 = 0.975 \cdot inWC$	

3.5.1.4 Measurement & Test Equipment (MTE)

The M&TE uncertainty should be less than or equal to the reference accuracy of the device being calibrated [Ref. 6.1]

$MTE = (m_1^2 + m_2^2)^{1/2}$

Where:

A = Accuracy of the Recorder
CS = Calibrated span of the Transmitter
m_1, m_2 = Uncertainty of input and output test instrument in mVdc
M_1, M_2 = Uncertainty of input (M_1) and output (M_2) test equipment in inWC
MTE = M&TE uncertainty in inWC

In this section, the required accuracy of the mVdc measurement is evaluated.

Test equipment uncertainties from Table 11

Since the Recorder is calibrated as a loop with transmitter input pressure adjusted to obtain ideal millivolt input values to the Recorder, only the DMM need be considered. The accuracy of the DMM must be better than or equal to the accuracy of the Recorder indication scale. In this case, since the calibration tolerance is 1.0% and the accuracy is 0.64%, for conservatism, the M&TE should be better than or equal to 0.64%.

$A_{4mv} := A_{4\%} \cdot 40 \cdot mV$	$A_{4mv} = 0.256 \cdot mV$	A of Indicator = 0.64% CS
$m_1 := 0.0547 \cdot mV$	$m_1 = 0.0547 \cdot mV$	mVdc accuracy for 3466 @ 50 mVdc [Table 11]
$M_1 := \frac{m_1}{40 \cdot mV} \cdot CS$	$M_1 = 0.5333 \cdot inWC$	Millivolt measurement uncertainty in inWC.

Since either the HP 3466 or HP 34401A has better accuracy than the recorder accuracy or CT, both are acceptable for recorder calibration based on transmitter output mV.

$MTE_4 := 0.0 \cdot inWC$	$MTE_4 = 0.000 \cdot inWC$	Recorder MTE uncertainty is included in the Recorder Loop Drift term (Assumption 2.3.18).

3.5.1.5 Drift (DR)

$DR_4 := 0 \cdot inWC$	$DR_4 = 0.000 \cdot inWC$	Recorder drift is included in the Recorder Loop Analyzed Drift term (Assumption 2.3.18).

3.5.1.6 Temperature Effect (TE)

$TE_{n4} = TE_{a4} = 0.0$ inWC $TE_4 := 0.0 \cdot inWC$	$TE_4 = 0.000 \cdot inWC$	Temperature effect during normal and accident conditions are the same and included in the Recorder Loop Analyzed Drift term (Assumption 2.3.18)

3.5.1.7 Humidity Effect (HE)

$HE_4 := 0 \cdot inWC$	$HE_4 = 0.000 \cdot inWC$	Humidity effect during normal and accident conditions are the same and included in the Recorder Loop Analyzed Drift term (Assumption 2.3.18)

3.5.1.8 Radiation Effect (RE)

$RE_{a4} = RE_{n4} = 0.0$ inWC $RE_4 := 0.0 \cdot inWC$	$RE_4 = 0.000 \cdot inWC$	Radiation effect during normal and accident conditions are the same and included in the Recorder Loop Analyzed Drift term (Assumption 2.3.18)

3.5.1.9 Seismic Effect (SE)

$SE_4 := 0.75 \cdot \% \cdot CS$	$SE_4 = 2.925 \cdot inWC$	Assumption 2.3.13

3.5.1.10 Power Supply Voltage Effect (VE)

$VE_4 := 0.0$ inWC	$VE_4 = 0.000 \cdot inWC$	Power Supply Voltage Effect during normal and accident conditions are the same and included in the Recorder Loop Drift term (Assumption 2.3.18)

3.5.2 Recorder (Green Pen) Total Module Uncertainty

3.5.2.1 Normal Conditions

$CE_4 = 3.900 \cdot inWC$

$e_{n4R} := CE_4$

Since MTE, RD, TE, HE, RE and VE are all included in Recorder Loop Drift term (Assumption 2.3.18).

$e_{n4R} = 3.900 \cdot inWC$

Normal recorder module uncertainty (e_{n4R}) for calibration every 3 months (114 days)

3.5.2.2 Testing Conditions

$CE_4 = 3.900 \cdot inWC$

$e_{t4R} := CE_4$

Since MTE, RD, TE, HE, RE and VE are all included in Recorder Loop Drift term (Assumption 2.3.18).

$e_{t4R} = 3.900 \cdot inWC$

Testing recorder module uncertainty (e_{t4R}) for calibration every 3 months (114 days)

3.5.2.3 Accident - LOCA (small break) with Seismic & without Radiation

$CE_4 = 3.900 \cdot inWC$ $\quad$ $SE_4 = 2.925 \cdot inWC$

$e_{a4R} := \sqrt{CE_4^2 + SE_4^2}$

Since MTE, RD, TE, HE, RE and VE are all included in Recorder Loop Drift term (Assumption 2.3.18), and mild environments.

$e_{a4R} = 4.875 \cdot inWC$

Accident recorder module uncertainty (e_{a4R}) for calibration every 3 months (114 days)

3.6 ERFIS Point F004 - (Module 5 - e_5)

$CT_{5gal} := 2.6 \cdot K \cdot gal$ | $CT_{5gal} = 2.600 \cdot K \cdot gal$ | Existing Calibration Tolerance in KGal per OP-4363 [Ref. 6.12] and Table 10.

$CT_5 := \frac{CT_{5gal}}{477.1 \cdot K \cdot gal} \cdot CS$ | $CT_5 = 2.125 \cdot inWC$ | Calibration Tolerance in inWC

$T_4 := 114 \cdot day$ | T_5 = Total time interval between calibrations = 3 months + 25% = 114 days

3.6.1 Uncertainty Elements

3.6.1.1 Reference Accuracy (A)

FS = Full scale input range of ERFIS PT = 80 mVdc	[Ref. 6.25 & Attach. J]
A_x = Gain Accuracy expression for 1 year	[Table 10 & Attach. J]
SIGRAN = Signal Range for PT F004 = 16 - 80 mV = 64 mV	[Attach. J]
IND_SPAN = Indication Span of 0 to 477.1 KGAL	[Ref. 6.12 & Attach. M]

$FS := 80 \cdot mV$

$A_x := 0.05 \cdot \% \cdot FS$

$SIGRAN := (80 - 16) \cdot mV$

$IND\_SPAN := 477100 \cdot gal$

$A_{5\%} := \frac{A_x}{SIGRAN}$ | $A_{5\%} = 0.0625 \cdot \%$ | ERFIS A/D Converter Accuracy in % of mVdc span

$A_{5Kgal} := A_{5\%} \cdot IND\_SPAN$ | $A_{5Kgal} = 298.188 \cdot gal$ | ERFIS Indication Accuracy in Kgal

$A_5 := A_{5\%} \cdot CS$ | $A_5 = 0.244 \cdot inWC$ | ERFIS Indication Accuracy in inWC

3.6.1.2 Calibration Effect (CE)

CE = CT = A
Where:
CT = Calibration tolerance of ERFIS
A = Instrument Reference (vendor) accuracy

Since ERFIS is digital equipment, then CE will equal CT [Ref. 6.33].

$CT_{5\%} := \frac{CT_5}{CS}$ $\quad CT_{5\%} = 0.545 \cdot \%$

Existing CT (0.545%) is much greater than A (0.0625%). Review of past ERFIS calibration data shows that 2.6 Kgal is an appropriate as-found tolerance [Ref. 6.8], therefore CT will be remain at 2.6 Kgal (0.545%) based on test data.

$CT_5 = 2.125 \cdot inWC$ ERFIS Calibration Tolerance in inWC

$CE_5 := CT_5$ $\quad CE_5 = 2.125 \cdot inWC$ ERFIS Calibration Effect in inWC

3.6.1.3 Readability (RD) Uncertainty

$RD_{5\%} := \frac{(10)}{477100}$ $\quad RD_{5\%} = 0.002 \cdot \%$ Resolution is to 0.01 KGal = +/- 10 gallons

$RD_5 := RD_{5\%} \cdot CS$ $\quad RD_5 = 0.008 \cdot inWC$ Readability uncertainty for the ERFIS is included in the ERFIS Point Loop Drift term (Assumption 2.3.18).

3.6.1.4 Measurement & Test Equipment (MTE)

The M&TE uncertainty should typically be less than or equal to the reference accuracy of the device being calibrated [Ref. 6.1]

$MTE = (m_1^2 + m_2^2)^{1/2}$
Where:
A = Accuracy of the ERFIS
CS = Calibrated span of the Transmitter
m_1, m_2 = Uncertainty of input and output test instrument in mVdc
M_1, M_2 = Uncertainty of input (M_1) and output (M_2) test equipment in inWC
MTE = M&TE uncertainty in inWC

In this section, the required accuracy of the mVdc measurement is evaluated.

Test equipment uncertainties from Table 11

Since the ERFIS point is calibrated as a loop with transmitter input pressure adjusted to obtain ideal millivolt input values to ERFIS, only the DMM need be considered. The accuracy of the DMM typically must be better than or equal to the accuracy of the component being calibrated (i.e. ERFIS indication). In this case, however, since the calibration tolerance is 0.545% and the accuracy is 0.0625%, the M&TE should be better than or equal to 0.545%.

$A_{5mv} := A_{5\%} \cdot 40 \cdot mV$	$A_{5mv} = 0.025 \cdot mV$	A of ERFIS = 0.0625% CS
$m_1 := 0.0547 \cdot mV$	$m_1 = 0.0547 \cdot mV$	mVdc accuracy for 3446 @ 50 mVdc [Table 11]
$M_1 := \dfrac{m_1}{40 \cdot mV} \cdot CS$	$M_1 = 0.5333 \cdot inWC$	Millivolt measurement uncertainty in inWC.

Since both the HP 3446 and HP 34401A have better accuracy than the ERFIS CT (0.218 mV), both are acceptable for ERFIS calibration based on transmitter output mV.

$MTE_5 := 0.0 \cdot inWC$	$MTE_5 = 0.000 \cdot inWC$	ERFIS MTE uncertainty is included in the ERFIS Loop Drift term (Assumption 2.3.18).

3.6.1.5 Drift (DR)

$DR_5 := 0 \cdot inWC$	$DR_5 = 0.000 \cdot inWC$	ERFIS drift is included in the ERFIS Loop Analyzed Drift term (Assumption 2.3.18).

3.6.1.6 Temperature Effect (TE)

$TE_{n5} = TE_{a5} = 0.0$ inWC

$TE_5 := 0.0 \cdot inWC$	$TE_5 = 0.000 \cdot inWC$	Temperature effect during normal and accident conditions are the same and included in the ERFIS Loop Analyzed Drift term (Assumption 2.3.18)

3.6.1.7 Humidity Effect (HE)

$HE_5 := 0 \cdot inWC$	$HE_5 = 0.000 \cdot inWC$	Humidity effect during normal and accident conditions are the same and included in the ERFIS Loop Analyzed Drift term (Assumption 2.3.18)

3.6.1.8 Radiation Effect (RE)

$RE_{a5} = RE_{n5} = 0.0$ inWC

$RE_5 := 0.0 \cdot inWC$	$RE_5 = 0.000 \cdot inWC$	Radiation effect during normal and accident conditions are the same and included in the ERFIS Loop Analyzed Drift term (Assumption 2.3.18)

3.6.1.9 Seismic Effect (SE)

$SE_5 := 0.0 \cdot \% \cdot CS$ $\qquad SE_5 = 0.000 \cdot inWC$

N/A for ERFIS

3.6.1.10 Power Supply Voltage Effect (VE)

$VE_5 := 0.0\ inWC$ $\qquad VE_5 = 0.000 \cdot inWC$

Power Supply Voltage Effect during normal and accident conditions are the same and included in the ERFIS Loop Drift term (Assumption 2.3.18)

3.6.1.11 ERFIS Scaling Bias

The ERFIS indication is scaled for 0 - 390 inWC = 10 - 50 mAdc = 16 to 80 mVdc = 0 to 477.1Kgal
Per VYC-723 Rev. 2, Attachment IX (Attachment B to this Rev.), each inch of CST level = 1224 gallons
Based on a monitored span of 0 to 390 inches, the total volume is 390 x 1224 = 477,360 gallons
Due to the scaling of the ERFIS point to 0 to 477.1Kgal, a bias error is introduced at each point based on the difference with actual level. The computations below will determine the magnitude of the bias.

$n1 := 0 .. 4$

$$Level_{n1} := \left[\left(n1 \cdot \frac{390}{4}\right) + 4\right] \cdot inWC$$

$$Actual_{n1} := (n1 \cdot 97.5) \cdot 1224 \cdot gal \qquad ERFIS_{n1} := n1 \cdot \frac{477100}{4} \cdot gal$$

$$ERFIS\_Bias\%_{n1} := \frac{ERFIS\_NegBias_{n1}}{477360 \cdot gal} \qquad ERFIS\_NegBias_{n1} := ERFIS_{n1} - Actual_{n1}$$

$Level_{n1}$ (inWC)	$Actual_{n1}$ (gal)	$ERFIS\_Bias\%_{n1}$ (%)	$ERFIS\_NegBias_{n1}$ (gal)	$ERFIS_{n1}$ (gal)
4.000	0	0	0	0
101.500	119340	-0.01362	-65.0	119275
199.000	238680	-0.02723	-130.0	238550
296.500	358020	-0.04085	-195.0	357825
394.000	477360	-0.05447	-260.0	477100

Based on the results presented above, the worst case bias error due to the current scaling of the ERFIS point is -260 gallons at the 477,360 gallon point which amounts to less than 0.25 inches of level error (-0.054%). Therefore, this bias error is negligible and will be ignored.

3.6.2 ERFIS Point F004 Total Module Uncertainty

3.6.2.1 Normal Conditions

$CE_5 = 2.125 \cdot inWC$

$e_{n5R} := CE_5$

Since MTE, RD, TE, HE, RE and VE are all included in ERFIS Loop Drift term (Assumption 2.3.18).

$e_{n5R} = 2.125 \cdot inWC$ ✓

Normal ERFIS module uncertainty (e_{n5R}) for calibration every 3 months (114 days)

3.6.2.2 Testing Conditions

$CE_5 = 2.125 \cdot inWC$

$e_{t5R} := CE_5$

Since MTE, RD, TE, HE, RE and VE are all included in ERFIS Loop Drift term (Assumption 2.3.18).

$e_{t5R} = 2.125 \cdot inWC$ ✓

Testing ERFIS module uncertainty (e_{t5R}) for calibration every 3 months (114 days)

3.6.2.3 Accident - LOCA (small break) with Seismic & without Radiation

Accident evaluation for ERFIS is N/A per section 1.3.2.

4.0 Total Loop Uncertainty

4.1 CST Alarm Unit Auto Suction Transfer Trip TLU (LT-107-5A & B, LSL-107-5A & B)

4.1.1 Normal Conditions

4.1.1.1 Random

$DA_1 := 0.649 \cdot \% \cdot CS$

$DA_1 = 2.531 \cdot inWC$ — Transmitter Analyzed Drift Term (Assumption 2.3.10 and Attachment P)

$e_{n1R} = 1.950 \cdot inWC$ — Transmitter normal uncertainty from section 3.2.2.1

$e_{n2R} = 2.412 \cdot inWC$ — Alarm Unit normal uncertainty from section 3.3.2.1 includes Analyzed Drift

$U_{nR12} := \sqrt{e_{n1R}^2 + e_{n2R}^2 + DA_1^2}$

$U_{nR12} = 4.003 \cdot inWC$ — Normal Random Uncertainty for alarm unit loop with quarterly calibration.

4.1.1.2 Bias

From section 2.0. magnitude of bias depends on point of interest

$\%Level_n$	$PM\ neg_n$	L_n	$PM\ pos_n$
%	inWC	inWC	inWC
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

$PM_{bias} := 0.190 \cdot inWC$

$U_{nB12\_pos} := PM_{bias}$

$U_{nB12\_pos} = 0.190 \cdot inWC$

For alarm unit actuation on decreasing level, positive bias is limiting (sensed level higher than actual). The process temperature bias is conservatively chosen at the 25% span point with the setpoint expected to be less than 10% (25 inWC setpoint/390 inWC span).

4.1.1.3 Normal Total Loop Uncertainty

$U_{n12} := U_{nR12} + U_{nB12\_pos}$

$U_{n12} = 4.193 \cdot inWC$ — Normal TLU in inWC

4.1.2 Testing Conditions

$e_{t2R} = 2.412 \cdot inWC$ — Alarm Unit test uncertainty from section 3.3.2.2 includes Analyzed Drift

$U_{tR2} := e_{t2R}$ — $U_{tR2} = 2.412 \cdot inWC$ ✓ — Testing Random Uncertainty for alarm unit with quarterly calibration. Alarm unit is calibrated as a module rather than as loop. Transmitter output is varied until trip and mV input to trip unit is measured and recorded at trip point.

4.1.2.1 Testing Total Loop Uncertainty

$U_{t2} := U_{tR2}$ — $U_{t2} = 2.412 \cdot inWC$ ✓ — Testing TLU in inWC. There are no bias terms associated with testing conditions.

4.1.3 Accident - Small Break LOCA with Seismic

4.1.3.1 Random

$DA_1 = 2.531 \cdot inWC$ — Transmitter Analyzed Drift Term (Section Assumption 2.3.14)

$e_{a1R} = 2.758 \cdot inWC$ — Transmitter accident uncertainty from section 3.2.2.3

$e_{a2R} = 2.412 \cdot inWC$ — Alarm Unit accident uncertainty from section 3.3.2.3 includes Analyzed Drift

$U_{aR12} := \sqrt{e_{a1R}^2 + e_{a2R}^2 + DA_1^2}$ ✓ — $U_{aR12} = 4.453 \cdot inWC$ ✓ — Accident Random Uncertainty for alarm unit loop with quarterly calibration.

4.1.3.2 Bias

$\%Level_n$	$PM\ neg_n$	L_n	$PM\ pos_n$
%	inWC	inWC	inWC
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

From section 2.0. magnitude of bias depends on point of interest

$PM_{bias} := 0.190 \cdot inWC$

$U_{aB12\_pos} := PM_{bias}$

$U_{aB12\_pos} = 0.190 \cdot inWC$

For alarm unit actuation on decreasing level, positive bias is limiting (sensed level higher than actual). The process temperature bias is conservatively chosen at the 25% span point with the setpoint expected to be less than 10% (25 inWC setpoint/390 inWC span).

4.1.3.3 Accident Total Loop Uncertainty

$U_{a12} := U_{aR12} + U_{aB12\_pos}$

$U_{a12} = 4.643 \cdot inWC$

Accident TLU in inWC

4.2 CST Indication Loop TLU (LT-107-5A, LI-107-5)

4.2.1 Normal Conditions

4.2.1.1 Random

$DA_{13} := 1.9932 \cdot \% \cdot CS$

$DA_{13} = 7.773 \cdot inWC$

Indicator Loop Analyzed Drift Term (Assumption 2.3.15)

$e_{n1R} = 1.950 \cdot inWC$

Transmitter normal uncertainty from section 3.2.2.1

$e_{n3R} = 7.800 \cdot inWC$

Indicator normal uncertainty from section 3.4.2.1

$U_{nR13} := \sqrt{e_{n1R}^2 + e_{n3R}^2 + DA_{13}^2}$

$U_{nR13} = 11.183 \cdot inWC$

Normal Random Uncertainty for indicator loop with quarterly calibration.

4.2.1.2 Bias

$\%Level_n$	$PM\ neg_n$	L_n	$PM\ pos_n$
%	inWC	inWC	inWC
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

From section 2.0. magnitude of bias depends on point of interest

$U_{nB13\_neg_n} := PM_{neg_n}$

$U_{nB13\_pos_n} := PM_{pos_n}$

For the indication function, both positive and negative bias at all points are considered.

4.2.1.3 Normal Total Loop Uncertainty

$U_{nR13_n} := U_{nR13}$

Normal Random uncertainty term

$U_{n13\_pos_n} := U_{nR13_n} + U_{nB13\_pos_n}$

Normal positive TLU with bias

$U_{n13\_neg_n} := \left(U_{nR13_n}\right) \cdot (-1) + U_{nB13\_neg_n}$

Normal negative TLU with bias

n	$\%Level_n$	U_{nR13_n}	$U_{nB13\_neg_n}$	$U_{nB13\_pos_n}$	$U_{n13\_neg_n}$	$U_{n13\_pos_n}$
	%	inWC	inWC	inWC	inWC	inWC
0	0	11.183	-0.020	0.007	-11.203	11.191
1	25.0	11.183	-0.506	0.190	-11.689	11.373
2	50.0	11.183	-0.992	0.372	-12.175	11.555
3	75.0	11.183	-1.478	0.554	-12.661	11.738
4	100.0	11.183	-1.964	0.736	-13.147	11.920

$U_{n13} := 13.147 \cdot inWC$

$U_{n13} = 13.147 \ inWC$

The bounding normal TLU of 13.147 inWC is conservatively chosen for all points.

4.2.2 Loop Testing Conditions

$DA_{13} = 7.773 \cdot inWC$ — Indicator Loop Analyzed Drift Term (Assumption 2.3.15)

$e_{t1R} = 1.950 \cdot inWC$ — Transmitter test uncertainty from section 3.2.2.2

$e_{t3R} = 7.800 \cdot inWC$ — Indicator test uncertainty from section 3.4.2.2

$$U_{tR13} := \sqrt{e_{t1R}^2 + e_{t3R}^2 + DA_{13}^2}$$

$U_{tR13} = 11.183 \cdot inWC$ — Testing Random Uncertainty for indicator loop with quarterly calibration.

4.2.2.1 Testing Total Loop Uncertainty

$$U_{t13} := U_{tR13}$$

$U_{t13} = 11.183 \cdot inWC$ — Testing TLU in inWC. There are no bias terms associated with testing conditions.

4.2.3 Accident - Small Break LOCA with Seismic

4.2.3.1 Random

$DA_{13} = 7.773 \cdot inWC$ — Indicator Loop Analyzed Drift Term (Assumption 2.3.15)

$e_{a1R} = 2.758 \cdot inWC$ — Transmitter accident uncertainty from section 3.2.2.3

$e_{a3R} = 7.800 \cdot inWC$ — Indicator accident uncertainty from section 3.4.2.3

$$U_{aR13} := \sqrt{e_{a1R}^2 + e_{a3R}^2 + DA_{13}^2}$$

$U_{aR13} = 11.352 \cdot inWC$ — Accident Random Uncertainty for indicator loop with quarterly calibration.

4.2.3.2 Bias

$\%Level_n$	$PM\ neg_n$	L_n	$PM\ pos_n$
%	inWC	inWC	inWC
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

From section 2.0. magnitude of bias depends on point of interest

$U_{aB13\_neg_n} := PM\ neg_n$

$U_{aB13\_pos_n} := PM\ pos_n$

For the indication function, both positive and negative bias at all points are considered.

4.2.3.3 Accident Total Loop Uncertainty

$U_{aR13_n} := U_{aR13}$

Accident Random uncertainty term

$U_{a13\_pos_n} := U_{aR13_n} + U_{aB13\_pos_n}$

Accident positive TLU with bias

$U_{a13\_neg_n} := \left(U_{aR13_n}\right)\cdot(-1) + U_{aB13\_neg_n}$

Accident negative TLU with bias

n	$\%Level_n$	U_{aR13_n}	$U_{aB13\_neg_n}$	$U_{aB13\_pos_n}$	$U_{a13\_neg_n}$	$U_{a13\_pos_n}$
	%	inWC	inWC	inWC	inWC	inWC
0	0	11.352	-0.020	0.007	-11.372	11.360
1	25.0	11.352	-0.506	0.190	-11.858	11.542
2	50.0	11.352	-0.992	0.372	-12.344	11.724
3	75.0	11.352	-1.478	0.554	-12.830	11.906
4	100.0	11.352	-1.964	0.736	-13.316	12.089

$U_{a13} := 13.316\cdot inWC$

$U_{a13} = 13.316\cdot inWC$

The bounding accident TLU of 13.316 inWC is conservatively chosen for all points.

4.3 CST Recorder Loop TLU (LT-107-5B, LR-23-73)

4.3.1 Normal Conditions

4.3.1.1 Random

$DA_{14} := 0.9709 \cdot \% \cdot CS$

$DA_{14} = 3.787 \cdot inWC$ — Recorder Loop Analyzed Drift Term (Assumption 2.3.16)

$e_{n1R} = 1.950 \cdot inWC$ — Transmitter normal uncertainty from section 3.2.2.1

$e_{n4R} = 3.900 \cdot inWC$ — Recorder normal uncertainty from section 3.5.2.1

$U_{nR14} := \sqrt{e_{n1R}^2 + e_{n4R}^2 + DA_{14}^2}$

$U_{nR14} = 5.775 \cdot inWC$ — Normal Random Uncertainty for recorder loop with quarterly calibration.

4.3.1.2 Bias

From section 2.0. magnitude of bias depends on point of interest

$\%Level_n$ (%)	PM_{neg_n} (inWC)	L_n (inWC)	PM_{pos_n} (inWC)
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

$U_{nB14\_neg_n} := PM_{neg_n}$

$U_{nB14\_pos_n} := PM_{pos_n}$

For the recorder indication function, both positive and negative bias at all points are considered.

4.3.1.3 Normal Total Loop Uncertainty

$U_{nR14_n} := U_{nR14}$ — Normal Random uncertainty term

$U_{n14\_pos_n} := U_{nR14_n} + U_{nB14\_pos_n}$ — Normal positive TLU with bias

$U_{n14\_neg_n} := \left(U_{nR14_n}\right)\cdot(-1) + U_{nB14\_neg_n}$

Normal negative TLU with bias

n	$\%Level_n$ (%)	U_{nR14_n} (inWC)	$U_{nB14\_neg_n}$ (inWC)	$U_{nB14\_pos_n}$ (inWC)	$U_{n14\_neg_n}$ (inWC)	$U_{n14\_pos_n}$ (inWC)
0	0	5.775	-0.020	0.007	-5.795	5.782
1	25.0	5.775	-0.506	0.190	-6.281	5.965
2	50.0	5.775	-0.992	0.372	-6.767	6.147
3	75.0	5.775	-1.478	0.554	-7.253	6.329
4	100.0	5.775	-1.964	0.736	-7.739	6.511

$U_{n14} := 7.739\cdot inWC$ $U_{n14} = 7.739\cdot inWC$

The bounding normal TLU of 7.739 inWC is conservatively chosen for all points.

4.3.2 Loop Testing Conditions

$DA_{14} = 3.787\cdot inWC$ Recorder Loop Analyzed Drift Term (Assumption 2.3.16)

$e_{t1R} = 1.950\cdot inWC$ Transmitter test uncertainty from section 3.2.2.2

$e_{t4R} = 3.900\cdot inWC$ Recorder test uncertainty from section 3.5.2.2

$U_{tR14} := \sqrt{e_{t1R}^2 + e_{t4R}^2 + DA_{14}^2}$ $U_{tR14} = 5.775\cdot inWC$

Testing Random Uncertainty for recorder loop with quarterly calibration.

4.3.2.1 Testing Total Loop Uncertainty

$U_{t14} := U_{tR14}$ $U_{t14} = 5.775\cdot inWC$

Testing TLU in inWC. There are no bias terms associated with testing conditions.

4.3.3 Accident - Small Break LOCA with Seismic

4.3.3.1 Random

$DA_{14} = 3.787 \cdot inWC$ — Recorder Loop Analyzed Drift Term (Assumption 2.3.16)

$e_{a1R} = 2.758 \cdot inWC$ — Transmitter accident uncertainty from section 3.2.2.3

$e_{a4R} = 4.875 \cdot inWC$ — Recorder accident uncertainty from section 3.5.2.3

$$U_{aR14} := \sqrt{e_{a1R}^2 + e_{a4R}^2 + DA_{14}^2}$$

$U_{aR14} = 6.761 \cdot inWC$ — Accident Random Uncertainty for recorder loop with quarterly calibration.

4.3.3.2 Bias

From section 2.0, magnitude of bias depends on point of interest

$\%Level_n$ (%)	PM_{neg_n} (inWC)	L_n (inWC)	PM_{pos_n} (inWC)
0	-0.020	4.0	0.007
25.0	-0.506	101.5	0.190
50.0	-0.992	199.0	0.372
75.0	-1.478	296.5	0.554
100.0	-1.964	394.0	0.736

$U_{aB14\_neg_n} := PM_{neg_n}$

$U_{aB14\_pos_n} := PM_{pos_n}$

For the indication function, both positive and negative bias at all points are considered.

4.3.3.3 Accident Total Loop Uncertainty

$U_{aR14_n} := U_{aR14}$ — Accident Random uncertainty term

$U_{a14\_pos_n} := U_{aR14_n} + U_{aB14\_pos_n}$ — Accident positive TLU with bias

$U_{a14\_neg_n} := (U_{aR14_n})\cdot(-1) + U_{aB14\_neg_n}$ — Accident negative TLU with bias

n	$\%Level_n$ (%)	U_{aR14_n} (inWC)	$U_{aB14\_neg_n}$ (inWC)	$U_{aB14\_pos_n}$ (inWC)	$U_{a14\_neg_n}$ (inWC)	$U_{a14\_pos_n}$ (inWC)
0	0	6.761	-0.020	0.007	-6.781	6.768
1	25.0	6.761	-0.506	0.190	-7.267	6.951
2	50.0	6.761	-0.992	0.372	-7.753	7.133
3	75.0	6.761	-1.478	0.554	-8.239	7.315
4	100.0	6.761	-1.964	0.736	-8.725	7.497

$U_{a14} := 8.725 \cdot inWC$ $\quad U_{a14} = 8.725 \cdot inWC$

The bounding accident TLU of 8.725 inWC is conservatively chosen for all points.

4.4 CST ERFIS Loop TLU (LT-107-5A, F004)

4.4.1 Normal Conditions

4.4.1.1 Random

$DA_{15} := 1.2237 \cdot \% \cdot CS$ $\quad DA_{15} = 4.772 \cdot inWC$

ERFIS Loop Analyzed Drift Term (Assumption 2.3.17)

$e_{n1R} = 1.950 \cdot inWC$

Transmitter normal uncertainty from section 3.2.2.1

$e_{n5R} = 2.125 \cdot inWC$

ERFIS normal uncertainty from section 3.6.2.1

$U_{nR15} := \sqrt{e_{n1R}^2 + e_{n5R}^2 + DA_{15}^2}$ $\quad U_{nR15} = 5.576 \cdot inWC$

Normal Random Uncertainty for ERFIS loop with quarterly calibration.

4.4.1.2 Bias

$DA_{bias} := -0.2293 \cdot \% \cdot CS$

$DA_{bias} = -0.894 \cdot inWC$

Bias associated with Analyzed Drift (Assumption 2.3.17)

$DA_{bias_n} := DA_{bias}$

From section 2.0. magnitude of PM bias depends on point of interest

$\%Level_n$ (%)	DA_{bias_n} (inWC)	PM_{neg_n} (inWC)	L_n (inWC)	PM_{pos_n} (inWC)
0	-0.894	-0.020	4.0	0.007
25.0	-0.894	-0.506	101.5	0.190
50.0	-0.894	-0.992	199.0	0.372
75.0	-0.894	-1.478	296.5	0.554
100.0	-0.894	-1.964	394.0	0.736

$U_{nB15\_neg_n} := PM_{neg_n} + DA_{bias_n}$

$U_{nB15\_pos_n} := PM_{pos_n}$

For the ERFIS indication function, both positive and negative bias at all points are considered.

4.4.1.3 Normal Total Loop Uncertainty

$U_{nR15_n} := U_{nR15}$

Normal Random uncertainty term

$U_{n15\_pos_n} := U_{nR15_n} + U_{nB15\_pos_n}$

Normal positive TLU with bias

$U_{n15\_neg_n} := \left(U_{nR15_n}\right) \cdot (-1) + U_{nB15\_neg_n}$

Normal negative TLU with bias

n	$\%Level_n$ (%)	U_{nR15_n} (inWC)	$U_{nB15\_neg_n}$ (inWC)	$U_{nB15\_pos_n}$ (inWC)	$U_{n15\_neg_n}$ (inWC)	$U_{n15\_pos_n}$ (inWC)
0	0	5.576	-0.914	0.007	-6.491	5.584
1	25.0	5.576	-1.400	0.190	-6.977	5.766
2	50.0	5.576	-1.886	0.372	-7.463	5.948
3	75.0	5.576	-2.372	0.554	-7.948	6.131
4	100.0	5.576	-2.858	0.736	-8.434	6.313

$U_{n15} := 8.434 \cdot inWC$ $\qquad$ $U_{n15} = 8.434 \cdot inWC$ $\qquad$ The bounding normal TLU of 8.434 inWC is conservatively chosen for all points.

4.4.2 Loop Testing Conditions

$DA_{15} = 4.772 \cdot inWC$ $\qquad$ ERFIS Loop Analyzed Drift Term (Assumption 2.3.17)

$e_{t1R} = 1.950 \cdot inWC$ $\qquad$ Transmitter test uncertainty from section 3.2.2.2

$e_{t5R} = 2.125 \cdot inWC$ $\qquad$ ERFIS test uncertainty from section 3.6.2.2

$U_{tR15} := \sqrt{e_{t1R}^2 + e_{t5R}^2 + DA_{15}^2}$ $\qquad$ $U_{tR15} = 5.576 \cdot inWC$ $\qquad$ Testing Random Uncertainty for ERFIS loop with quarterly calibration.

4.4.2.1 Testing Total Loop Uncertainty

$DA_{bias} := -0.2293 \cdot \% \cdot CS$ $\qquad$ $DA_{bias} = -0.894 \cdot inWC$ $\qquad$ Bias associated with Analyzed Drift (Assumption 2.3.17)

$U_{t15} := U_{tR15}$ $\qquad$ $U_{t15} = 5.576 \cdot inWC$ $\qquad$ Testing TLU in inWC. DA_{bias} term is applicable for testing conditions, however, DA_{bias} term is omitted from U_{t15} equation for conservatism.

4.4.3 Accident - Small Break LOCA with Seismic

Accident conditions are N/A for ERFIS

4.5 Summary of Results

4.5.1 Module As-Found (FT)/ As-Left (CT) Calibration Tolerances

$DA_1 = 2.531 \cdot inWC$ — Transmitter Analyzed Drift Term (Assumption 2.3.10)

$e_{t1R} = 1.950 \cdot inWC$ — Transmitter test uncertainty from section 3.2.2.2

$U_{t1} := \sqrt{e_{t1R}^2 + DA_1^2}$ ✓ $U_{t1} = 3.195 \cdot inWC$ ✓ — Testing Random Uncertainty for transmitter module with quarterly calibration.

Component	FT (inWC)	FT (Calibr. Units)	CT (inWC)	CT (Calibration Units)
Transmitter LT-107-5A & B	$U_{t1} = 3.195 \cdot inWC$ ✓	$\frac{U_{t1}}{CS} \cdot 40 \cdot mV = 0.328 \cdot mV$ ✓	$CT_1 = 1.950 \cdot inWC$ ✓	$\frac{CT_1}{CS} \cdot 40 \cdot mV = 0.200 \cdot mV$ ✓
Alarm Unit LSL-107-5A & B	$U_{t2} = 2.412 \cdot inWC$ ✓	$\frac{U_{t2}}{CS} \cdot 40 \cdot mV = 0.247 \cdot mV$ ✓	$CT_2 = 1.950 \cdot inWC$ ✓	$\frac{CT_2}{CS} \cdot 40 \cdot mV = 0.200 \cdot mV$ ✓
Indicator LI-107-5	N/A	N/A	$CT_3 = 7.800 \cdot inWC$ ✓	$\frac{CT_3}{CS} = 2.000 \cdot \%$ ✓
Recorder LR-23-73 (Green)	N/A	N/A	$CT_4 = 3.900 \cdot inWC$ ✓	$\frac{CT_4}{CS} = 1.000 \cdot \%$ ✓
ERFIS F004	N/A	N/A	$CT_5 = 2.13 \cdot inWC$ ✓	$\frac{CT_5}{CS} \cdot 477.1 \cdot K \cdot gal = 2.600 \cdot K \cdot gal$ ✓

Note: The Transmitters and Alarm Units are the only devices calibration checked as modules rather than as a loop under OP-4363 (Attachment M).

4.5.2 Loop As-Found Calibration Tolerances (FT)

Loop	FT (inWC)	FT (Calibration Units)	
Alarm Unit Trip (LSL-107-5A & B)	N/A	N/A	Alarm Unit is calibrated as a module rather than as a loop (See section 4.1.2 and Attach. M page 6)
Indicator (LI-107-5)	$U_{t13} = 11.183 \cdot inWC$ ✓	$\frac{U_{t13}}{CS} = 2.868 \cdot \%$ ✓	
Recorder Indication (LR-27-73 Green Pen)	$U_{t14} = 5.775 \cdot inWC$ ✓	$\frac{U_{t14}}{CS} = 1.481 \cdot \%$ ✓	
ERFIS Indication (F004)	$U_{t15} = 5.58 \cdot inWC$ ✓	$\frac{U_{t15}}{CS} \cdot 477.1 \cdot K \cdot gal = 6.822 \cdot K \cdot gal$ ✓	

4.5.3 Loop As-Left Calibration Tolerances (CT)

$CT_1 = 1.950 \cdot inWC$ — Transmitter CT from section 3.2

$CT_3 = 7.800 \cdot inWC$ — Indicator CT from section 3.4

$CT_4 = 3.900 \cdot inWC$ — Recorder CT from section 3.5

$CT_5 = 2.125 \cdot inWC$ — ERFIS CT from section 3.6

$CT_{loop13} := \sqrt{CT_1^2 + CT_3^2}$ ✓ $CT_{loop13} = 8.040 \cdot inWC$ ✓ Indicator Loop CT in inWC

$CT_{loop14} := \sqrt{CT_1^2 + CT_4^2}$ ✓ $CT_{loop14} = 4.360 \cdot inWC$ ✓ Recorder Loop CT in inWC

$CT_{loop15} := \sqrt{CT_1^2 + CT_5^2}$ ✓ $CT_{loop15} = 2.884 \cdot inWC$ ✓ ERFIS Loop CT in inWC

4.5.3.1 Loop As-Left Calibration Tolerances (CT)

Loop	CT (inWC)	CT (Calibration Units)	
Alarm Unit Trip (LSL-107-5A & B)	N/A	N/A	Alarm Unit is calibrated as a module rather than as a loop (See section 4.1.2 and Attach. M page 6)
Indicator (LI-107-5)	$CT_{loop13} = 8.040 \cdot inWC$	$\frac{CT_{loop13}}{CS} = 2.062 \cdot \%$	
Recorder Indication (LR-27-73 Green Pen)	$CT_{loop14} = 4.360 \cdot inWC$	$\frac{CT_{loop14}}{CS} = 1.118 \cdot \%$	
ERFIS Indication (F004)	$CT_{loop15} = 2.884 \cdot inWC$	$\frac{CT_{loop15}}{CS} \cdot 477.1 \cdot K \cdot gal = 3.529 \cdot K \cdot gal$	

4.5.4 Normal/Accident Total Loop Uncertainty (TLU)

Loop	Normal (inWC)	Normal (Calib. Units)	Accident (inWC)	Accident (Calib. Units)
Alarm Unit Trip (LSL-107-5A & B)	$U_{n12} = 4.193 \cdot inWC$	$\frac{U_{n12}}{CS} \cdot 40 \cdot mV = 0.430 \cdot mV$	$U_{a12} = 4.643 \cdot inWC$	$\frac{U_{a12}}{CS} \cdot 40 \cdot mV = 0.476 \cdot mV$
Indicator (LI-107-5)	$U_{n13} = 13.147 \cdot inWC$	$\frac{U_{n13}}{CS} = 3.371 \cdot \%$	$U_{a13} = 13.316 \cdot inWC$	$\frac{U_{a13}}{CS} = 3.414 \cdot \%$
Recorder Indication (LR-27-73 Green Pen)	$U_{n14} = 7.739 \cdot inWC$	$\frac{U_{n14}}{CS} = 1.984 \cdot \%$	$U_{a14} = 8.725 \cdot inWC$	$\frac{U_{a14}}{CS} = 2.237 \cdot \%$
ERFIS Indication (F004)	$U_{n15} = 8.434 \cdot inWC$	$\frac{U_{n15}}{CS} \cdot 477.1 \cdot K \cdot gal = 10.318 \cdot K \cdot gal$	N/A	N/A

5.0 Setpoint Evaluation

5.1 Setpoint Requirements

For the auto-suction transfer setpoint of LSL-107-5A & B to be acceptable, the setpoint must satisfy three requirements:

1.) TS Limit - setpoint is ≥ 3% Tank Volume	[TS Table 3.2.1]
2.) ≥ Critical height of submergence	[Ref. 6.10; VYC-1844]
3.) 10,000 gallons useable volume available at switchover	[Ref. 6.19]

Since the direction of interest is decreasing level, and since the reset point of the alarm unit provides no required function, only the positive loop uncertainties need be considered.

VYC-1844 [Ref. 6.10] has evaluated the three requirements above and determined a new process limit value which satisfies all three requirements.

L_0 = Tank Bottom = 253' 00" = 0"	[Attachment B - CST Volumetric Evaluation]
L_1 = HPCI Minimum Suction Level = 253' 11" = 11" above tank bottom	[Attachment B - CST Volumetric Evaluation]
L_2 = Instrument Level Tap = 254' 00" = 12" above tank bottom	[Attachment B - CST Volumetric Evaluation]
L_3 = Internal Standpipe = 259' 03" = 6' 03" above tank bottom	[Attachment B - CST Volumetric Evaluation]
L_4 = Tank Overflow = 286' 06" = 33' 06" above tank bottom	[Attachment B - CST Volumetric Evaluation]
L_5 = Process Limit = ≥ 255' 4.2" = 28.2" above tank bottom	[Ref. 6.10]
Gal = Gallons per inch = 1223.996883 gal	[Attachment B - CST Volumetric Evaluation]
Head = Static head on transmiters at 0" sensed level = 4"	[Attachment B - CST Volumetric Evaluation]
SP = Existing setpoint = 12.1 mV = 20.475" above transmitter tap = 32.475" above tank bottom	[Ref. 6.12 & Attachment M]

$Gal := 1223.996883 \cdot gal \cdot in^{-1}$	$Gal = 1223.997 \cdot gal \cdot in^{-1}$	
$L_0 := 0 \cdot in$	$L_0 = 0.00 \cdot in$ ✓	Tank bottom
$L_1 := 11 \cdot in$	$L_1 = 11.00 \cdot in$ ✓	
$L_2 := 12 \cdot in$	$L_2 = 12.00 \cdot in$ ✓	
$L_3 := 6 \cdot ft + 3 \cdot in$	$L_3 = 75.00 \cdot in$ ✓	
$L_4 := 33 \cdot ft + 6 \cdot in$	$L_4 = 402.00 \cdot in$ ✓	
$L_5 := 28.2 \cdot in$	$L_5 = 28.20 \cdot in$ ✓	New Process Limit per Ref. 6.10 & Attach. C
$head := 4 \cdot in$	$head = 4.00 \cdot in$ ✓	Static head on transmitter
$SP_{mv} := 12.1 \cdot mV$	$SP_{mv} = 12.10 \cdot mV$ ✓	Current setpoint in mV

$$SP := \frac{(SP_{mv} - 10\cdot mV)}{40\cdot mV}\cdot 390\cdot in + L_2$$ $SP = 32.475 \cdot in$ Current setpoint referenced to tank bottom.

It should be noted that the previously calculated setpoint did not consider the requirement for minimum height of submergence due to the effects of potential vortexing within the CST; in addition, the calculated TLU used in the setpoint determination was +/- 8".

5.2 Evaluation of Current Setpoint (12.1mV = 32.475 inWC above tank bottom)

5.2.1 Current Tech Specs (CTS)/ Improved Tech Specs (ITS) - Quarterly Testing

LSP = Process limit + TLU (accident) = $L_5 + U_{a12}$

$M_1 = SP - LSP$

$SP = 32.475 \cdot in$ $\quad U_{a12} = 4.643 \cdot inWC$

$LSP := L_5 + \frac{U_{a12}}{inWC}\cdot in$ $\quad LSP = 32.843 \cdot in$

$M_1 := SP - LSP$ $\quad M_1 = -0.368 \cdot in$

5.2.2 Conclusion: The current setpoint of 12.1 mV is not acceptable because it does not support the minimum level requirement of ≥ 28.2" above tank bottom [Ref. 6.10 & Attachment C] plus alarm Unit TLU with positive margin from the SP to the LSP.

Requirement	Required Level	LSP	Current Setpoint	Margin to LSP
Process Limit	≥ 28.2" above bottom (L_5)	$LSP = 32.843 \cdot in$	$SP = 32.475 \cdot in$	$M_1 = -0.368 \cdot in$

5.3 Evaluation of Revised Setpoint

5.3.1 Current Tech Specs (CTS)/ Improved Tech Specs (ITS) - Quarterly Testing

An value of 33.45" (equal to 12.2 mV) is chosen as a proposed new setpoint such that it is larger than the minimum level requirement (with uncertainties).

LSP = Process limit + TLU (accident) = $L_5 + U_{a12}$

M_1 = SP - LSP

$SP := 33.45 \cdot in$

$SP = 33.450 \cdot in$ — Proposed new setpoint referenced to tank bottom

$L_5 = 28.200 \cdot in$ — Process Limit referenced to bottom of tank

$U_{a12} = 4.643 \cdot inWC$ ✓ — Accident Alarm Unit TLU from section 4.1.3.3

$LSP := L_5 + \frac{U_{a12}}{inWC} \cdot in$ ✓ $\quad LSP = 32.843 \cdot in$ ✓

$M_1 := SP - LSP$ ✓ $\quad M_1 = 0.607 \cdot in$ — Setpoint Margin for proposed setpoint

5.3.2 Determination of calibration setpoint value

$SP_{cal} := \left[\frac{(SP - L_2) + head}{in}\right] \cdot inWC$ ✓ $\quad SP_{cal} = 25.450 \cdot inWC$ ✓ — New calibration setpoint in inWC as sensed by the transmitter

$SP_{mv} := \left[\frac{(SP - L_2)}{390 \cdot in} \cdot 40 \cdot mV\right] + 10 \cdot mV$ ✓ $\quad SP_{mv} = 12.200 \cdot mV$ ✓ — New calibration setpoint in mV as measured at the transmitter output

5.3.3 Conclusion: The revised setpoint of 12.2 mV is acceptable because it is higher than the Limiting Setpoint by a Margin of 0.607".

Requirement	Required Level	LSP	New Setpoint	Margin to LSP
Process Limit	$\geq$ 28.2" above bottom (L_5) ✓	$LSP = 32.843 \cdot in$ ✓	$SP = 33.450 \cdot in$ ✓	$M_1 = 0.607 \cdot in$ ✓

ATTACHMENT O
VYC-723 REV.3
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CALCULATION / ANALYSIS REVIEW

CALCULATION NO. VYC-723 REVISION NO. 3

COMMENTS	RESOLUTION
1. In Ref. 6.1 TE_{CAL} is typically based on ΔT 20°F. What is the basis for using ΔT 30 °F in Section 2.3.1 and 2.3.18 for the transmitter's TE_{CAL} (as accounted for in ADR).	SINCE CALIBRATIONS ARE PERFORMED QUARTERLY, ALL POSSIBLE TEMP. VARIATIONS DUE TO SEASONAL CHANGES ARE EXPERIENCED AND THEREFORE ASSUMED INCLUDED IN TRANSMITTER ANALYZED DRIFT.
2. In Section 2 (or elsewhere, as appropriate) expand discussion relative to loop calibrations vs. single-component calibrations.	ADDED SECTION 2.2.1 TO DESCRIBE ALL LOOP AND MODULE CALIBRATIONS.
3. Relative to the indicator and recorder calibration end points (existing) in Tables 7 & 8, consider a recommendation for choosing calibration end points that would allow even-sided tolerances.	RECOMMENDATION 5.4.3 REVISED TO INCLUDE SUGGESTION FOR USING THE 10% AND 90% CAL POINTS VS. 0% AND 100% DETAILED CALIBRATION POINT INFO PROVIDED IN INTERDEPARTMENTAL REVIEW FOR INIT. OPTION FOR CHANGE TO 10% + 90%

Identify method(s) of review:

- ■ Calculation / analysis review
- ☐ Alternative calculational method
- ☐ Qualification testing

Resolution By: [signature] 11/21/98
Preparer / Date

Comments Continued on page: 2

Concurrence with Resolution: [signature] for MA 11-23-98
PER TCON
Reviewer / Date

CALCULATION / ANALYSIS REVIEW

CALCULATION NO. VYC-723 REVISION NO. 3

COMMENTS	RESOLUTION
4. From the Attach. B CST Volumes	SETPOINTS AND INDICATIONS
Sketch it is indeterminant if	EVALUATED IN THIS CALCULATION
the specific elevation datum	ARE BASED ON TANK LEVELS
Lines, to which various height	AS REFERENCED TO THE
And instrument range values	INSIDE BOTTOM OF THE TANK
Are referenced, have taken	AS IS THE MINIMUM SUCTION
into account the shell thick-	ELEVATION PROVIDED BY
ness of the bottom of the tank	VYC-1844 (≥ 28.2" ABOVE
Noting that one parameter (the	BOTTOM). VYC-1844 EVALUATES
10K gal Reserve) is a function	THE 10,000 GAL, ≥ 3% AND
of Δh and is thus independent	75,000 GAL REQUIREMENTS
of a datum Line:	AND IT IS NOT A CONCERN
Is it a requirement of this	OF VYC-723 TO CONSIDER
calculation to develop any	SHELL THICKNESS SINCE
scaling other than instrument	ONLY HEIGHT OF WATER
range, or is the PL (sourced	MEASUREMENT IS EVALUATED.
outside this calculation) a	
direct design input?	[initials]

Identify method(s) of review:

- ■ Calculation / analysis review
- ☐ Alternative calculational method
- ☐ Qualification testing

Resolution By: [signature] 11/21/98
Preparer / Date

Comments Continued on page: —

Concurrence with Resolution: [signature] for MA / 11-23-98
[signature] Reviewer / Date

APPENDIX B
WE-103 REVIEW CHECKLIST

Preparer		Reviewer	
Name (please print)	BRIAN F. DAVIDSON	Name (please print)	M. ANDERSON
Organization	VY SETPOINT PROJECT	Organization	VY SETPOINT PROJECT
Signature	[signature]	Signature	[signature] for M. Anderson *
Date	11/20/98	Date	11-23-98

Requirement	Preparer	Reviewer
Ensure the title page is appropriately filled out. • Correct number of pages. • QA Record filled out. • ~~IMS number filled out.~~ BR 11/18/98 • Record number filled out (13.C09.001 included if microfiche or hard copy of computer runs are attached to the calculation). • Descriptive title. • Plant, cycle number and calculation number included. "N/A" can be used for plant and cycle number. • Signatures and dates are included, and are in correct chronological order. Print the name and individuals' organization (if other than YAEC) below the signature. The title page reviewer and approver dates do not pre-date any date in the calculation except for changes containing that individual's initials and date. • All WE-108 computer codes and other keywords not in the title which can be used to retrieve the calculation are listed in the keyword field.	BR	[initials] *
Ensure the Form WE-103-2 is included and properly completed when a computer code is used.	N/A	[initials] *
Ensure Form WE-103-3 is included, and has signatures/dates from both the preparer and the reviewer and that all comments have been addressed. If no comments, use the following statement: "Reviewed in accordance with WE-103 with no comments."	BR	[initials] *
Ensure review of the calculation can be done without recourse to the originator.	BR	N/A
Ensure computer codes are used in accordance with WE-103 Steps 4.1.4.4 through 4.1.4.6.	N/A	[initials] *
Ensure the calculation includes a title page, objective, method, inputs, assumptions, calculations, results, conclusions and references.	BR	[initials] *
Ensure the inputs are referenced to formal documents, e.g., WE-103. The reference cannot be a YAEC report unless formal QA records are checked and also referenced.	BR	N/A
Ensure design input internal and external correspondence is prepared and reviewed, and is, therefore, a QA record. If there is only one signature on the correspondence, verify that it is a QA record.	BR	N/A

VERMONT YANKEE DESIGN ENGINEERING
CALCULATION NO. VYC-723 REV. 3
ATTACHMENT 0 PAGE 3 OF 9

* Per TCON
11-23-98
CJH for MA

APPENDIX B
WE-103 REVIEW CHECKLIST
(Continued)

Requirement	Preparer	Reviewer
Ensure that if design specifications were used as input to the calculation, the performance characteristics are verified in writing by the provider of the component/product or by cognizant YAEC/plant personnel.	N/A	N/A
Ensure that input and modeling uncertainties are explicitly addressed in the calculation.	[illegible]	N/A
Ensure that the applicable input considerations from WE-100, Table 1 have been incorporated and are explicitly addressed within the calculation.	[illegible]	N/A
Ensure individuals responsible for each portion of the calculation are identified when multiple preparers and/or reviewers are utilized. Page initialing is optional, even in the cases where initial boxes are provided on the pages.	N/A	[illegible]*
| Ensure each page has a page number and the calculation number and revision number, if applicable. Dates on each page are optional.	[illegible]	[illegible]*
Ensure that every page of every attachment (or Appendix) contains its attachment (or Appendix) number.	[illegible]	[illegible]*
Ensure corrections are addressed in one of the following approaches: • Retyped and identified by a vertical line with revision number, if applicable, in the right margin; OR • Lined out, initialed and dated by preparer; OR • Photocopy of original to eliminate any previous correction tape, whiteout, or erasures.	N/A	[illegible]*
Ensure enhancements and clouding are initialed and dated.	N/A	[illegible]*
| Confirm legibility meets WE-103, Appendix A. Specific pages can be exempt if they are: (1) documents received from another organization who is the original QA custodian, or (2) supplemental pages included for information only. In these two cases, make sure a memo was issued to RMS per WE-002, Section 3.4.3.	[illegible]	[illegible]*
Review of 10CFR50.46 reporting requirements has been documented for analyses which assess conformance with 10CFR50.46.	N/A	N/A
Ensure computer codes are validated for the computing environment.	N/A	N/A
Ensure script files are included in the calculation or referenced to another calculation. Also, ensure the preparer identifies how the code/script was run.	N/A	N/A
| Ensure applicable outstanding Condition Reports (CRs) have been reviewed for influence on the calculation and note review in calculation.	N/A	N/A
| Ensure relevant conditions/limitations have been reviewed for their effect on this calculation and the review is noted in the calculation.	[illegible]	[illegible]*

* Per TCW 11-23-98 GDI for MA

VERMONT YANKEE DESIGN ENGINEERING
CALCULATION NO. VYC-723
REV. 3
ATTACHMENT O PAGE 4 OF 9

VERMONT YANKEE SETPOINT CONTROL PROGRAM
INTERDEPARTMENTAL REVIEW OF CALCULATION:

ATT. O

VYC-723 Revision 3 PG 5 OF 9

VYC-723 Revision 3, has been prepared and independently reviewed. The Departments impacted by this calculation are requested to review the results of this calculation, concur with the results and/or recommendations, and document the department's acceptance prior to the calculation being approved.

1. Summary: This calculation evaluates the uncertainty for the High Pressure Coolant Injection (HPCI) System Auto Suction Transfer on Low CST Level as well as CST Level Indication Loop for normal and Post Accident, CST Level Recorder Loop, and CST ERFIS Indication Loop. The loop components evaluated are as follows:

   LT-107-5A & B, LSL-107-5A & B, LI-107-5, LR-23-73, and ERFIS PTID F004

2. Calculation Open Items: AP-0028 to be Assigned

   2.1. Approval of Dirft Calculation Memo for GE 555 Transmitters LT-107-5A & B; used as design input for Assumption 2.3.10 and included as Attach. P. Approved 11-23-98 GH

3. Department Review - contact the Setpoint Program Manager (G. Hengerle) if not in agreement with the conclusions/statements.

   3.1. Vermont Yankee E&C

   3.1.a. The Calibration Sections of OP-4363 for LT-107-5A & B, LSL-107-5A & B, LI-107-5, LR-23-73, and ERFIS PTID F004 will require the following changes based on CTS/ITS and quarterly calibrations:

   3.1.a. Procedure OP-4363 Revision 24 will require the following changes (changes based on Custom Technical Specifications/standard surveillance cycle):

   1. Add the following in the procedure discussion:

      a. Limiting Setpoint (LSP):

LSL-107-5A & B Low Level Suction Transfer	12.138 mVDC (32.843 inches)*
LSL-107-5A & B Low-Low Level Alarm	N/A

      * Referenced to Tank Bottom (24.843 inches applied at transmitter)

      b. Module As Found values:

	From	To
Transmitter LT-107-5A & B	± 0.2mVDC	± 0.32mVDC
Alarm Unit LSL-107-5A & B (Lo & Lo-Lo)	± 0.2mVDC	± 0.24mVDC
Indicator LI-107-5	± 2%	No Change
Recorder LR-23-73	± 1%	No Change
ERFIS PTID F004	± 2.6kGal	No Change

      c. Loop As Found values:

	From	To
Indicator LT-107-5A to LI-107-5	± 2.5%	No Change
Recorder LT-107-5B to LR-23-73	± 1.0%	± 1.5%
ERFIS LT-107-5A to ERFIS F004	± 2.6kGal	± 6.82kGal

      d. Head correction to remain at: 4"H20

      e. Revise the M&TE requirements of OP-4363 to remove the Heise 730A-03. The following test equipment (or equivalent) is recommended for use:

Gauge	Heise 901B (0-400 inwc)
DMM	HP 34401A (0-100mV Range)

   2. In the body of the procedure and the data sheet revise as follows:

Vermont Yankee Setpoint Control Program
Interdepartmental Review of Calculation VYC-723 Rev. 3

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		From	To
a.	Module Calibration Tolerance (As Left)	From	To
	Transmitter LT-107-5A & B	± 0.2mVDC	No Change
	Alarm Unit LSL-107-5A & B	± 0.2mVDC	No Change
	Indicator LI-107-5*	± 2.5%	± 2.0%
	Recorder LR-23-73	± 1.0%	No Change
	ERFIS F004	± 2.6kGal	No Change

* Per calculation section 3.4.1.2, the tightening of the calibration tolerance is based on past performance and indicator readability.

		From	To
b.	Loop Calibration Tolerance (As Left)		
	Indicator	± 2.5%	± 2.0%
	Recorder	± 1.0%	No Change
	ERFIS	± 2.6kGal	± 3.53kGal

		From	To
c.	Trip Setpoint LSL-107-5A & B		
	Auto Suction Xfer & "CST LEVEL LO" Alarm	12.1 mV ↓	12.2 mV ↓
	"INST PWR TRBL" Alarm	10.2 mV ↓	No change

d. Head correction to remain at: 4"H20

e. Insert a 9-point module calibration for the following instruments:

Transmitter *LT-107-5A & B* Input	Output	Level Indicator *LI-107-5* Input	Output	Level Recorder *LR-23-73* Input	Output	ERFIS *Point ID F004* Input	Output
394.0 inWC	50.0 mV	50.0 mV	100.0 %	50.0 mV	100.0 %	50.0 mV	477.1 Kgal
355.0 inWC	46.0 mV	46.0 mV	90.0 %	46.0 mV	90.0 %	46.0 mV	429.4 Kgal
296.5 inWC	40.0 mV	40.0 mV	75.0 %	40.0 mV	75.0 %	40.0 mV	357.8 Kgal
199.0 inWC	30.0 mV	30.0 mV	50.0 %	30.0 mV	50.0 %	30.0 mV	238.6 Kgal
101.5 inWC	20.0 mV	20.0 mV	25.0 %	20.0 mV	25.0 %	20.0 mV	119.3 Kgal
43.0 inWC	14.0 mV	14.0 mV	10.0 %	14.0 mV	10.0 %	14.0 mV	47.7 Kgal
4.0 inWC	10.0 mV	10.0 mV	0.0 %	10.0 mV	0.0 %	10.0 mV	0.0 Kgal

3.1.b. The following comments/recommendations apply:

Concur

1. *Replace current 0% and 100% calibration points with 10% and 90% calibration points as given above, per recommendation 5.4.3, so that two sided Loop as-found and module as-left tolerances can be applied vice current single sided tolerances at 0% and 100%.* ☑

Sign & Date [signature] 11/23/98
Vermont Yankee RE Representative

3.2. Vermont Yankee Reactor Engineering

3.2.a. *None*

Concur ☑

Sign & Date [signature] 11/23/98
Vermont Yankee RE Representative

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Interdepartmental Review of Calculation VYC-723 Rev. 3

3.3. Vermont Yankee Operations

		Concur
3.3.a.	Review alarm response sheets (9-3-S-4 and 9-3-T-9)	☑

No impact

Sign & Date ____ 11/23/98
Vermont Yankee Operations Representative

3.4. Vermont Yankee Systems Manager

		Concur	Comments
3.4.a.	This analysis supports the design basis for the HPCI System and Condensate Demineralized Water Transfer System.	☑	

Sign & Date ____ for DR 11/23/98
Vermont Yankee System Engineering Representative

3.5. YNSD Nuclear Engineering

			Concur	Comments
3.5.a.	Custom Technical Specifications (After setpoint change to 12.2 mV)			
1.	Process Limit used in auto-transfer setpoint evaluation:	≥ 28.2 inches*	☐	
2.	Potential Normal Trip Point	CST Level = 29.25 inches*	☐	
3.	Potential Accident Trip Point (LOCA)**	CST Level = ~~28.80~~ 28.82 inches*	☐	
4.	Potential Accident Trip (HELB):	N/A 11-23-98	☐	
3.5.b.	Improved Technical Specifications (After setpoint change to 12.2 mV)			
1.	Process Limit used in auto-transfer setpoint evaluation:	≥ 28.2 inches*	☐	
2.	Potential Normal Trip Point	CST Level = 29.25 inches*	☐	
3.	Potential Accident Trip Point (LOCA)**	CST Level = ~~28.80~~ 28.82 inches*	☐	
4.	Potential Accident Trip (HELB):	N/A 11-23-98	☐	

* Referenced to Tank Bottom
** Small break LOCA

Sign & Date ____ / 11/23/98
YNSD NED Representative

3.6. Vermont Yankee DBD Manager

		Yes	No
3.6.a.	The ~~Emergency Diesel Generator~~ HPCI 11-23-98 DBD should reference this analysis.		
	The DBD is complete (an AP-0028 to follow)	☑	☐
	The DBD is not complete. Incorporate reference to this analysis as appropriate.	☐	☑

Sign & Date ____ / 11-23-98
ISP Program Manager

3.7. Vermont Yankee Licensing Impact

			Yes	No
3.7.a.	FSAR Changes (AP-0028 to follow)	None	☐	☑
3.7.b.	Other impact on licensing basis:	None	☐	☑

Sign & Date ____ / 11-23-98
ISP Program Manager

Vermont Yankee Setpoint Control Program
Interdepartmental Review of Calculation VYC-723 Rev. 3

3.8. Vermont Yankee ITS Manager

		Yes	No
3.8.a.	This analysis provides an input to the ITS. An Allowable Value applies. Allowable Value = *N/A*	☐	☑
3.8.b.	This analysis provides an input to Technical Requirements Manual. Incorporate as appropriate. *N/A*	☐	☑

Sign & Date ______ / 11-23-98
ISP Program Manager

3.9. Other Department(s)/Program(s) *None*

3.9.a. Impact assessment/recommendations: NA — Concur ☐

Sign & Date ______ / 11-23-98
ISP Program Manager

4. Setpoint Program Manager

	Completed	
4.1. Concurs with above.	☑	
4.2. Interdepartmental Review form (copy/steps 1 through 3) incorporated into calculation.	☑	
4.3. Calculation has been approved.	☑	Approved on 11-23-98
4.4. AP-0028 commitments have been assigned and forwarded for incorporation into the Commitment Tracking System.	☑	

Sign & Date ______ / 11-23-98
ISP Program Manager

5. Post-Approval Requirements

a. E&C (perform as appropriate): — AP0028 VYC0723R03-01
- Initiate AP0022 Setpoint Change Request
- Update MPAC
- Revise calibration/functional/logic test procedure
- Inform the following after changes are implemented:
  - Setpoint Coordinator
  - Setpoint Program Manager
  - Training (notified via AP-0022 if initiated)
  - Operations (notified via AP-0022 if initiated)
  - Design Engineering

b. Setpoint Program Manager: Update Program Manual (after step 5.a). — AP0028 ~~VYC0723R03~~ VYC0723R03-02 11-23-98

c. Setpoint Coordinator: Update Setpoint Data Base (after step 5.a) — AP0028 VYC0723R03-03

d. Design Engineering: Initiate FSAR/DBD changes, as appropriate (if DBD has been completed — AP0028 VYC0723R03-04

e. DESIGN ENGINEERING/FLUID SYSTEMS: INCORPORATE REVISED SETPOINT INTO VYC-1844 — AP0028 VYC0723R03-05

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Vermont Yankee Setpoint Control Program
Interdepartmental Review of Calculation VYC-723 Rev. 3

Comments:

1) ADD COMMITMENT TO FLUID SYSTEMS TO INCORPORATE NEW
SETPOINT INTO VYC-1844 (NED COMMENT)

Hengerle, George

From: Hengerle, George
Sent: Monday, November 23, 1998 4:47 PM
To: Lynch, Joseph
Cc: Vibert, Roger; January, Richard; Lewis, John (C)
Subject: HPCI CST Level Calculation VYC-723

Joe: VYC-723 has been approved (11-23-98). Lillian had one comment that I will convert to a Fluid System 0028: Ensure VYC-1844 incorporates the actual setpoint to document the 75,000 gallon requirement is satisfied. The setpoint changes (<1-inch) but John Lewis reviewed the plant calibration data and determined the "As Left" setpoint is within the new setpoint tolerance. GJH

VY CALCULATION CHANGE NOTICE (CCN)

VYC-723 Rev. 3 CCN-01
Page 1 of ~~19~~ 20

CCN Number: 01 Calculation Number: VYC-723 Rev. No. 3 J.W. Allen 2/28/00

Calculation Title: Condensate Storage Tank Level (HPCI) Monitoring

Initiating Document: Technical Specification proposed change No. 217
VYDC/MM/TM/Spec. No./ other

Safety Evaluation Number: N/A (See Description of Change Below)

Superseded Document: N/A

Reason for Change:
Evaluate the impact of the increase in Technical Specification Surveillance Interval from Monthly to Quarterly on the Logic test performed Monthly in OP-4363.

Description of Change:

1. This Change is a CCN because, for these loops, the identified impact is not technically significant relative to the existing calculation's output.
2. Evaluate CTS Quarterly testing interval on calculation outputs.
   OP-4363 currently calibrates the tripping devices on a Quarterly basis, a functional test of the logic is performed monthly. VYC-723 Rev. 3 provides the uncertainty for the tripping devices on a Quarterly calibration interval. A statement was added to the Calculation Objectives & Conclusion of VYC-723 Rev. 3 to include an evaluation of the impact by increasing the CTS Functional Test Interval from Monthly to Quarterly. Also, a description of the functional testing methodology was added to section 2 of VYC-723 Rev. 3.
3. Address open Recommendations of VYC-723 Rev. 3.
   A. The open recommendations of VYC-723 Rev. 3 are contained under commitment UND-99104_00 (Review calculations completed per the new setpoint program to determine if recommendations appearing in the calculations have assigned tracking methods). No open items were assigned to this CCN due to the on going work of UND-99104_00.
4. This CCN and associated output does not require a Safety Evaluation. The CCN is not an implementing document. Any changes to plant procedures would be screened during the procedure change process.

Technical Justification for Change:
Technical Specification proposed change No. 217 requests surveillance test interval change from monthly to quarterly.

Conclusions:
For CTS Quarterly:

1. The existing setpoints, uncertainties and calibration tolerances support the Quarterly functional testing interval.
2. The Setpoints and calibration attributes remain unchanged.
3. For the purpose of Logic – only Functional Testing, where relay actuation to a known input is not a requirement, a Quarterly Functional Interval is supported by this calculation.

Prepared By/Date	Interdiscipline Review By/Date	Independent Review By/Date	Approved By/Date
John H. Lewis 1/15/00 John H. Lewis 1/15/00	SEE ATTACHED REVIEW FORMS	Mark S. McKinley Mark S. McKinley 2/23/00	James W. Allen 2/28/00 James W. Allen

Installation Verification N/A James W. Allen / 2/28/00
Signature Date

Note: VYAPF 0017.07 should be included immediately following this form. VYAPF 0017.08 (Sample)
AP 0017 Rev. 5
Page 1 of 1
DI #99-381

VY CALCULATION DATABASE INPUT FORM

VYC-723-CCN-01	3	N/A	N/A
VY Calculation/CCN Number	Revision Number	Vendor Calculation Number	Revision Number

Vendor Name: N/A PO Number: N/A

VYC-723 Rev. 3 CCN-01
Page 2 of ~~19~~ 20
R.W. A[illegible] 2/28/00

Calculation Type (Originating Department): VY Design Engineering (EI&C)

Implementation Required? ☐ Yes ☑ No

Asset/Equipment ID Number(s): Same as currently represented by the VY Calculation Database

Asset/System ID Number(s): Same as currently represented by the VY Calculation Database

Keywords: No New Keywords

General References

Reference #	Reference Title (including Rev. No. and Date, if applicable) (See App. A, Section 3.1.7 for Guidance)	Critical Reference (_)
	No New References	

Design Input Documents - The following documents provide design input to this calculation.

Document #	Document Title (including Rev. No. and Date, if applicable)	Critical Reference (_)
	No New Design Inputs	

Design Output Documents - This calculation provides output to the following documents.

Document #	Document Title	Critical Reference (_)
1	OP-4363	
2	Setpoint Matrix	
3	FSAR	

VYC-723 Rev. 3 CCN-01
Page 3 of ~~19~~ 20
J.W. Allen 2/28/00

VY CALCULATION OPEN ITEM LIST

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Open Item	Resolution	Method of OI Tracking or Date Closed
1. None		

VYC-723 Rev 3 CCN-01
Page 4 of 19 20 [signature] 2/28/00

1. PURPOSE

1.1. Calculation Objectives

This calculation has been developed in support of the Vermont Yankee Setpoints program and covers instrument loops LT-107-5A and LT-107-5B in the Condensate and Demineralized Water Transfer System and has the following major objectives:

1. Document the instrument loop functions and the basis for the setpoint(s).
2. Establish the total loop uncertainty for each output function and verify consistency with the design basis.
3. Calculate the limiting setpoints and Allowable Value (AV) for inclusion in the Improved Technical Specifications (ITS) if applicable.
4. Evaluate the adequacy of the existing setpoint and calibration limits.
5. Provide as-found and as-left tolerances for use in instrument calibration and functional test procedures. Determine Measuring and Test Equipment selection requirements. Verify and document process corrections, instrument scaling, and calibration methods.
6. VYDEP-15 requires that applicable operating procedures, alarm responses, and standard, off-normal, and emergency operating procedures be included in the evaluation. This requirement is accomplished by the inter-departmental review which supplements the WE-103 review process.

CCN-01 [initials] 2/14/00 [initials] 2/23/00

7. Evaluate the impact of the increase in Technical Specification Surveillance Interval from Monthly to quarterly for the Functional Testing of the logics.

at the correct level could result in failure of the HPCI system to supply makeup water to the reactor.

Calculation of the CST level indication loop and level recording loop functions could be performed using the Class 2 approach because these loops provide no automatic function and provide indication to support operator actions and post accident monitoring. However, for simplicity, the Class 1 approach will be used throughout. Standard methods employed in this calculation are explained in the Design Guide, special techniques and criteria are explained below.

2.2. Criteria

2.2.1. Special Criteria

The Indicator, Recorder, and ERFIS loops evaluated under this calculation are functionally tested and calibration checked as loops [Ref. 6.12] by applying pressures to the transmitter, and then verifying the output indication is within tolerance.

The alarm units are functionally tested and calibration checked as individual components only. Since the transmitters are functionally tested and calibration checked as both modules and as part of the above mentioned loops, they will be evaluated for both situations under this calculation.

CCN-01 [initials] 1/14/00 [initials] 2/23/00 SEE INSERT 1 (NEXT PAGE)

2.2.2. Software Criteria

Calculations in Attachment D (Mathsoft MathCad 7 Professional) were manually verified using a hand calculator in accordance with WE-108 (Computer Codes). No errors were found in the manual verification of the calculations performed.

MathCad 7 stores numbers with a 15-digit accuracy, all calculation outputs displayed within the calculation are rounded from the values stored in MathCad 7. Rounding errors induced by MathCad 7 are assumed to be negligible.

Computer specifications:
Gateway 2000 G6-233 – Serial number 0008583505 (12/4/97)
Intel Pentium II, 233 MHz w/ MMX Technology
96 MB RAM
Integral Math Co-Processor

Software specifications:
Microsoft® Windows® 95
Microsoft® Word Version 97 SR-1
Mathsoft MathCad 7 Professional

2.3. Assumptions

2.3.1. Calibration of instruments is assumed to be at a temperature within the ranges shown in the following table. The control room reference temperatures are per the design guide [Ref. 6.1]. The Condensate Storage Tank is located outside

VY CALCULATION SHEET

VYC-723 Rev. 3 CCN-01
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Calculation Number: VYC-723 Revision Number: 3

P.W. Allen 2/28/00

CCN Number: 01 Page 6 of 19

CCN-1

2/23/00

2/23/00

Insert 1 Functional Test – Per the Technical Specifications Surveillance Functional Tests are performed Monthly. Technical Specification Proposed change No. 217 and TS Table 4.2.1 (Note 1) suggests Quarterly Functional Tests are a viable option. Per OP-4363, Rev. 25, the Functional is implemented by isolating the level transmitter and bleeding off the pressure until the trips are actuated and the relays change state appropriately. Since the Functional Test is not to know inputs it is essentially a logic test only.

Calibration – Calibration is performed using known inputs on a quarterly basis.

VYC-723 Rev. 3 CCN-1
Page 7 of 19 20 [illegible] 2/29/00

considerations:

a) The analyzed drift data shows the 50% point to be the largest value at 1.2237% with the 0% value at 1.0625%, and the 100% point at 1.0604%. The 50% analyzed drift value is largest, and will be used as a conservative drift value.

b) From review of this drift analysis and the histograms, the data exhibits a near-normal distribution for all points. As indicated in the time dependency discussion for the OP-4363 CST Level Computer Point Loop (Attachment L), some time dependency is exhibited at the 100% point. However, the Significance F at all points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 82-day ADR term.

c) The average drift value for this group is –0.2293% at the 100% point, -0.2163% at the 50% point, and –0.1580% at the 0% point. Since these values are all more than 0.08% (N ≤ 40 and STDEV ≥ 0.25%), this term must be considered as a significant bias term [REF. 6.11].

$ADR_{bias} = -0.2293\%$

d) The ERFIS loop ADR value for the operating cycle is calculated directly as follows:

$ADR_{114\text{-}Days} = ADR_{82\text{-}Days} = \pm 1.2237\%$

2.3.18. Given that Analyzed Drift (ADR) data is available for each of the loops and components evaluated under this calculation, and given that these loops and components will be evaluated for mild environmental conditions for the Control Room and CST (i.e. normal conditions), then it is assumed that the Analyzed Drift (ADR) term for each includes the Temperature Effect (TE), Readability (RD), M&TE Uncertainty (MTE), Barometric Pressure Effect (PB), Power Supply Voltage Effect (VE), Humidity Effect (HE), and Radiation Effect (RE) for each of the associated loop components [Ref. 6.1 section 3.6.5] under both normal and accident conditions.

CCN-01 [illegible] 1/14/00 [illegible] 2/23/00 SEE INSERT 2 (NEXT PAGE)

3. INPUT DATA

Data used to calculate loop uncertainties, process corrections, setpoints, and decision points are tabulated below with the applicable reference or basis noted.

3.1. Process and Loop Data

Process data used to evaluate process corrections, decision points, and setpoint limitations are tabulated below with the applicable references.

Calculation Number: VYC-723 Revision Number: 3

CCN Number: 01 Page 8 of 19

Insert 2 2.3.19 For the Functional Test interval, either Monthly or Quarterly, there are no time-sensitive instrument effects associated with the logic test.

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2/23/00
2/23/00

5.4.7. G-191175 Sh. 1 shows ES-1-156-5 (C-6) with no connection to LT-107-5B loop or to LT-16-19-38B (see CWD 1229A). Revise accordingly.

5.4.8. LR-23-73 connections on G-191175 Sh. 1 (L-13) do not agree with MPAC. Show LT-16-19-38B connected to LR-23-73 via LSH-16-19-38B as does CWD 1229A. MPAC says LT-17-19-38B feeds Red pen of LR-23-73. Revise accordingly.

5.4.9. MPAC references CWD 526 for LR-23-73; cannot find any connections related to LR-23-73 on CWD 526. Revise accordingly.

5.4.10. G-191175 Sh. 1 shows ES-16-19-43 (M-1) with no connection to LT-107-5A loop. Also indicates LT-16-19-38A & 38B are both powered from ES-16-19-43, however, CWD 1229A shows only LT-16-19-38A from ES-16-19-43 and LT-16-19-38B from ES-1-156-5. Revise accordingly.

CCN-01 2/1/00 2/23/00 SEE INSERT 3 (NEXT PAGE)

5.5. VYDEP-15 Impact Considerations

VYDEP-15 Section 2.1 [Ref. 6.5] requires that applicable alarm responses, standard and off normal operating procedures, and EOPs be included in the evaluation. This calculation will evaluate the accuracy of loop components, including indicators and recorders where applicable. The accuracy determined by this calculation will be used as an input for generic evaluations for alarm response, operating procedure, off normal operating procedure, and EOP impact. The interdepartmental review will also ensure associated procedures or operator interfaces are considered as an output of this calculation. Therefore, this calculation adequately addresses the impact to the License and Design bases of the plant as well as the impact to plant procedure and operations.

The following has been considered and is either addressed in this analysis or via the Inter-departmental review process:

FSAR changes
Technical Specifications (Custom & Improved Technical Specifications)
Procedures
Technical Programs
Prints
Related Design Basis Calculations (input/output)
Design Basis Documents
Based on the above, all impact considerations of VYDEP-15 are addressed.

VY CALCULATION SHEET

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Calculation Number: VYC-723

Revision Number: 3 S.W. Allen 2/28/00

CCN Number: 01

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Insert 3 5.4.11 For the purpose of Logic – only Functional Testing, where relay actuation to a known input is not a requirement, a Quarterly Functional Interval is supported by this calculation.

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2/23/00

APPENDIX H

VYC-723 Rev. 3 CCN-01
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R.W. Allen 2/28/00

REVIEW CHECKLIST
(ER 961090_01)

N/A any items not applicable to the calculation or CCN.

Requirement		Preparer	Reviewer
1.	Ensure the title page is properly filled out (items that are applicable).		
	• Calculation or CCN number on cover • Title reflects subject • Correct QA record status box checked • Page numbering and count is correct • Cycle number is included ("NA" if not applicable) • Initiating document is listed • SSC I.D. numbers listed • Vendor calculation and revision number listed • Vendor safety class P.O. number listed • Superseded calculations listed • Keywords assigned • Computer codes (input/output) listed • Signatures and dates are included and are in correct chronological order. The title page reviewer and approver dates do not predate other dates in the calculation	[signature]	[signature]
2.	The following forms are properly filled out and attached (if applicable):		
	• Review forms VYAPF 0017.04 (Ensure dated signatures form the preparer and reviewer are included and all comments have been addressed)	[signature]	[signature]
	• Open Item Listing VYAPF 0017.05	[signature]	[signature]
	• Evaluation of Computer Code Use VYAPF 0017.06	N/A	N/A
	• Calculation Database Input VYAPF 0017.07	[signature]	[signature]
	• Calculation Change Notice VYAPF 0017.08	[signature]	[signature]
3.	Ensure review of the calculation can be done without recourse to the originator.	[signature]	[signature]
4.	Screening Evaluation/Safety Evaluation included.	N/A	N/A
5.	Ensure individuals responsible for each portion of the calculation are identified when multiple preparers and/or reviewers are used.	[signature]	[signature]

Requirement		Preparer	Reviewer
6.	Ensure that the calculation contains a title page, table of contents, calculation objective,method of solution, design inputs and sources, assumptions, calculation, results, conclusions and references.	N/A	N/A
7.	Ensure that each page has a page number, calculation number, revision number and CCN number, if applicable.	[signature]	[signature]
8.	Ensure that every page of every attachment (or Appendix) contains its attachment (or Appendix) number.	[signature]	[signature]
9.	Ensure that the methods for revising and correcting the calculation meet the requirements of App. C of AP 0017.	[signature]	[signature]
10.	Ensure that the legibility requirements of App. D of AP 0017 have been met.	[signature]	[signature]
11.	Ensure that the appropriate design inputs (e.g. QA records) were used and the source of these inputs are clearly referenced.	[signature]	[signature]
12.	Ensure that the calculation design information, both external and internal requirements have been met.	[signature]	[signature]
13.	Ensure that if design specifications were used as input to the calculation the performance characteristics are independently verified and documented.	[signature]	[signature]
14.	Ensure that all reviewers' comments have been addressed.	[signature]	[signature]
15.	Ensure that input and modeling uncertainties are explicitly addressed in the calculation. (ER 961090_02)	N/A	N/A
16.	Ensure that any restrictions and/or limitations on the use of the calculation are clearly stated.	[signature]	[signature]
17.	Ensure that computer codes are used in accordance with App. E of AP 0017.	N/A	N/A
18.	Ensure that the applicable input considerations from App. C to AP 6008 have been incorporated and are explicitly addressed within the calculation.	[signature]	[signature]
19.	Ensure review of 10CFR50.46 reporting requirements has been documented for analyses which assess conformance to 10CFR50.46.	[signature]	[signature]

R.W. Allen 2/28/00

J. W. Allen 2/28/00

Requirement		Preparer	Reviewer
20.	Ensure relevant conditions/limitations have been reviewed for their effect on this calculation and the review is noted in the calculation.	JHL	MSM

PREPARER		REVIEWER	
Name (print)	John H. Lewis	Name (print)	Mark S. McKinley
Organization	Excel Services (VY Design Eng)	Organization	Excel Services (VY Design Eng)
Signature	John H Lewis	Signature	Mark S McKinley
Date	2/23/00	Date	2/23/00

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

Reviewer Assigned: Mark McKinley Required Date: 2/15/2000

VYC-723 Rev. 3 CCN-01
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J.W. Allen 2/28/00

Comments*	Resolution
REVIEWED IN ACCORDANCE WITH AP 0017 without comment.	

Mark A. McKinley / 2/23/00
Reviewer Signature Date

N/A James W. Allen / 2/28/00
Calculation Preparer (Comments Resolved) Date

Method of Review:
- ☑ Calculation/Analysis Review
- ☐ Alternative Calculation
- ☐ Qualification Testing

N/A James W. Allen / 2/28/00
Reviewer Signature (Comments Resolved) Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

Reviewer Assigned: I&C Department Required Date: 2/15/2000

VYC-723 Rev. 3 CCN-01
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J.W. Allen 2/28/00

Comments*	Resolution
No Comments	

Reviewer Signature [signature] / Date 1/17/00

Calculation Preparer (Comments Resolved) N/A James W. Allen / Date 2/28/00

Method of Review:
- ☑ Calculation/Analysis Review
- ☐ Alternative Calculation
- ☐ Qualification Testing

Reviewer Signature (Comments Resolved) N/A James W. Allen / Date 2/28/00

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

Page 1 of 1

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

Reviewer Assigned: Reactor Engineering Required Date: 2/15/2000

VYC-723 Rev. 3 CCN-01
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S.W. Allen 2/28/00

Comments*	Resolution
NONE.	
No Comments. ED	

M A Benoit 1/27/2000
Reviewer Signature Date

Ed Duda 2/7/2000

Calculation Preparer (Comments Resolved) / Date

Method of Review:
- [x] Calculation/Analysis Review
- [ ] Alternative Calculation
- [ ] Qualification Testing

N/A Ed Duda 2/7/2000
Reviewer Signature (Comments Resolved) / Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

VY CALCULATION REVIEW FORM

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Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

Reviewer Assigned: Operations Department Required Date: 2/15/2000

Comments*	Resolution
No Comments	G.W. Allen 2/28/00

Reviewer Signature / Date: [signature] / 2/15/00

Calculation Preparer (Comments Resolved) / Date: /

Method of Review:
- ☑ Calculation/Analysis Review
- ☐ Alternative Calculation
- ☐ Qualification Testing

Reviewer Signature (Comments Resolved) / Date: N/A /

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

Reviewer Assigned: System Engineering Required Date: 2/15/2000

VYC-723 Rev. 3 CCN-01
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P.W. Aeen 2/28/00

Comments*	Resolution
No Comments.	

[signature] / 2/14/00
Reviewer Signature Date

_____ / _____
Calculation Preparer (Comments Resolved) Date

Method of Review:
- ☑ Calculation/Analysis Review
- ☐ Alternative Calculation
- ☐ Qualification Testing

_____ / _____
Reviewer Signature (Comments Resolved) Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 01

Title: Condensate Storage Tank Level (HPCI) Monitoring

VYC-723 Rev. 3 CCN-01
Page 19 of ~~19~~ 20
G.W. Allen 2/28/00

Reviewer Assigned: NED Required Date: 2/15/2000

Comments*	Resolution
Not included in Review	(see next page) G.W. Allen 2/28/00

_____ / _____
Reviewer Signature Date

_____ / _____
Calculation Preparer (Comments Resolved) Date

Method of Review:
- ☐ Calculation/Analysis Review
- ☐ Alternative Calculation
- ☐ Qualification Testing

_____ / _____
Reviewer Signature (Comments Resolved) Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

Safety Analysis Review Screen

Calculation No. VYC-723 Rev. 3 CCN. 1

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This screen is designed to determine if new or revised setpoint/uncertainty analyses require review by responsible VY department.

If necessary the calculation preparer can contact the responsible department for assistance in completing the screen.

No	Question	Answer[1]
1.	Has the analytical limit for either normal, accident or environmental conditions changed?[2]	No
	If the answer to question 1 is **No** the screening is complete and no review by responsible department is necessary. If the answer to question 1 is **Yes** or **Unknown**, proceed to question 2.	
2	Is the setpoint applicable to any of the analysis in the following areas: [3] Short-term containment analysis? (GE/OPL4A) Long-term containment analysis? (GE/OPL4A) Torus Temperature? (DE&S) Appendix R? (DE&S) LOCA? (GE/OPL4) EQ HELB/Heatup ? (DE&S) EQ Radiological? (DE&S) Reactor physics? (GE and DE&S) Transient analysis? (GE/OPL3 and DE&S)	
	A yes to both questions (1) and (2) requires documented review by the VY department responsible for the safety analysis(es) affected. [4]	

See Notes on Page 2

J. Lewis / 2/23/00

Calculation Preparer Date

Comments: ______________________________

VY CALCULATION CHANGE NOTICE (CCN)

CCN Number: 02 Calculation Number 723 Rev. No. 3

Calculation Title: Condensate Storage Tank Level (HPCI) Monitoring

Initiating Document: EDCR 99-404
VYDC/MM/TM/Spec. No./ other

Safety Evaluation Number: N/A

Superseded Document: N/A

Implementation Required: ☐ Yes ☒ No

Reason for Change: ERFIS Analog input DSA Equipment in DAS Cab B was Replaced with RTP DAS Equip.
Description of Change: Various pages of the calculation are being revised to List pertinent Information associated with the new RTP Corp. model RTP8436/2x input card for ERFIS PTID F004 (Condensate Storage Tank Level)
Technical Justification for Change: The Input card for ERFIS PTID F004 is Being Replaced By EDCR 99-404-ERFIS DAS B Replacement. The new input card (RTP model 8436/2X) is more Accurate than the existing Analogic TTC 9500. Therefore, the uncertainty of the existing card is Bounding and therefore conservative. Additionally, The ERFIS uncertainty is Bounded By the Control Room indication which are the primary means of indication
Conclusions: 1. The TLU is unaffected by this CCN, consequently there is no impact to successor documents 2. This CCN does not require a Safety Evaluation. This Calc. or CCN is not an implementing document.

Prepared By/Date	Interdiscipline Review By/Date	Independent Review By/Date	Approved By/Date
Harry T Hyams 11/2/2000 Harry T Hyams	N/A	Joseph Garuzzo 11/2/00 JOSEPH GARUZZO	Richard G. [illegible] 11/2/2000 Richard G. [illegible]

Installation Verification/Final Turnover to DCC:

Open Items Associated with CCN ☐ Yes ☒ No ☐ Closed (Section 2.3.2)

Installation Verification (Section 2.3.4)

☒ Calculation accurately reflects plant as-built configuration, OR
☐ N/A, calculation does not affect plant configuration

Resolution of documents identified in the Design Output Documents Section of VYAPF 0017.07 (Section 2.3.6)

Harry T Hyams / Harry T Hyams / 11/2/2000
Print Name Signature Date

Total number of pages in package including all attachments 16

Note: VYAPF 0017.07 should be included immediately following this form.

VYC 723 Rev 3
CCN-02
Pg 2 of 16

VY CALCULATION DATABASE INPUT FORM

VYC 723 / CCN-01	3	N/A	N/A
VY Calculation/CCN Number	Revision Number	Vendor Calculation Number	Revision Number

Vendor Name: N/A PO Number: N/A

Originating Department: VY Design Engineering CE/I&C

| Critical References Impacted: ☐ FSAR ☐ DBD ☐ Reload. "Check" the appropriate box if any critical document is identified in the tables below.

| EMPAC Asset/Equipment ID Number(s): ~~ERFIS PTID F004~~ N/A NHL 11/2/2000

| EMPAC Asset/System ID Number(s): HPCI

Keywords: Non New Keywords

| For Revision/CCN only: Are deletions to General References, Design Input Documents or Design Output Documents required? ☐ Yes† ☐ No

General References

* Reference #	** DOC #	REV #	*** Reference Title (including Date, if applicable) (See App. A, Section 3.2.7 for Guidance)	**** Affected Program	Critical Reference (✓)

Design Input Documents - The following documents provide design input to this calculation. (Refer to Appendix A, section 4)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	Critical Reference (✓)

Design Output Documents - This calculation provides output to the following documents. (Refer to Appendix A, section 5)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	Critical Reference (✓)

* Reference # - Assigned by preparer to identify the reference in the body of the calculation.
** Doc # - Identifying number on the document, if any (e.g., 5920-0264, 0191172, VY6-1286)
*** Reference Title - List the specific documentation in this column. "See attached list" is not acceptable. Design Input/Output Documents should identify the specific design input document used in the calculation or the specific document affected by the calculation and not simply reference the document (e.g., VYDC, MM) that the calculation was written to support.
**** Affected Program - List the affected program or the program that reference is related to or part of. If the reference is FSAR, DBD or Reload (IASD or OPL), check Critical Reference column and check FSAR, DBD or Reload, as appropriate, on this form (above).

† If "yes," attach a copy of "VY Calculation Data" marked-up to reflect deletion (See Section 3.1.8 for Revision and 5.2.3.18 for CCNs).

1.2. System & Components

This calculation applies to the Condensate Storage Tank Level Monitoring Loops which provide automatic HPCI suction transfer as well as Post Accident Monitoring level indication. The specific components addressed are as listed in Table 1 below.

Table 1
Component Identification

Tag Number	Manufacturer	Model	Rack/Cabinet	Description (MPAC)	SYS	Flow Diagram	CWD (B-191301)
LT-107-5A	GE	50-555111ADAA3AEB	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LT-107-5B	GE	50-555111ADAA3PBI	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LSL-107-5A LSL-107-5B	GE	50-560321AAAC1	CRP 9-20	HPCI CST LEVEL SWITCH	107	G-191176 Sheet 1	Sheet 1229A
LI-107-5	GE	180	CRP 9-6	CONDENSATE STORAGE TANK LEVEL INDICATOR	107	G-191176 Sheet 1	Sheet 1229A
ES-16-19-43	GE	50-570062FAAC1	CRP 9-20	ATMOS CONT SYS AND PRIM LEAK DET POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229
ES-1-156-5	GE	50-570062FAAC1	CRP 9-20	ATMOSPHERIC CONTROL SYSTEM POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229B
LR-23-73	Foxboro	N-E274-S2RA6	CRP 9-3	CST LEVEL RECORDER (GREEN PEN)	HPCI	G-191169 Sheet 1	Sheet 1229A

1. Although not Listed Above, ERFIS Point F004 is Being Replaced with RTP Corp. RTP 8436/2x (AID Card) And RTP 7436/50 (Gate Card) under EDCR 99-404.

1.3. Instrument Loop Functions

The high pressure coolant injection (HPCI) system provides emergency core cooling in the event of a small line break in the nuclear system that does not result in rapid depressurization of the reactor vessel simultaneous with a loss of normal auxiliary power. The HPCI System permits the reactor to be shutdown while maintaining sufficient reactor vessel water inventory until the reactor pressure drops sufficiently to enable low pressure injection systems to be placed in operation. The HPCI turbine-driven pump is designed to supply make-up water into the vessel at the rate of 4250 gpm over a reactor pressure range of 1135 to 165 psia.

The Condensate Storage Tank is the initial source of water volume for the HPCI pump. When level has decreased to a low level setpoint, HPCI suction is transferred to the suppression chamber. These channels provide the indication and trip actuations associated with these functions.

considerations:

a) The analyzed drift data shows the 50% point to be the largest value at 1.2237% with the 0% value at 1.0625%, and the 100% point at 1.0604%. The 50% analyzed drift value is largest, and will be used as a conservative drift value.

b) From review of this drift analysis and the histograms, the data exhibits a near-normal distribution for all points. As indicated in the time dependency discussion for the OP-4363 CST Level Computer Point Loop (Attachment L), some time dependency is exhibited at the 100% point. However, the Significance F at all points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 82-day ADR term.

c) The average drift value for this group is −0.2293% at the 100% point, -0.2163% at the 50% point, and −0.1580% at the 0% point. Since these values are all more than 0.08% ($N \leq 40$ and $STDEV \geq 0.25\%$), this term must be considered as a significant bias term [REF. 6.11].

$ADR_{bias} = -0.2293\%$

d) The ERFIS loop ADR value for the operating cycle is calculated directly as follows:

$ADR_{114\text{-}Days} = ADR_{82\text{-}Days} = \pm 1.2237\%$

2.3.18. Given that Analyzed Drift (ADR) data is available for each of the loops and components evaluated under this calculation, and given that these loops and components will be evaluated for mild environmental conditions for the Control Room and CST (i.e. normal conditions), then it is assumed that the Analyzed Drift (ADR) term for each includes the Temperature Effect (TE), Readability (RD), M&TE Uncertainty (MTE), Barometric Pressure Effect (PB), Power Supply Voltage Effect (VE), Humidity Effect (HE), and Radiation Effect (RE) for each of the associated loop components [Ref. 6.1 section 3.6.5] under both ~~normal and accident conditions~~.

Add 2.3.20 - See Attachment.

3. INPUT DATA

Data used to calculate loop uncertainties, process corrections, setpoints, and decision points are tabulated below with the applicable reference or basis noted.

3.1. Process and Loop Data

Process data used to evaluate process corrections, decision points, and setpoint limitations are tabulated below with the applicable references.

2.3.20 The input card for ERFIS PTID F004 (Condensate Storage Tank Level) is being replaced with RTP Corp. model RTP8436/2X (A/D card) and RTP-7436/50 (gate card) under EDCR 99-404. The new ERFIS input card is more accurate than the existing ERFIS input card. See attachment J for the new input card specifications. The stated accuracy is for both cards combined. The uncertainty calculated for the existing Analogic input card is bounding and is therefore conservative. In addition, the uncertainty of the ERFIS input is bounded by the uncertainty of the control room indication. Primary indication is the control room indicator.

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3.7. **Power Supply ES-16-19-43 & ES-1-156-5 Data**

Table 9
Power Supply Input Data

Basis	Description	Data
Ref. 6.24 & Attachment I	Output voltage Output current	52.5 ± 8% Vdc (52.5 ± 4.2 Vdc) 0 to 50 mA for up to 5 transmitters
Ref. 6.24 & Attachment I	Source voltage range 120 cps Ripple Operating Temperature Range	107-127 vac (50-60Hz) ± 0.03% rms 40°F to 120°F

3.8. **ERFIS Computer Point F004 Input Data**

Table 10
ERFIS Computer Point Input Data *

Basis	Description	Data
Attachment J	ITG-9500 Input Channels Per Rack Input Types and Ranges Overrange/underrange Gain Accuracy (30 day) Gain Accuracy (1 year) Input Power Requirements Operating Temperature Humidity Drift	16 ± 160, ± 80, ± 40, ± 20 mVdc 1% 0.01% rdg + 0.01% FSR max at 25°C 0.05% FSR, 0-60°C 104-125 volts AC, < 20 watts 0 to 55°C (32 to 130°F) 0 to 95% (non-condensing) Not specified
Attachment J	Accuracy[7] $= \pm \dfrac{(0.05\% \times 80mV)}{(80mV - 16mV)}$	± 0.0625%
Ref. 6.25 & Att. J	Input Span	16 to 80 mVdc[8]
Ref. 6.12	Indication span	0 to 477.1 KGAL
Ref. 6.8 & Att. L	Resolution	0.01 KGAL
Ref. 6.12	Calibration Input Span	10 to 50 mVdc[9]
Ref. 6.12	Existing Loop/Component Calib. Tol.	± 2.6 KGAL (0.545% span)
Assumption 2.3.17	ERFIS Loop Analyzed Drift Bias (DA_{bias})	- 0.2293% Span
Assumpt. 2.3.17	ERFIS Loop Analyzed Drift (DA)	± 1.2237% Span

* The ERFIS Input Card is Being Replaced with RTP Corp model RTP 8436/2x (a/d card) and RTP 7436/50 (Gate card). See paragraph 2.3.20 for Additional Information

7 Accuracy of Analog to Digital converter.
8 10 to 50 mAdc through 160Ω personality module.
9 Measured as 10 to 50 mVdc at the transmitter output test terminals. 10 to 50 mAdc through 100Ω.

TELEPHONE & CONFERENCE MEMORANDUM

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ATTACHMENT J
VYC-723 REV. 3
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DATE: August 13, 1997

WITH: Mike Flanagan (800) 237-2200
Customer Service Engineer
Analogic Corporation

BY: Brian Davidson (301) 934-1226 8/13/97
Excel Services Corporation

RE: **ANALOGIC ITG-9500 and ITG-5600 Data Acquisition System**
Equipment performance specifications for various input types

I contacted Mr. Flanagan to inquire into performance specifications for the Analogic equipment which process Type "E" thermocouple inputs to the DAS.

In the Vermont Yankee system, it appears that the ITG-9500 is used for the basic input signal processing. The applicable performance specs of the ITG-9500 (which include A/D conversion and temperature compensation) are as follows:

16 Channels programmed for ± 160 mVdc, ± 80mVdc, ± 40 mVdc, or ± 20 mVdc

Resolution: 15 bits plus sign

Input Offset: 10μV max; Typical 3μV @ ambient

Gain Accuracy: ± 0.01% reading + 0.01% FS Max at 25°C for 30 days;
1 year 0.05% FS reading (0-60 degree)

Reference Junction Compensation Error: ± 0.25°C Max @ ambient (Over 30 days)
± 0.005°C per °C max (0-60°C)
± 0.02°C per $\sqrt{\text{month}}$

In the Vermont Yankee system, the ITG-5600 may also be used for input signal processing. The configuration of the ITG-5600 includes separate circuit cards for specific input signal types and processing functions. A typical ITG-5600 configuration may include the following circuit boards:

AC1330 - Dual Analog Input Card

AC3000 - Self Test Module

AC4270 - Thermocouple Input (Type "T") ± 21 mV FS

AC4600 - RTD Input

AC4900/4910 - High Speed Buffer (A/D Converter)

AC4270 - Thermocouple Input (Type "E") ± 7.7 mV FS

CC: VYC-809

APPENDIX B

ITG-9500 Product Specifications

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ANALOG CHARACTERISTICS

Number of Channels	16
Input Types and Ranges	
Millivolt ranges	±160, ±80, ±40, ±20
Overrange/underrange	1%

Input Impedance
1000 megohms with 50 pF common mode
≥100 megohms normal mode at DC in-range
approx. 3000 ohms DC overrange and AC
Resolution
15 bits plus sign

Input Offset*
10 microvolts max., 3 microvolts typical at 25 degrees C
30 microvolts max., 10 microvolts typical 0-60 degrees C
Gain Accuracy*
0.01% reading + 0.01% FSR max. at 25 degrees C for 30 days
0.05% FSR, 1 year, 0-60 degrees C
Reference Junction Compensation Error
0.25 degrees C max. at 25 degrees C over 30 days
0.005 degrees C/degree C max. 0-60 degrees C
0.02 degrees C per square root month
Channel to Reference Temperature Gradient Error
0.25 degree C adjacent channel
0.85 degree C worst case (0.2 degrees C per channel)

Conversion Rate
(independent of gain/offset/CJC readings)
160 raw conversions per second, minimum
with digital noise filter, 2.5 conversions per second per channel
Common Mode Noise Rejection Ratio
112 dB min. at 60 Hz (126 dB min. at 60 Hz with digital noise filter)
106 dB min. at DC
Normal Mode Noise Rejection Ratio
26 dB min. above 50 Hz
46 dB min: 50/60 Hz with digital filter
Maximum Common Mode Voltage
±200 volts peak
Maximum Normal Mode Voltage
50VRMS or DC sustained
IEEE 472 surge withstand
Offset Stability
0.5 microvolts per degree C max.
0.1 microvolts per degree C typical
Gain Stability
7 ppm per degree C max.
3 ppm per degree C typical
<±20 ppm per square root month typical

COMMUNICATIONS

Data Transmission Rates

Bitbus 375 kbps

Maximum Cable Length (twisted pair)

Bitbus 1000 feet at 375 kbps

POWER AND ENVIRONMENTAL

Power
104-125 volts AC,<20 watts

Temperature
Operating 0 to 55 degrees C (32 to 130 degrees F)
Storage -25 to 85 degrees C (-13 to 185 degrees F)

Humidity
0 to 95% non-condensing

Size
19"w x 1-3/4"h x 8"d
19" relay rack mounting, 1 EIA rack unit

* including all error sources, draft free, 30 min warmup

ATTACHMENT J
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MINI-DAS INSTRUCTION MANUAL

FOR

VERMONT YANKEE NUCLEAR POWER CORPORATION

EMERGENCY RESPONSE FACILITY INFORMATION SYSTEM (ERFIS)

PREPARED BY

EI INTERNATIONAL, INC.
P. O. BOX 50736
IDAHO FALLS, ID 83405

JANUARY 1990

ORIGINATOR	DATE	REVIEWER	DATE
FUNCTIONAL MANAGER	DATE	SYSTEM ENGINEER	DATE
PROJECT MANAGER	DATE		

CONTRACT NO. VY-0387-07

REVISIONS

NOTE: All revisions are flagged with the symbol N in the right margin where N is the number of the revision. The individual section revision history is on the following page.

Rev. 0 Issued for use
Rev. 1 As-Built

TABLE 5 (Continued)

PTID	DESCRIPTION	CWD_DWG	DAS_CWD	SIGRAN	F_RANGE
E005	4KV BUS 2 KV	312		0/80	0-80MV
E006	4KV BUS 3 KV	312		0/80	0-80MV
E007	4KV BUS 4 KV	312		0/80	0-80MV
E008	DC-1 BATTERY VOLTAGE	350		0/80	0-80MV
E009	DC-2 BATTERY VOLTAGE	350		0/80	0-80MV
E010	BATTERY A VOLTAGE +24V BUS	357		0/80	0-80MV
E011	BATTERY A VOLTAGE -24V BUS	357		0/80	0-80MV
E012	BATTERY B VOLTAGE +24V BUS	357		0/80	0-80MV
E013	BATTERY B VOLTAGE -24V BUS	357		0/160	0-160MV
E014	120 VOLT VITAL BUS AC VOLTAGE	312		0/80	0-80MV
E015	480 VOLT BUS 8 VOLTAGE	338		0/80	0-80MV
E016	SCOBIE-379 LINE MVAR	250		-80/80	±80MV
E017	NORTHFIELD-381 LINE MVAR	251		-80/80	±80MV
E018	480 VOLT BUS 9 VOLTAGE	343		0/80	0-80MV
E026	RX FEED PUMP A MOTOR WINDING	560		-9.83/76.2	TC-E
E027	RX FEED PUMP B MOTOR WINDING	560		-9.83/76.2	TC-E
E028	RX FEED PUMP C MOTOR WINDING	560		-9.83/76.2	TC-E
E029	CONDENSATE PUMP A MOTOR WINDING	352		-9.83/76.2	TC-E
E030	CONDENSATE PUMP B MOTOR WINDING	352		-9.83/76.2	TC-E
E031	CONDENSATE PUMP C MOTOR WINDING	352		-9.83/76.2	TC-E
E032	RHR PUMP A MOTOR WINDING	352		-6.25/20.8	TC-T
E033	RHR PUMP B MOTOR WINDING	352		-6.25/20.8	TC-T
E034	RHR PUMP C MOTOR WINDING	352		-6.25/20.8	TC-T
E035	RHR PUMP D MOTOR WINDING	352		-6.25/20.8	TC-T
E036	COOLIGE 340 LINE MW	292		-80/80	±80MV
E037	COOLIGE 340 LINE MVAR	292		-80/80	±80MV
E038	MCC 89A	370	1608	0/7.07107V	0-120VAC
E039	MCC 89B	364	1656	0/7.07107V	0-120VAC
E040	24 VOLT DC ECCS SI	872	1611	0/10V	0-50VDC
E041	24 VOLT DC ECCS SII	873	1612	0/10V	0-50VDC
E042	125V DC BATTERY BUS DC-2A	368	1617	0/2.5V	0-150VDC
E043	DG-A KW	613	1657	0/10V	0-4000KW
E044	DG-B KW	612	1616	0/10V	0-4000KW
E045	DG-A FREQUENCY	613	1657	0/10V	55-65HZ
E046	DG-B FREQUENCY	612	1616	0/10V	55-65HZ
F002	CONDENSER A HOTWELL LEVEL	518		16/80	10-50MA
F003	CONDENSER B HOTWELL LEVEL	518		16/80	10-50MA
F004	CONDENSATE STORAGE TANK LEVEL	1229A		16/80	10-50MA
F005	CONDENSATE FLOW DIFF PRESSURE	524		16/80	10-50MA
F006	DEMIN WATER STORAGE TANK VOLUME	526		16/80	10-50MA
F007	CONDENSATE REJECT FLOW	524		16/80	10-50MA
F008	CONDENSATE PUMP DISCH HDR PRESS	524		16/80	10-50MA
F009	RX FEED PUMP DISCH HDR PRESS	525		16/80	10-50MA
F010	REACTOR FEEDWATER PRESSURE	524		16/80	10-50MA
F011	GLAND STEAM HEADER PRESSURE	108		16/80	10-50MA

EDCR 99-404

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ENCLOSURE (E)

Procurement Information

All equipment required for this EDCR is classified as Non-Nuclear Safety (NNS) related and Non-seismic. Consequently, no special purchase requirements or certificates of compliance are required. The equipment to be used in this design change, including spares, is listed below.

Quantity	Model #	Description
1	RTP 2000/20-000	Target Node System with Ethernet Controller, Chassis, 115 VAC, with SOE.
4	7431/60-000	Universal I/O Sub System, 115 VAC
1	7416/20-000	RTP I/O Bus Termination Card
1	7414/31-005	RTP I/O Bus Cable, Controller/Host to Chassis, Non-PVC, 5 Ft.
3	7417/31-002	RTP I/O Bus Cable, Chassis to Chassis, Non-PVC, 2 Ft
1	RTP 200/00-000NT	Full System Graphical Configurator, Windows NT.
7	8436/31-003	RTD Bridge, 100 Ohm Platinum, 16 Bit A/D, Calibration Source, TB Connector
5	8436/31-103	RTD Bridge, 10 Ohm Platinum, 16 Bit A/D, Calibration Source, TB Connector
23	8436/30-003	Thermocouple Card, 8-Ch, 16 Bit A/D, CJC Senso, Calibration Source, TB Connector
2	8455/38-101	Isolated Analog Output Card, 8-Ch, 12-Bit D/A Converter, 4-20 mA, 0-20 mA.
35	7436/50-003	Wide Range High Speed Gate Card, Card Edge Connector
37	7505/51-001	Crimp & Insert Card Edge Connector Kit
4	8436/24-012	16 Bit A/D Converter Card
6	7436/10-001	DALCAL Card
1	RTP 2000/30-000	I/O Controller, Interface Card, Fan Assy.
1	060-5004-000	120 VAC Power Supply
1	RTP 021-5419-000	Universal Chassis Interface Card

1	Equipto equipment cabinet (Designated as 960-2)
75 Ft	3 Conductor – 12 AWG Cable, Rockbestos FWIII, or Equivalent (To be used for DAS A/B Power feeds)
40 Ft	1" Flex Conduit
1	20-Ampere circuit breaker: Bryant Type BR120, or equivalent
1	24 point terminal strip: plant stock.

Joe Garozzo VY 802-451-3030

David McCully RTP Corp 8/2/00

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Per Dave This applies to RTP 8436/ex A/D

WORSE CASE ACCURACY ANALYSIS FOR RTP7436/21 AND RTP7436/50

10/6/98 DAVID MCCULLY

STATIC ERROR AT CONSTANT TEMPERATURE AS +/- % FULL SCALE

INPUT VOLTAGE RANGE	OFFSET	GAIN LINEAR 1/2 LSB	NOISE	TOTAL STATIC ERROR
10.240	0.0015%	0.025%	0.0143%	0.0407%
5.120	0.0029%	0.025%	0.0163%	0.0442%
2.560	0.0059%	0.025%	0.0204%	0.0513%
1.280	0.0117%	0.025%	0.0286%	0.0653%
0.640	0.0031%	0.025%	0.0157%	0.0438%
0.320	0.0063%	0.025%	0.0192%	0.0505%
0.160	0.0125%	0.025%	0.0263%	0.0638%
0.080	0.0125%	0.025%	0.0247%	0.0622%
0.040	0.0250%	0.025%	0.0372%	0.0872%
0.020	0.0500%	0.025%	0.0622%	0.1372%
0.010	0.1000%	0.025%	0.1122%	0.2372%

TEMPERATURE ERROR AS +-% OF FULL SCALE PER DEGREE C

STATIC ERRORS PLUS TEMP ERRORS FOR +/- 10 DEGREES C AS +/- % OF FULL SCALE

INPUT VOLTAGE RANGE	GAIN	ZERO	TOTAL		STATIC ERROR	TEMP ERROR +/-10 C	TOTAL ERROR
10.240	0.0085%	0.0012%	0.0097%		0.0407%	0.0965%	0.1371%
5.120	0.0085%	0.0016%	0.0101%		0.0442%	0.1011%	0.1453%
2.560	0.0085%	0.0025%	0.0110%		0.0513%	0.1102%	0.1615%
1.280	0.0085%	0.0043%	0.0128%		0.0653%	0.1284%	0.1937%
0.640	0.0085%	0.0012%	0.0097%		0.0438%	0.0973%	0.1411%
0.320	0.0085%	0.0018%	0.0103%		0.0505%	0.1026%	0.1531%
0.160	0.0085%	0.0028%	0.0113%		0.0638%	0.1131%	0.1769%
0.080	0.0085%	0.0018%	0.0103%		0.0622%	0.1028%	0.1650%
0.040	0.0085%	0.0029%	0.0114%		0.0872%	0.1135%	0.2007%
0.020	0.0085%	0.0050%	0.0135%		0.1372%	0.1350%	0.2722%
0.010	0.0085%	0.0093%	0.0178%		0.2372%	0.1780%	0.4152%

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1-5.2 RTP8436/2x A/D Card Specifications

Sampling Conversion Times
(From Data Output pulse to
Data Ready condition):

	12-Bit A/D	14-Bit A/D	16-Bit A/D	Fast 12-Bit A/D
Solid State Gate	39.9 μs	28.9 μs	30.9 μs	23.3 μs
Fast Solid-State Gate	33.6 μs	22.6 μs	24.6 μs	17.0 μs
Relay Gate	10 ms* 7 ms**	10 ms* 7 ms**	10 ms* 7 ms**	10 ms* 7 ms**
Wide-Range Gate	45 μs** 100 μs*	34 μs** 100 μs*	34 μs** 100 μs*	28.4 μs** 100 μs*

* Sampled channel is on the same gate card as the previously sampled channel

** Sampled channel is on a different gate card than the previously sampled channel

System Speed $$\frac{1}{\text{Sample and Convert Time + CPU Latency Time}}$$

Gain Stability, Typical (ppm/°C):

	12-Bit A/D	14-Bit A/D	16-Bit A/D	Fast 12-Bit A/D
Solid State Gate	±100	±85	±85	±100
Fast Solid-State Gate	±100	±85	±85	±100
Relay Gate	±50	±60	±60	±50
Wide-Range Gate	±85	±85	±85	±85

Gain Accuracy: Less than ±0.025% of Full Scale

Zero Stability (Typical):

Solid-State Gate Cards: ±45 μV/°C RTI: ±0.003% FS/°C RTO (12-Bit A/D)
±0.0007% FS/°C RTO (14-Bit and 16-Bit A/D)

Relay Gate Cards: ±0.5 μV/°C RTI; ±45 μV/°C on A/D card;
±0.003% FS/°C RTO (12-Bit A/D)
±0.0007% FS/°C RTO (14-Bit and 16-Bit A/D)

VY CALCULATION REVIEW FORM

Calculation Number: VYC-723 Revision Number: 3 CCN Number: 02

Title: Condensate Storage Tank Level (HPCI) monitoring

Reviewer Assigned: Required Date:

☐ Interdiscipline Review ☒ Independent Review

Comments*	Resolution
NO COMMENTS	

Reviewer Signature / Date: 11/2/00

Calculation Preparer (Comments Resolved) / Date

Method of Review:
☐ Calculation/Analysis Review
☐ Alternative Calculation
☐ Qualification Testing

Reviewer Signature (Comments Resolved) / Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.

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Page 1 of ____

VY CALCULATION CHANGE NOTICE (CCN)

CCN Number: 03 Calculation Number VYC-0723 Rev. No. 3

Calculation Title: CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING

Initiating Document: ER-2000-1575 01
VYDC/MM/TM/Spec. No./ other

Safety Evaluation Number: N/A

Superseded Document: N/A

Implementation Required: ☑ Yes ☐ No

Reason for Change: To increase the assumed normal area temperature in the CST valve room enclosure from 55-85°F to 45-100°F.
Description of Change: Revise appropriate pages as required to incorporate additional instrument uncertainty (temperature affect) associated with increasing the ambient temperature range for the CST level transmitter to 45-100°F
Technical Justification for Change: The basis for the temperature range of 45-100°F is contained in ER 2000-1575. The temperature affect uncertainty is based on the vendor's specifications associated with the CST level transmitter.
Conclusions: 1. The increase in instrument uncertainty due to the increase in ambient temperature has been incorporated into the uncertainty analysis.. 2. This Calculation or CCN is not an implementing document. Therefore, this CCN does not require a safety evaluation.

Prepared By/Date	Interdiscipline Review By/Date	Independent Review By/Date	Approved By/Date
Joseph C. Garozzo 4/2/03	N/A	James W. Allen 4/29/03	Richard G. Janny 4/30/03

Installation Verification/Final Turnover to DCC:

Open Items Associated with CCN ☐ Yes ☑ No ☐ Closed (Section 2.3.2)

Installation Verification (Section 2.3.4)

☒ Calculation accurately reflects plant as-built configuration, OR
☐ N/A, calculation does not affect plant configuration

Resolution of documents identified in the Design Output Documents Section of VYAPF 0017.07 (Section 2.3.6)

JOSEPH GAROZZO / [signature] / 4/2/03
Print Name / Signature / Date

Total number of pages in package including all attachments

Note: VYAPF 0017.07 should be included immediately following this form.

VY CALCULATION DATABASE INPUT FORM

VYC-0723 CCN-03	3		
VY Calculation/CCN Number	Revision Number	Vendor Calculation Number	Revision Number

Vendor Name:______________________ PO Number:

Originating Department:

Critical References Impacted: ☐ FSAR ☐ DBD ☐ Reload. "Check" the appropriate box if any critical document is identified in the tables below.

EMPAC Asset/Equipment ID Number(s):

EMPAC Asset/System ID Number(s):

Keywords:

For Revision/CCN only: Are deletions to General References, Design Input Documents or Design Output Documents required? ☐ Yes† ☑ No

General References

* Reference #	** DOC #	REV #	*** Reference Title (including Date, if applicable) (See App. A, Section 3.2.7 for Guidance)	**** Affected Program	Critical Reference (✓)

Design Input Documents - The following documents provide design input to this calculation. (Refer to Appendix A, section 4)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	Critical Reference ()
6.34			ER 2000-1575		

Design Output Documents - This calculation provides output to the following documents. (Refer to Appendix A, section 5)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	Critical Reference ()

* Reference # - Assigned by preparer to identify the reference in the body of the calculation.
** Doc # - Identifying number on the document, if any (e.g., 5920-0264, G191172, VY6-1286)
*** Reference Title - List the specific documentation in this column. "See attached list" is not acceptable. Design Input/Output Documents should identify the specific design input document used in the calculation or the specific document affected by the calculation and not simply reference the document (e.g., VYDC, MM) that the calculation was written to support.
**** Affected Program - List the affected program or the program that reference is related to or part of. If the reference is FSAR, DBD or Reload (IASD or OPL), check Critical Reference column and check FSAR, DBD or Reload, as appropriate, on this form (above).

† If "yes," attach a copy of "VY Calculation Data" marked-up to reflect deletion (See Section 3.1.8 for Revision and 5.2.3.18 for CCNs).

and the level transmitters are located on rack RK-25-66 inside an insulated and un-heated room attached to the side of the CST. ~~The expected temperature extremes for the CST instrument room are based on discussions with the E&C System Engineer and the Setpoint Project Site Representative (Attachment N).~~ ER 2000-1575 (REF. 6.34) The normal ambient temperature extremes expected are as listed in Table 2.

Table 2
Normal Area Temperatures

Plant Area	Minimum	Maximum
Condensate Storage Tank - Instrument Rack 25-66	45 ~~55~~ °F	100 ~~85~~ °F
Control Room – All areas	60 °F	80 °F

2.3.2. CST water minimum temperature is maintained ≥ 50 °F (as read on TI-107-3) per VY Procedure AP-0150, Auxiliary Operator Round Sheet TB/OUT, page 5 of 7 (Attachment M). The tank is heated by auxiliary steam heating coils. As a conservative value for minimum temperature, the assumed value of 40°F from FSAR section 14.5.2 will be used [Ref. 6.2].

CST water maximum temperature is assumed equal to the maximum ambient temperature of 100 °F as identified in FSAR section 2.3.5 and on HPCI Process Diagram 5920-0784 [Ref. 6.29.1].

2.3.3. The calibration interval is assumed to occur once every quarter or 114 days (91.2 days + 25%).

2.3.4. The transmitter loops are calibrated quarterly and the test equipment temperatures will be bounded by the ambient temperatures extremes listed in Table 2 above. For the test equipment uncertainty evaluations performed under VYC-1758 [Ref. 6.9, Attachment K], the RB RHR Cmr Rm 232' environment conservatively bounds the environment to be expected at the CST instrument room, and will therefore be used as representative of the CST instrument room.

2.3.5. The temperature variation within a cabinet is the same as the variation of the room in which it is located. The temperature difference between the room and the cabinet is therefore constant. Calibration data are assumed collected with the equipment at the operating temperature of the cabinet.

2.3.6. Review of the Vermont Yankee Environmental Qualification Program Manual [Ref. 6.7] indicates that none of the loop components covered by this calculation is environmentally qualified and are therefore only expected to operate under mild conditions, and negligible radiation exposure. Other than the pressure transmitters located at the tank enclosure, all loop components are located in the control room.

2.3.7. Calibration Tolerance is an output of this calculation, and will be based on the accuracy of the devices. The existing calibration tolerances shown in Tables 5 through 10 are for information only.

considerations:

a) The analyzed drift data shows the 50% point to be the largest value at 1.2237% with the 0% value at 1.0625%, and the 100% point at 1.0604%. The 50% analyzed drift value is largest, and will be used as a conservative drift value.

b) From review of this drift analysis and the histograms, the data exhibits a near-normal distribution for all points. As indicated in the time dependency discussion for the OP-4363 CST Level Computer Point Loop (Attachment L), some time dependency is exhibited at the 100% point. However, the Significance F at all points is much greater than 0.05, indicating no correlation between drift magnitude and time interval. Since there is no indication of a drift to time relationship, the 114-day Analyzed Drift Term will be derived directly from the 82-day ADR term.

c) The average drift value for this group is –0.2293% at the 100% point, -0.2163% at the 50% point, and –0.1580% at the 0% point. Since these values are all more than 0.08% ($N \leq 40$ and $STDEV \geq 0.25\%$), this term must be considered as a significant bias term [REF. 6.11].

$ADR_{bias} = -0.2293\%$

d) The ERFIS loop ADR value for the operating cycle is calculated directly as follows:

$ADR_{114\text{-}Days} = ADR_{82\text{-}Days} = \pm 1.2237\%$

2.3.18. Given that Analyzed Drift (ADR) data is available for each of the loops and components evaluated under this calculation, and given that these loops and components will be evaluated for mild environmental conditions for the Control Room and CST (i.e. normal conditions), then it is assumed that the Analyzed Drift (ADR) term for each includes the Temperature Effect (TE), Readability (RD), M&TE Uncertainty (MTE), Barometric Pressure Effect (PB), Power Supply Voltage Effect (VE), Humidity Effect (HE), and Radiation Effect (RE) for each of the associated loop components [Ref. 6.1 section 3.6.5] under both normal and accident conditions.

INSERT "A"

3. INPUT DATA

Data used to calculate loop uncertainties, process corrections, setpoints, and decision points are tabulated below with the applicable reference or basis noted.

3.1. Process and Loop Data

Process data used to evaluate process corrections, decision points, and setpoint limitations are tabulated ~~below with the applicable references.~~

2.3.19. GE INSTRUCTION (ATTACHMENT E) SPECIFIES TE AS:
±1%/100°F @ 100% TO 50% SPAN
±1% TO 2%/100°F FROM 49% TO 20% SPAN.
IT IS ASSUMED THAT BELOW 20% SPAN
TE = ±2%/100°F

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Insert "A"

ER 2000-1575 was issued to document a concern that the CST valve room enclosure general area temperature assumption of 55-85°F (delta - 30 °F) could not be validated. The ER provides the basis for increasing the general area temperature range to 45-100°F (delta - 55 °F).

Per the guidance in the Vermont Yankee Setpoint Program Manual, Appendix D, Sections 3.6.6 and 3.6.8, a delta of 30 °F is assumed to be included in the drift term. The remaining delta of 25°F will be calculated per the vendor's specifications and addressed separately as Temperature Effect (TE).

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Table 3
Process/Loop Inputs

Basis	Description	Data
Ref. 6.2 Section 14.5.2.3 & Assumpt. 2.3.2 Ref. 6.2 section 2.3.5 & Ref. 6.29.1	CST Water Temperature Minimum CST Water Temperature Maximum	40 °F 100 °F
Ref. 6.10 (Attachment C)	Process Limit (ITS/CTS) -- Critical height submergence (Vortexing) 10,000 gallon reserve	≥ 28.2" above CST[1] bottom 20.0 " above CST bottom 8.2" above critical height
TS 3.2.A & Table 3.2.1 Ref. 6.10 (Attachment C)	Technical Specification Limit (CTS)	Low CST Water Level Trip (HPCI auto suction transfer) ≥ 3% CST Volume
VYC-723 Rev. 2 Attach. IX (Attachment B)	Lowest point credited for HPCI Suction	11.25" above CST bottom
Ref. 6.30.2 VYC-723 Rev. 2 (Attach. B) Ref. 6.30.2	Reference Elevation; floor at rack 25-66 Transmitter Center Line Transmitter Sensing Tap Elevation	El. 252' 6" El. 253' 8" El. 254'
Ref. 6.3 Table 4.2.1	Calibration Test Interval	Every 3 months (114 days)

3.2. **Environmental Conditions**

The following information provides the environmental conditions expected for the components located at the Condensate Storage Tank and in the Main Control Room.

Table 4
Environmental Input Data

Basis	Description	Data
Ref. 6.2 Table 2.3.2	CST Area Ambient Temperature Extremes	-33 to 100°F
Assumption 2.3.1	CST Rack 25-66 Normal Ambient Temperature	~~55~~ 45 to ~~85~~ 100°F
Assumption 2.3.6	CST Rack 25-66 Accident Ambient Temp.	~~55~~ 45 to ~~85~~ 100°F
Assumption 2.2.1	Control Room Normal Temperature	60 to 80°F
Assumption 2.2.1	Control Room Accident Temperature	60 to 80°F

[1] This limit includes consideration for the 10,000 gallon inventory requirements and the TS Limit of ≥ 3%. Critical height of submergence prevents introduction of air into HPCI suction prior to completion of transfer to suppression pool; includes consideration for CST Vortexing based on HPCI flow [See Attachment C].

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3.3. Transmitter LT-107-5A and LT-107-5B Data

Table 5
Transmitter Input Data

Basis	Description	Data
Ref. 6.21 & Attachment E	Minimum span Maximum span (URL) Zero Suppr./Elevation Pressure Rating Over-Pressure Protect. Output signal Power Supply Test Jacks Damping	0 to 170 inches water 0 to 850 inches water 0% to 80% of range (URL) 2000 psig Either direction to full pressure rating 10 to 50 mAdc into 0 to 500Ω load 52.5 (± 5%) volts DC Built in (10 to 50 mV full scale, 1mV per mA) Adjustable – 4 positions
Ref. 6.21 & Attachment E	Ambient temperature Maximum fluid temp. Vibration Shock Humidity	-20°F to +185°F 250°F Up to 1G in any direction for 25 to 120 Hz Up to 0.03 inches peak-to-peak amplitude for 0-25 Hz Will not be damaged by shocks up to 100G, any direction Not affected by MIL-F-5272 test (24-hour cycle, 68°F to 158°F at 100% relative humidity)
Ref. 6.~~23~~ 21 & Attachment E ASSUMP. 2.3.19 Assump. 2.3.10 Assump. 2.3.10	Accuracy Temperature effect Static Pressure effect Rated drift Power Supply Effect Deadband	± 0.4% span (incl. Linearity, hysteresis, and repeatability) ± 1% span/100°F ΔT at 100% to 50% span ± 1% to ± 2% span/100°F at 49% to 20% span ± 0.4% span/500 psi at 100% to 50% span ± 0.4% to ± 1% span/100°F ~~at 49% to 20% span~~ ±2% SPAN/100°F 0-19% SPAN None given 0.1% span for 20 volt variation Negligible
Ref. 6.12 Ref. 6.12	Existing Input Span Existing Output span Existing Cal Tolerance	4.0 to 394.0 inches water 10.00 to 50.00 madc ± 0.2 mV
Assump. 2.3.6	Radiation effect	N/A
Assump. 2.3.10	Seismic Effect	± 0.5% span
Assump. 2.3.10	Analyzed Drift (DA)	0.649%

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3.9. Calibration M&TE Input Data

Table 11
Calibration M&TE Input Data

Basis	Description	Range	Resolution	Accuracy (% Rdg or Span)	Accuracy (Calibr. Units)
Attachment K	HP 34401A DMM	100 mVdc	0.0001 mVdc	0.0216% rdg @ 50 mVdc	0.010817 mVdc
Attachment K	HP 3466 DMM	200 mVdc	0.01 mVdc	0.1095% rdg @ 50 mVdc	0.0547 mVdc
Attachment K	Heise 901B	0 – 400" H_2O	0.01 "H_2O	0.1449% span	0.5797" H_2O
Attach. K & M	Heise 901B	0 – 1000" H_2O	0.1 "H_2O	0.1452% span	1.4524" H_2O
Attach. K & M	Heise CMM	0 – 800" H_2O	1.0 "H_2O	0.1616% span	1.2925" H_2O
Attach. K & M	Heise CMM	0 – 830" H_2O	1.0 "H_2O	0.1613% span	1.3391" H_2O
Attach. K & M	Heise 730A-03	-100 – 860" H_2O	0.1 "H_2O	0.1691% span	1.6236" H_2O

4. CALCULATION DETAIL

The detailed calculation of loop uncertainties, setpoints, testing tolerances, and margins have been perfomed using MathCad and are documented as Attachment D.

5. RESULTS AND CONCLUSIONS

5.1. Total Loop Uncertainty

Total Loop Uncertainties (TLU) have been evaluated for the HPCI CST Level indication, trip, recorder, and ERFIS Loops and the results are presented in Table 12 below.

Table 12
Total Loop Uncertainty

Loop	TLU Normal	TLU Normal	TLU Accident	TLU Accident
	± % CS	± Cal Units	± % CS	± Cal Units
LT-107-5A/B / LSL-107-5A/B Trip	~~1.075~~ 1.191 ✓	~~0.430~~ 0.476 mVdc ✓	~~1.190~~ 1.295 ✓	~~0.476~~ 0.518 mVdc ✓
LT-107-5A / LI-107-5 Indicator	~~3.371~~ 3.419 ✓	~~3.371~~ 3.419 % ✓	~~3.414~~ 3.457 ✓	~~3.414~~ 3.457 % ✓
LT-107-5B / LR-23-73 Recorder	~~1.984~~ 2.067 ✓	~~1.984~~ 2.067 % ✓	~~2.237~~ 2.308 ✓	~~2.237~~ 2.308 % ✓
LT-107-5A / ERFIS F004	~~2.163~~ 2.247 ✓	~~10.318~~ 10.723 Kgal ✓	~~N/A~~	N/A

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5.2. Setpoint Evaluation

5.2.1. Current Low Level Suction Transfer setpoint

As evaluated in Attachment D, section 5.2, the existing Low Level suction transfer setpoint of 12.1 mVdc cannot be supported based on the new requirements for critical height of submergence of the HPCI suction. The revised Process Limit of ≥ 28.2" from CST bottom [Ref. 6.10 and Attachment C] includes consideration for the TS requirement that the setpoint be ≥ 3% and that there be 10,000 gallons reserve at the suction transfer point. See Table 13 below.

5.2.2. Revised Low Level Suction Transfer setpoint

A revised setpoint is evaluated in Attachment D, section 5.3; the proposed setpoint of 12.2 mVdc decreasing supports the requirements for critical height of submergence of the HPCI suction + 10,000 gallon reserve and has adequate margin from LSP to SP. See Table 13 below.

Table 13
Setpoint Results

Loop	Existing Setpoint (12.1 mV) ✓		Revised Setpoint (12.2 mV) ✓	
	Inches[10]	Inches[11]	Inches[10]	Inches[11]
Process Limit (PL)	≥28.2 ✓	≥20.2 ✓	≥28.2 ✓	≥20.2 ✓
Accident Uncertainty (U_{a12})	~~4.643~~ 5.052 ✓	~~4.643~~ 5.052 ✓	~~4.643~~ 5.052 ✓	~~4.643~~ 5.052 ✓
Limiting Setpoint (LSP)	~~32.843~~ 33.252 ✓	~~24.843~~ 25.252 ✓	~~32.843~~ 33.252 ✓	~~24.843~~ 25.252 ✓
Setpoint (SP)	32.475 ✓	24.475 ✓	33.45 ✓	25.45 ✓
Margin (M_1)	~~-0.368~~ -0.777 ✓	~~-0.368~~ -0.777 ✓	~~0.607~~ +0.198 ✓	~~0.607~~ +0.198 ✓

5.3. Calibration and Test Results

In order to support and implement the results of this calculation, the loop instruments are to be calibrated at nine points based on the following ranges :

[10] Referenced to tank bottom.
[11] As sensed by transmitter; level above transmitter tap (0") plus 4" static head.

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Table 14
Module Calibration Ranges

Description	Value	Units
Transmitter input range	4 to 394	Inches H_2O
Transmitter output range	10.0 to 50.0	mVdc[12]
Indicator input range	10.0 to 50.0	mAdc
Indicator output range	0 to 100	%
Alarm Unit input range	1.0 to 5.0	Vdc
Alarm Unit Lo Setpoint (CST LEVEL LO)	12.2 decr ✓	mVdc
Alarm Unit Lo-Lo Setpoint (INST PWR TRBL)	10.2 decr ✓	mVdc
Recorder input range	1 to 5	Vdc
Recorder output indication range	0 to 100	%
Computer input range	16 to 80	mVdc[13]
Computer output indication range	0 to 477.1	Kgal

Test as-found tolerances (FT) and as-left tolerances (CT) are shown below.

Table 15
Module Calibration Tolerances

Device	Tag No.	As Found (FT)[14]		As Left (CT)	
		0.960	0.38		
		± % CS	± Cal Units	± % CS	± Cal Units
Transmitter	LT-107-5A & B	~~0.80~~ ✓	~~0.32 mVdc~~ ✓	0.50 ✓	0.20 mVdc ✓
Alarm Unit	LSL-107-5A & B[15]	0.60 ✓	0.24 mVdc ✓	0.50 ✓	0.20 mVdc ✓
Indicator	LI-107-5	N/A	N/A	2.0 ✓	2.0 % ✓
Recorder	LR-23-73	N/A	N/A	1.0 ✓	1.0 % ✓
Computer Point	F004	N/A	N/A	0.545 ✓	2.6 Kgal ✓

12 10-50 mAdc through a 1Ω transmitter test resistor.
13 10-50 mAdc through a precision 160Ω resistor.
14 Module As-Found values provided for alarm unit and transmitter because all other components are Calibration Checked as loops per Ref. 6.12; LSL-107-5A & B tested as modules only per Ref. 6.12 (Attach. M).
15 As-found and As-left tolerances apply to both setpoints of each alarm unit.

6.30.2. Drawing G-191261 Sheet 65B, "Tank Level Instrument Hookups," Rev. 6.

6.30.3. Drawing B-191260, Sheets 107.1, 111.6, 111.19, and 112.26, Vermont Yankee Instrument List, (Superseded by MPAC).

6.31. International Instruments Test Report #SBI-3, "Seismic Qualification Test Report for Indicating Control Instrument Model 9270 and Meter Models 1122, 1136, 1151," Rev. 1, February 10, 1976, (Excerpts – Attachment G).

6.32. "ASME Steam Tables," Thermodynamic and Transport Properties of Steam, Sixth Edition, 1993.

6.33. VYI 92/97, "Application of CT, CE and A for Single Point Devices, Rev. 1," Memo from G. J. Hengerle/R.T. Vibert to Distribution, dated 6/26/98.

6.34. ER 2000-1575, SSDI INSPECTION IDENTIFIED LACK OF ADMINISTRATIVE CONTROLS TO MONITOR CST TANK VALVE ENCLOSURE GENERAL AREA TEMPERATURE AND ASSOCIATED IMPACT ON INPUT ASSUMPTIONS TO HPCI CST/RCIC/CST LOOP MONITORING CALCULATIONS VYC-723, REV3 AND VYC-706, REV. 1.

$MTE_1 := 0.0 \cdot inWC$

$MTE_1 = 0.000 \cdot inWC$ ✓

Transmitters MTE uncertainty is included in the Loop or Module Drift term (Assumption 2.3.18).

3.2.1.5 Drift (DA)

$DA_1 := 0.649 \cdot \% \cdot CS$

$DA_1 = 2.531 \cdot inWC$ ✓

Transmitter analyzed drift (Assumption 2.3.10 and Attachment P).

3.2.1.6 Temperature Effect (TE)

$TE_{n1} = TE_{a1} = \cancel{0.0 \cdot inWC}$ 100 − 45 = 65°F, 65°F − 30°F = 25°F Δ

25°F × 2%/100°F = 0.50% of 390"wc = 1.95 inWC

$TE_1 := \cancel{0.0 \cdot inWC}$

$TE_1 = \cancel{0.000 \cdot inWC}$ ✓

Temperature effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18). Normal ΔT of 30°F is included in Loop or module ADR since quart~~erly calibrations experience all conditions.~~

Additional 25°F temperature effect required

3.2.1.7 Barometric Pressure Effect (PB)

Barometric pressure effect is either the effect on the vented side of gage pressure transmitters, or the error associated with calibration of an absolute pressure transmitter using gauge pressure test instruments.

The GE 555 is a differential pressure transmitter monitoring a tank vented to atmosphere, therefore this effect is negligible per Ref. 6.1 section 3.6.8.

$PB_1 := 0 \cdot inWC$

3.2.1.8 Humidity Effect (HE)

$HE_1 := 0 \cdot inWC$

Humidity effect during normal and accident conditions are the same and included in the Loop or Module Drift term (Assumption 2.3.18)

3.2.1.9 Radiation Effect (RE)

$RE_{a1} = RE_{n1} = 0.0$ inWC

$RE_1 := 0.0 \cdot inWC$

3.2.1.10 Seismic Effect (SE)

$SE_1 := 0.5 \cdot \% \cdot CS$

3.2.1.11 Process Pressure Effects (SP)

$SP_1 := 0.0 \cdot inWC$

3.2.1.12 Power Supply Voltage Effect (VE)

$VE_1 := 0.0$ inWC

3.2.2 Transmitter Total Module Uncertainty

3.2.2.1 Normal Conditions

$CE_1 = 1.950 \cdot inWC$ $\qquad DB_1 = 0.00$

$$e_{n1R} := \sqrt{CE_1^{\,2} + DB_1^{\,2} + TE_1^{\,2}}$$

VY CALCULATION CHANGE NOTICE (CCN)

CCN Number: 04 Calculation Number VYC-0723 Rev. No. 3

Calculation Title: CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING

Initiating Document: ER 2000-1578_01
VYDC/MM/TM/Spec. No./ other

Safety Evaluation Number: N/A

Superseded Calculation: N/A Superceded by: N/A

Implementation Required: ☐ Yes ☒ No

Computer Codes: N/A

Reason for Change: Commitment ER 2000-1578_01 instructs to add FSAR Sections 4.7 and 11.8 as references and to add a discussion pertaining to the required CST volume.
Description of Change: Added FSAR Sections 4.7 and 11.8 as references and added a discussion pertaining to the required CST volume (Appendix Q).
Technical Justification for Change: References and discussion are required as a compensatory measure documented under ER 2000-1578.
Conclusions: References and discussion added per commitment ER 2000-1578_01.

Are there any open items in this CCN? ☐ Yes ☒ No

Prepared By/Date	Interdiscipline Review By/Date	Independent Review By/Date	Approved By/Date
Joseph Garozzo 7/23/01 JOSEPH GAROZZO	N/A	James W. Allen 7/23/01 James W. Allen	Richard G. Sanborn 7/23/2001 Richard G. Sanborn

Final Turnover to DCC (Section 2):

1) All open items, if any, have been closed.

2) Implementation Confirmation (Section 2.3.4)

☒ Calculation accurately reflects existing plant configuration,
(confirmation method indicated below)
☐ Walkdown ☐ As-Build input review ☒ Discussion with Joseph Garozzo
OR (print name)
☐ N/A, calculation does not reflect existing plant configuration

3) Resolution of documents identified in the Design Output Documents Section of VYAPF 0017.07 has been initiated as required (Section 2.3.6, 2.3.7)

_______________ / _______________ / _______________
Print Name Signature Date

Total number of pages in package including all attachments 11

VY CALCULATION DATABASE INPUT FORM

Place this form in the calculation package immediately following the Title page or CCN form.

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VYC-0723, CCN-04 — VY Calculation/CCN Number
3 — Revision Number
Vendor Calculation Number
Revision Number

Vendor Name: PO Number:

Originating Department:

Critical References Impacted: ☐ UFSAR ☐ DBD ☐ Reload. "Check" the appropriate box if any critical document is identified in the tables below.

EMPAC Asset/Equipment ID Number(s):

EMPAC Asset/System ID Number(s):

Keywords:

For Revision/CCN only: Are deletions to General References, Design Input Documents or Design Output Documents required? ☐ Yes† ☒ No

Design Input Documents and General References - The following documents provide design input or supporting information to this calculation. (Refer to Appendix A, sections 3.2.7 and section 4)

* Reference #	** DOC #	REV #	***Document Title (including Date, if applicable)	Significant Difference Review ††	**** Affected Program	Critical Reference (✓)
6.34	ER 2000-1509		NRC Concern CST 75,000 Gallons.			
6.35	ER 2000-1578		Inadequate 50.59(a)(1) Screening Associated with SCR 98C-068 (LSL-107-5A&B)			

VY CALCULATION DATABASE INPUT FORM (Continued)

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Design Output Documents - This calculation provides output to the following documents. (Refer to Appendix A, section 5)

* Reference #	** DOC #	REV #	Document Title (including Date, if applicable)	**** Affected Program	†††Critical Reference (✓)

* Reference # -	Assigned by preparer to identify the reference in the body of the calculation.
** Doc # -	Identifying number on the document, if any (e.g., 5920-0264, G191172, VYC-1286)
*** Document Title -	List the specific documentation in this column. "See attached list" is not acceptable. Design Input/Output Documents should identify the specific design input document used in the calculation or the specific document affected by the calculation and not simply reference the document (e.g., VYDC, MM) that the calculation was written to support. If a DBD is used as a general reference, include the most current interim change number after the title.
**** Affected Program -	List the affected program or the program that reference is related to or part of.
†	If "yes," attach a copy of "VY Calculation Data" marked-up to reflect deletion (See Section 3.1.8 for Revision and 5.2.3.18 for CCNs).
††	If the listed input is a calculation listed in the calculation database that is not a calculation of record (see definition), place a check mark in this space to indicate completion of the required significant difference review. (see Appendix A, section 4.1.4.4.3). Otherwise, enter "N/A."
†††	If the reference is UFSAR, DBD or Reload (IASD or OPL), check Critical Reference column and check UFSAR, DBD or Reload, as appropriate, on this form (above).

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List of Attachments

1.2. System & Components

This calculation applies to the Condensate Storage Tank Level Monitoring Loops which provide automatic HPCI suction transfer as well as Post Accident Monitoring level indication. The specific components addressed are as listed in Table 1 below.

Table 1
Component Identification

Tag Number	Manufacturer	Model	Rack/Cabinet	Description (MPAC)	SYS	Flow Diagram	CWD (B-191301)
LT-107-5A	GE	50-555111ADAA3AEB	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LT-107-5B	GE	50-555111ADAA3PBI	CST Local Rack 25-66	COND STORAGE TANK LEVEL TRANSMITTER	107	G-191176 Sheet 1	Sheet 1229A
LSL-107-5A LSL-107-5B	GE	50-560321AAAC1	CRP 9-20	HPCI CST LEVEL SWITCH	107	G-191176 Sheet 1	Sheet 1229A
LI-107-5	GE	180	CRP 9-6	CONDENSATE STORAGE TANK LEVEL INDICATOR	107	G-191176 Sheet 1	Sheet 1229A
ES-16-19-43	GE	50-570062FAAC1	CRP 9-20	ATMOS CONT SYS AND PRIM LEAK DET POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229
ES-1-156-5	GE	50-570062FAAC1	CRP 9-20	ATMOSPHERIC CONTROL SYSTEM POWER SUPPLY	PCAC	G-191175 Sheet 1	Sheet 1229B
LR-23-73	Foxboro	N-E274-S2RA8	CRP 9-3	CST LEVEL RECORDER (GREEN PEN)	HPCI	G-191169 Sheet 1	Sheet 1229A

1.3. Instrument Loop Functions

The high pressure coolant injection (HPCI) system provides emergency core cooling in the event of a small line break in the nuclear system that does not result in rapid depressurization of the reactor vessel simultaneous with a loss of normal auxiliary power. The HPCI System permits the reactor to be shutdown while maintaining sufficient reactor vessel water inventory until the reactor pressure drops sufficiently to enable low pressure injection systems to be placed in operation. The HPCI turbine-driven pump is designed to supply make-up water into the vessel at the rate of 4250 gpm over a reactor pressure range of 1135 to 165 psia.

The Condensate Storage Tank is the initial source of water volume for the HPCI pump. When level has decreased to a low level setpoint, HPCI suction is transferred to the suppression chamber. These ~~channels provide the indication and trip actuations associated with these functions.~~ SEE ATTACHMENT Q FOR A DISCUSSION PERTAINING TO REQUIRED CST VOLUME

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6. REFERENCES

6.1. "Instrument Uncertainty and Setpoints Design Guide," Vermont Yankee, Rev. 0.

6.2. "Vermont Yankee Final Safety Analysis Report", Sections 4.1 2.3, 6.3, 6.4, 6.6, 7.4.3.2, 11.8, 14.5.2, and Tables 2.3.2, 6.3.1 and 7.4.1.

6.3. "Vermont Yankee Technical Specifications", 3/4.2.A, 3.5.E.1.b, and Tables 3.2.1/4.2.1 (through amendment 150)

6.4. WE-103, Yankee Procedure, "Engineering Calculations and Analyses," Rev. 18.

6.5. VYDEP-15, Vermont Yankee Project Procedure, "Calculations," Rev. 2.

6.6. Vermont Yankee Regulatory Guide 1.97 Program Manual, Rev.0 (Attachment M).

6.7. "Vermont Yankee Environmental Qualification Program Manual," Rev. 36.

6.8. VYC-1608, "Drift Calculation For Condensate Storage Tank Level Loop Calibrations," Original (Excerpts – Attachment L).

6.9. VYC-1758, "Measuring & Test Equipment Uncertainty Calculation," Rev. 0 (Excerpts – Attachment K).

6.10. VYC-1844, "CST Vortexing Effects on level measurement," Rev. 0 (Excerpts – Attachment C).

6.11. VYI 31/97, "ISP Application of Analyzed Drift Values in Setpoint Determination, Rev. 1," Memo from G. J. Hengerle to File, dated 5/15/97.

6.12. OP-4363, "HPCI Suction Transfer on Condensate Storage Tank (CST) Low Level Functional Test and CST Level Instrumentation Calibration," Rev. 24, 2/21/97 (Excerpts – Attachment M).

6.13. AP-0150, "Conduct Of Operations And Operator Rounds", Rev. 31, 7/5/96, through DI 97-45 (Excerpts – Attachment M).

6.14. VYEM-0018, "Foxboro E-27R Series Recorder," Rev. 1, 8/10/95.

6.15. VYEM-0145, "Type 180 Meters," Rev. 2, 5/1/96.

6.16. VYEM-0176, "Gemac Instrumentation," Rev. 1, 7/8/92.

6.17. GEK 32448, Process Instrumentation Subsystem of the High Pressure Coolant Injection System, Operation & Maintenance Instructions, dated 11/70.

6.18. GE System Design Specification 22A1217, "Condensate Storage and Transfer System MPL 1-142," Rev. 1, 6/30/69.

6.19. GE System Design Specification 257HA354AE, "High Pressure Coolant Injection System – Data Sheet," Rev. 3, 6/15/70.

6.20. Foxboro Product Specification PSS 9-7C1A (Attachment H).

6.21. Product Data Sheet, GE 198 4532K16-300B, Type 555 Differential-Pressure Transmitter (Attachment E).

6.30.2. Drawing G-191261 Sheet 65B, "Tank Level Instrument Hookups," Rev. 6.

6.30.3. Drawing B-191260, Sheets 107.1, 111.6, 111.19, and 112.26, Vermont Yankee Instrument List, (Superseded by MPAC).

6.31. International Instruments Test Report #SBI-3, "Seismic Qualification Test Report for Indicating Control Instrument Model 9270 and Meter Models 1122, 1136, 1151," Rev. 1, February 10, 1976, (Excerpts – Attachment G).

6.32. "ASME Steam Tables," Thermodynamic and Transport Properties of Steam, Sixth Edition, 1993.

6.33. VYI 92/97, "Application of CT, CE and A for Single Point Devices, Rev. 1," Memo from G. J. Hengerle/R.T. Vibert to Distribution, dated 6/26/98.

6.34. ER 2000-1509; NRC CONCERN CST 75,000 GALLONS.

6.35. ER 2000-1570, INADEQUATE 50.59(a)(1) SCREENING ASSOCIATED WITH SCR 98C-068 (LSL-107-5A & 5B).

Discussion Pertaining to Required Condensate Storage Tank (CST) Volume

ER-2000-1578 was issued to document a concern that the 10CFR 50.59 (a) (1) screening associated with Setpoint SCR 98C-068 (for LSL-107-5A&5B). It may not have been adequate since it did not address the impact of the setpoint change on the basis for required volume (addressed in FSAR Sections 4.7 and 11.8).

SCR 98C-068 was issued as a follow-up activity associated with calculation VYC-723, Rev. 3. The above revision incorporates the results of VYC-1844, Rev. 0, "HPCI and RCIC Vortex Height". The purpose of VYC-1844 is to determine the critical height of submergence due to vortexing (thus providing the basis for the CST level trip settings) and to document that operation of the tank needs to be restricted to water levels greater than the critical height of submergence.

ER 2000-1509 was issued to document an NRC inspection concern associated with the basis for the TS requirement for the CST to contain 75,000 gallons of condensate. The basis for this question involved whether the HPCI/RCIC switchover setpoint was set at a height consistent with the basis for the CST tank volume as specified in FSAR Section 11.8 (*A volume equal to an eight-hour supply for makeup to the reactor in hot standby via either the Reactor Core Isolation Cooling System or the High Pressure Cooling Injection System, or both, when the reactor is above 300°F)*. ER 2000-1509 has concluded that there are presently no operability concerns.

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ATTACHMENT Q
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of core standby cooling systems. (See Section 14, "Station Safety Analysis.") The pump suction is normally lined up to the condensate storage tank. Except for HPCIS, other systems which use the same reservoir for condensate and which could jeopardize the availability of this quantity have their suctions located so that 75,000 gallons are reserved for RCIC and HPCI; also, a low level alarm from the condensate storage tank is provided in the main Control Room. The alarm is energized and automatic transfer of pump suction to the torus is initiated when the level in the storage volume falls to the minimum required to meet the design requirements of the RCICS.

Three pump suction valves are provided in the RCICS. One valve lines up pump suction from the condensate storage tank, the other two from the suppression chamber. The condensate storage tank is the preferred source. All three valves are operated by dc motors. The control arrangement is shown on Drawing 5920-25. Although the condensate storage tank suction valve is normally open, an RCICS initiation signal opens it if it is closed. If the water level in the condensate storage tank falls below a preselected level, the suppression chamber suction valves automatically open. When the suppression chamber valves are both fully open, the condensate storage tank suction valve automatically closes. Two level transmitters are used to detect the condensate storage tank low water level condition. Either transmitter can cause the suppression chamber suction valves to open.

During the suction swap, when the three suction MOVs are all open for a short period of time, the water seal on the suction line in the torus and the check valve in the line to the CST form the primary containment isolation barrier. The water seal has been determined to remain effective for all conditions in which RCIC will be required to operate.

The turbine pump assembly is located below the level of the condensate storage tank and below the minimum water level in the suppression pool to assure positive suction head to the pump. Pump NPSH requirements are met by providing adequate suction head and adequate suction line size. System performance under various operating conditions is shown on Drawing 5920-605.

All components necessary for initiating operation of the RCICS are completely independent of auxiliary ac power, station service air, and external cooling water systems, requiring only dc power from the station batteries to operate the valves. The power source for the turbine pump unit is the steam generated in the reactor pressure vessel by the decay heat in the core. The steam is piped directly to the turbine and the turbine exhaust is piped to the suppression pool. The RCIC turbine exhaust piping is provided with vacuum

The 500,000 gallon condensate storage tank is a cone-roofed tank and is located outside the southeast corner of the Turbine Building. It was field erected of aluminum plates, is of welded construction, has an inner diameter of 50 feet, an overall height of 36 feet 9 inches, and an estimated weight of 45,190 pounds. It was built in accordance with USAS B96.1 standards and Class I seismic requirements.

It was designed to be of sufficient size to handle the condensate requirements during refueling periods and during regular plant operation.

The refueling requirements consist of the sum of the following:

1. The volume required to fill the reactor vessel from the normal operating level to the vessel flange;

2. The volume required to fill the reactor head cavity;

3. The volume required to fill the equipment storage pool and the connecting slots to the fuel storage pool;

4. A volume equal to one waste sample tank; and

5. 10% of the above.

Although the refueling requirements exceed the operating requirements and govern the sizing of the tank, the operating requirements are listed below. The operating requirement is the sum of:

1. A volume equal to one waste sample tank; plus

2. A volume equal to an eight-hour supply for makeup to the reactor in hot standby via either the Reactor Core Isolation Cooling System or the High Pressure Cooling Injection System, or both, when the reactor is above 300°F; plus

3. 10% of the above.

So that the eight-hour supply indicated above will always be available, all other suction pipes are terminated at a level above that required for the eight-hour supply.

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VY CALCULATION REVIEW FORM

Calculation Number: VYC-0723 Revision Number: 3 CCN Number: 4

Title: CONDENSATE STORAGE TANK LEVEL (HPCI) MONITORING

Reviewer Assigned: James W. Allen Required Date: ____________

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☐ Interdiscipline Review ☒ Independent Review

Comments* **Resolution**

N/C

James W. Allen / 7/23/01
Reviewer Signature Date

____________ / ____________
Calculation Preparer (Comments Resolved) Date

Method of Review: ☒ Calculation/Analysis Review
☐ Alternative Calculation
☐ Qualification Testing

____________ / ____________
Reviewer Signature (Comments Resolved) Date

*Comments shall be specific, not general. Do not list questions or suggestions unless suggesting wording to ensure the correct interpretation of issues. Questions should be asked of the preparer directly.