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United States Nuclear Regulatory Commission
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Washington, DC 20555

Gentlemen:

TECHNICAL SPECIFICATION BASES CHANGE
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NO. NPF-57
DOCKET NO. 50-354

PSEG Nuclear LLC is providing revised Technical Specification (TS) Bases pages for Specification 3/4.3.2. The revised pages were reviewed in accordance with the requirements of 10 CFR 50.59.

TS 3/4.3.2 pertains to the isolation actuation instrumentation. The TS Bases have been revised to include additional background information (system description and identification of applicable Safety Limits and acceptance criteria) and discussions of applicable safety analyses, Limiting Conditions for Operation, Applicability, Actions, and Surveillance Requirements.

Specific guidance is being added for footnote (e) and for Trip Functions 1.c, 2.c and 2.d in TS Table 3.3.2-1.

Attachment 1 contains the revised pages for the Hope Creek Technical Specification Bases. Please incorporate these changes into the Technical Specification Bases.

Should you have any questions regarding this submittal, please contact Paul Duke at 856-339-1466.

Sincerely,

for G. Salamon
Manager – Nuclear Safety & Licensing

Attachment

A001

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FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354
REVISIONS TO THE TECHNICAL SPECIFICATIONS BASES

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3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

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 secondary containment isolation instrumentation automatically initiates closure of appropriate secondary containment isolation valves (SCIVs) and starts the Filtration, Recirculation and Ventilation System (FRVS). The function of these systems, in combination with other accident mitigation systems, is to limit fission product release during and following postulated Design Basis Accidents (DBAs) (Ref. 1). Secondary containment isolation and establishment of vacuum with the FRVS within the assumed time limits ensure 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 primary containment, secondary 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:

- reactor vessel water level,
- area ambient and differential temperatures,
- main steam line (MSL) flow,
- Standby Liquid Control (SLC) System initiation,
- condenser vacuum,
- main steam line pressure,
- high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) steam line flow,
- drywell pressure,
- RCIC and HPCI steam line pressure,
- RCIC and HPCI turbine exhaust diaphragm pressure,
- reactor water cleanup (RWCU) differential flow,
- reactor steam dome pressure,
- main steam line radiation,
- reactor building exhaust radiation, and
- refueling floor exhaust high radiation.

Redundant sensor input signals from each parameter are provided for

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BACKGROUND (continued)

initiation of isolation. In addition, manual isolation of the logics is provided.

The isolation actuation instrumentation has inputs to the trip logic of the isolation functions listed below.

1. Primary Containment Isolation

Most Primary Containment Isolation Functions receive inputs from eight sensors in four channels. These inputs are arranged into four two-out-of-two logic PCIS channels. Each one of the two valves on each penetration is closed by one of the four PCIS logics, arranged so that operation of any three logics isolates all of the associated penetrations.

The exception to this arrangement is the Reactor Building Exhaust Radiation - High Function. For this trip function, three radiation monitoring channels input to four two-out-of-three PCIS initiation logics.

The valve groups actuated by the Primary Containment Isolation Trip Function are listed in Table 3.3.2-1.

2. Secondary Containment Isolation

The outputs of the logic channels in a trip system are arranged into four two-out-of-two trip system logics for Reactor Vessel Water Level - Low Low, Level 2 and for Drywell Pressure - High. The Reactor Building and Refueling Floor Exhaust Radiation - High trip functions each have three radiation monitoring channels that input to four two-out-of-three initiation logics. Each one of the two valves on each penetration and each FRVS unit is actuated by one of the four trip logics, so that operation of any three logics isolates the secondary containment and provides for the necessary filtration of fission products.

The valve groups actuated by the Secondary Containment Isolation Trip Function are listed in Table 3.3.2-1.

3. Main Steam Line Isolation

Most MSL Isolation Functions receive inputs from four channels. The outputs from these channels are combined in a one-out-of-two taken twice logic to initiate isolation of all main steam isolation valves (MSIVs). The outputs from the same channels are arranged into two two-out-of-two logic trip systems to isolate all MSL drain valves. The MSL drain line has two isolation valves with one two-out-of-two logic system associated with each valve.

The exceptions to this arrangement are the Main Steam Line Flow - High Function and Main Steam Line Tunnel Temperature - High Function. The Main Steam Line Flow - High 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 MSL isolation. Each trip string has four inputs (one per MSL), any one of which will trip the trip string. The trip strings are

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BACKGROUND (continued)

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 of the MSIVs. Similarly, the 16 flow channels are connected into two two-out-of-two logic trip systems (effectively, two one-out-of-four twice logic), with each trip system isolating one of the two MSL drain valves.

The Main Steam Tunnel Temperature - High Function receives input from 16 channels. The logic is arranged similar to the Main Steam Line Flow - High Function.

The valve groups actuated by the MSL Isolation Trip Functions are listed in Table 3.3.2-1.

4. Reactor Water Cleanup System Isolation

The Reactor Vessel Water Level - Low Low, Level 2 Isolation Function receives input from four reactor vessel water level channels. The outputs from the reactor vessel water level channels are connected into two two-out-of-two trip systems. The Differential Flow - High and SLC System Initiation Functions receive input from two channels, with each channel in one trip system using a one-out-of-one logic. The Area Temperature - High Function receives input from twelve temperature monitors, six to each trip system. The Area Ventilation Differential Temperature - High Function receives input from twelve differential temperature monitors, six in each trip system. These are configured so that any one input will trip the associated trip system. Each of the two trip systems is connected to one of the two valves on each RWCU penetration.

The valve groups actuated by the RWCU Isolation Trip Functions are listed in Table 3.3.2-1.

5, 6. High Pressure Coolant Injection System Isolation and Reactor Core Isolation Cooling System Isolation

Most Functions that isolate RCIC and HPCI receive input from two channels, with each channel in one trip system using a one-out-of-one logic. Each of the two trip systems in each isolation group is connected to one of the two valves on each associated penetration.

The exceptions are the RCIC and HPCI Turbine Exhaust Diaphragm Pressure - High and Steam Supply Line Pressure - Low Functions. These Functions receive inputs from four turbine exhaust diaphragm pressure and four steam supply pressure channels for each system. The outputs from the turbine exhaust diaphragm pressure and steam supply pressure channels are each connected to two two-out-of-two trip systems. Each trip system isolates one valve per associated penetration.

The valve groups actuated by the RCIC and HPCI System Isolation Trip Functions are listed in Table 3.3.2-1.

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BACKGROUND (continued)

7. Shutdown Cooling System Isolation

The Reactor Vessel Water Level - Low, Level 3 Function receives input from four reactor vessel water level channels. The outputs from the reactor vessel water level channels are connected to two two-out-of-two trip systems. The Reactor Vessel Pressure - High Function receives input from four channels, with each channel in one trip system using a one-out-of-two trip logic. Each of the two trip systems is connected to one of the two valves on each shutdown cooling penetration.

The valve groups actuated by the Shutdown Cooling System Isolation Trip Functions are listed in Table 3.3.2-1.

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The isolation signals generated by the isolation instrumentation are implicitly assumed in the safety analyses of References 1 and 2 to initiate closure of valves to limit offsite doses. Refer to Bases Sections 3/4.6.3, "Primary Containment Isolation Valves," and 3/4.6.5, "Secondary Containment," for more detail of the safety analyses.

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

The OPERABILITY of the isolation actuation instrumentation is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.2-1. Each Function must have a required number of OPERABLE channels, with their setpoints within the specified Allowable Values, where appropriate. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. The actual setpoint is calibrated consistent with applicable setpoint methodology assumptions.

Table 3.3.2-1 is modified by Note (a) to indicate that a channel may be placed in an inoperable status for up to 6 hours for required surveillance without placing the trip system in the tripped condition provided at least one OPERABLE channel in the same trip system is monitoring that parameter. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to OPERABLE status or the applicable Action must be taken. This Note 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 isolation valves will isolate the penetration flow path(s) when necessary.

Allowable Values are specified for each isolation actuation Function specified in the Table. Operation with a trip setpoint less conservative than its Trip Setpoint, but within its Allowable Value, is acceptable on the basis that the difference between each Trip Setpoint and the Allowable Value is an allowance for instrument drift specifically allocated for each trip in the safety analyses.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

In general, the individual Functions are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 consistent with the Applicability for TS 3.6.1.1, "Primary Containment Integrity." Functions that have different Applicabilities are discussed below in the individual Functions discussion.

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

Primary Containment Isolation

1.a. 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 Level 2 (Trip Function 1.a.1) and Level 1 (Trip Function 1.a.2) supports actions to ensure that offsite dose limits of 10 CFR 100 are not exceeded. The Reactor Vessel Water Level - Low Low, Level 2 and Low Low Low, Level 1 Trip Functions associated with isolation are implicitly assumed in the UFSAR analysis as these leakage paths are assumed to be isolated post LOCA.

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. Two channels of Reactor Vessel Water Level - Low Low, Level 2 and Low Low Low, Level 1 Trip Functions are available and are required to be OPERABLE for each PCIS channel to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by these Functions are listed in Table 3.3.2-1.

1.b. Drywell Pressure - High

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 100 are not exceeded. The Drywell Pressure - High 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. Two channels of Drywell Pressure - High Function are available and are required to be OPERABLE for each PCIS channel to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

1c. Reactor Building Exhaust Radiation - High

High Reactor Building exhaust radiation is an indication of possible gross failure of the fuel cladding. The release may have originated from the primary containment due to a break in the RCPB. When Exhaust Radiation - High is detected, valves whose penetrations communicate with the primary containment atmosphere are isolated to limit the release of fission products.

The Exhaust Radiation - High signals are initiated from radiation detectors that are located on the ventilation exhaust piping coming from the reactor building. The system consists of three channels. Four high radiation alarms, one from each channel through Class 1E to Class 1E isolation, are supplied to each channel of the Primary Containment Isolation System (PCIS), where two out of three logic is used to initiate closure of primary containment isolation valves and dampers. Three channels of Reactor Building Exhaust - High Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

1.d. Manual Initiation

The Manual Initiation push button channels introduce signals into the isolation actuation logic that are redundant to the automatic protective instrumentation and provide manual isolation capability. There is no specific UFSAR safety analysis that takes credit for this Function. It is retained for overall redundancy and diversity of the isolation function as required by the NRC in the plant licensing basis.

There are four push buttons for the logic, one manual initiation push button per PCIS channel.

Four channels of the Manual Initiation Function are available and are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3, since these are the OPERATIONAL CONDITIONS in which the Isolation Actuation automatic Trip Functions are required to be OPERABLE.

Secondary Containment Isolation

2.a Reactor Vessel Water Level - Low Low, Level 2

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 FRVS are initiated in order to minimize the potential of an offsite dose release. The Reactor Vessel Water Level - Low Low, Level 2 Function is one of the Functions assumed to be OPERABLE and capable of providing isolation and initiation signals. The isolation and initiation systems on Reactor Vessel Water Level - Low Low, Level 2 support actions to ensure that any offsite releases are within the limits calculated in the safety analysis.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Reactor Vessel Water Level - Low Low, Level 2 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. Two channels of Reactor Vessel Water Level - Low Low, Level 2 Function are available and are required to be OPERABLE for each PCIS channel to ensure that no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low Low, Level 2 Function is required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 where considerable energy exists in the Reactor Coolant System (RCS); thus, there is a probability of pipe breaks resulting in significant releases of radioactive steam and gas. In OPERATIONAL CONDITIONS 4 and 5, the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these OPERATIONAL CONDITIONS; thus, this Function is not required. In addition, the Function is also required to be OPERABLE during operations with a potential for draining the reactor vessel (OPDRVs), when handling irradiated fuel in the secondary containment and during CORE ALTERATIONS, because the capability of isolating potential sources of leakage must be provided to ensure that offsite dose limits are not exceeded if core damage occurs.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

2.b Drywell Pressure - High

High drywell pressure can indicate a break in the reactor coolant pressure boundary (RCPB). An isolation of the secondary containment and actuation of the FRVS are initiated in order to minimize the potential of an offsite dose release. The isolation 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. Two channels of Drywell Pressure - High Functions are available and are required to be OPERABLE for each PCIS channel to ensure that no single instrument failure can preclude performance of the isolation function.

The Drywell Pressure - High Function is required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 where considerable energy exists in the RCS; thus, there is a probability of pipe breaks resulting in significant releases of radioactive steam and gas. This Function is not required in OPERATIONAL CONDITIONS 4 and 5 because the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these OPERATIONAL CONDITIONS.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

2.c, 2.d. Refueling Floor and Reactor Building Exhaust Radiation - High

High Refueling Floor or Reactor Building exhaust radiation is an indication of possible gross failure of the fuel cladding. The release may have originated from the primary containment due to a break in the RCPB or

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

the refueling floor due to a fuel handling accident. When Exhaust Radiation - High is detected, secondary containment isolation and actuation of the FRVS are initiated to limit the release of fission products as assumed in the UFSAR safety analyses (Ref. 4).

The Exhaust Radiation - High signals are initiated from radiation detectors that are located on the ventilation exhaust ducts coming from the reactor building and the refueling floor zones, respectively. Three channels of Reactor Building Exhaust Radiation - High Function and three channels of Refueling Floor Exhaust Radiation - High Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The Refueling Floor and Reactor Building Exhaust Radiation - High Functions are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 where considerable energy exists; thus, there is a probability of pipe breaks resulting in significant releases of radioactive steam and gas. In OPERATIONAL CONDITIONS 4 and 5, the probability and consequences of these events are low due to the RCS pressure and temperature limitations of these OPERATIONAL CONDITIONS; thus, these Functions are not required. In addition, the Functions are also required to be OPERABLE during OPDRVs, when handling irradiated fuel in the secondary containment and during CORE ALTERATIONS, 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.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

2.e. Manual Initiation

The Manual Initiation for secondary containment isolation can be performed by manually initiating a primary containment isolation. There is no specific UFSAR safety analysis that takes credit for this Function. It is retained for the overall redundancy and diversity of the secondary containment isolation instrumentation as required by the NRC approved licensing basis.

There are four push buttons for the logic, one manual initiation push button per PCIS channel. There is no Allowable Value for this Function, since the channels are mechanically actuated based solely on the position of the push buttons.

Four channels of Manual Initiation Function are available and are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3, and during OPDRVs, when handling irradiated fuel in the secondary containment and during CORE ALTERATIONS. These are the OPERATIONAL CONDITIONS and other specified conditions in which the Secondary Containment Isolation automatic Functions are required to be OPERABLE.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Main Steam Line Isolation

3.a. Reactor Vessel Water Level - Low Low Low, Level 1

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. Therefore, isolation of the MSIVs and other interfaces with the reactor vessel occurs to prevent offsite dose limits from being exceeded. The Reactor Vessel Water Level - Low Low Low, Level 1 Function is one of the many Functions assumed to be OPERABLE and capable of providing isolation signals. The Reactor Vessel Water Level - Low Low Low, Level 1 Function associated with isolation is assumed in the analysis of the recirculation line break (Ref. 1). The isolation of the MSLs on Level 1 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 Reactor Vessel Water Level - Low Low Low, Level 1 Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

3.b. Main Steam Line Radiation - High, High

The Main Steam Line Radiation - High, High Function is provided to detect gross release of fission products from the fuel and to initiate closure of the reactor recirculation water sample line isolation valves. Four detectors, one for each main steam line, monitor the gross gamma radiation. Each detector provides an input to one of the four trip logic channels.

3.c. Main Steam Line Pressure - Low

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 Main Steam Line Pressure - Low Function is directly assumed in the analysis of the pressure regulator failure (Ref. 2). For this event, the closure of the MSIVs ensures that the RPV temperature change limit (100°F/hr) is not reached. In addition, this Function supports actions to ensure that Safety Limit 2.1.1.1 is not exceeded. (This 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% RTP.)

The MSL low pressure signals are initiated from four transmitters that are connected to the MSL header. Four channels of Main Steam Line Pressure - Low Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Main Steam Line Pressure - Low Function is only required to be OPERABLE in OPERATIONAL CONDITION 1 since this is when the assumed transient can occur (Ref. 2).

The valve groups actuated by this Function are listed in Table 3.3.2-1.

3.d. Main Steam Line Flow - High

Main Steam Line Flow - High 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, the isolation is initiated on high flow to prevent or minimize core damage. The Main Steam Line Flow - High Function is directly assumed in the analysis of the main steam line break (MSLB) (Ref. 1). 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 100 limits.

The MSL flow signals are initiated from 16 transmitters that are connected to the four MSLs. Four channels of Main Steam Line Flow - High 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 valve groups actuated by this Function are listed in Table 3.3.2-1.

3.e. Condenser Vacuum - Low

The Condenser Vacuum - Low 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 Condenser Vacuum - Low 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 of the diaphragm installed to protect the turbine exhaust hood, thereby preventing a potential radiation leakage path following an accident.

Condenser vacuum pressure signals are derived from four pressure transmitters that sense the pressure in the condenser. Four channels of Condenser Vacuum - Low Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

As noted in the footnote Table 3.3.2-1, the channels are not required to be OPERABLE in OPERATIONAL CONDITIONS 2 and 3 when all turbine stop valves (TSVs) are less than 90% open, since the potential for condenser overpressurization is minimized. Switches are provided to manually bypass the channels when all TSVs are closed.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

3.f. Main Steam Line Tunnel Temperature - High

The Main Steam Line Tunnel Temperature - High is provided to detect a leak in the RCPB and provides diversity to the high flow instrumentation. The isolation occurs when a very small leak has occurred. 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.

Area temperature signals are initiated from sensors located in the main steam tunnel. Sixteen channels of Main Steam Tunnel Temperature - High Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

3.g. Manual Initiation

The Manual Initiation push button channels introduce signals into the MSL isolation logic that are redundant to the automatic protective instrumentation and provide manual isolation capability. There is no specific UFSAR safety analysis that takes credit for this Function. It is retained for the overall redundancy and diversity of the isolation function as required by the NRC in the plant licensing basis.

There are four push buttons for the logic, two manual initiation push buttons per trip system.

Four channels of Manual Initiation Function are available and are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3, since these are the OPERATIONAL CONDITIONS in which the MSL isolation automatic Functions are required to be OPERABLE.

Reactor Water Cleanup System Isolation

4.a, 4.b. RWCU Differential Flow - High

The high differential flow signal is provided to detect a break in the RWCU System. This will detect leaks in the RWCU System when area or differential temperature would not provide detection (i.e., a cold leg break). Should the reactor coolant continue to flow out of the break, offsite dose limits may be exceeded. Therefore, isolation of the RWCU System is initiated when high differential flow is sensed to prevent exceeding offsite doses. A time delay is provided to prevent spurious trips during most RWCU operational transients. This Function is not assumed in any UFSAR transient or accident analysis, since bounding analyses are performed for large breaks such as MSLBs.

The high differential flow signals are initiated from transmitters that are connected to the inlet (from the reactor vessel) and outlets (to condenser and feedwater) of the RWCU System. Two channels of RWCU Differential Flow - High Function are available and are required to be

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

4.c, 4.d. RWCU Area Temperature and Area Ventilation Differential Temperature - High

RWCU area temperatures and area ventilation differential temperatures are provided to detect a leak from the RWCU System. The isolation occurs even when very small leaks have occurred and is diverse to the high differential flow instrumentation for the hot portions of the RWCU System. If the small leak continues without isolation, offsite dose limits may be reached. 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 recirculation or MSL breaks.

Area temperature and area ventilation differential temperature signals are initiated from temperature elements that are located in the room that is being monitored. Twelve ambient temperature sensor/monitors provide input to the RWCU Area Temperature - High Function. Twelve channels are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

Twelve differential temperature sensor/monitors provide input to the RWCU Area Ventilation Differential Temperature - High Function. Twelve channels are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

4.e. SLC System Initiation

The isolation of the RWCU System is required when the SLC System has been initiated to prevent dilution and removal of the boron solution by the RWCU System. SLC System initiation signals are initiated from the two SLC pump start signals.

Two channels (one from each pump) of the SLC System Initiation Function are available and are required to be OPERABLE only in OPERATIONAL CONDITIONS 1, 2 and 5 (when the SLC system is required to be OPERABLE), since these OPERATIONAL CONDITIONS are consistent with the Applicability for the SLC System (TS 3.1.5).

4.f. Reactor Vessel Water Level - Low Low, Level 2

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, isolation of some interfaces with the reactor vessel occurs to isolate the potential sources of a break. The isolation of the RWCU System on Level 2 supports actions to ensure that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46. The Reactor Vessel Water Level - Low Low, Level 2 Function associated with RWCU isolation is not

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

directly assumed in the UFSAR safety analyses because the RWCU System line break is bounded by breaks of larger systems (recirculation and MSL breaks are more limiting).

Reactor Vessel Water Level - Low Low, Level 2 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 Vessel Water Level - Low Low, Level 2 Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

4.g. Manual Initiation

The Manual Initiation push button channels introduce signals into the RWCU System isolation logic that are redundant to the automatic protective instrumentation and provide manual isolation capability. There is no specific UFSAR safety analysis that takes credit for this Function. It is retained for overall redundancy and diversity of the isolation function as required by the NRC in the plant licensing basis.

There are two push buttons for the logic, one manual initiation push button per trip system.

Two channels of the Manual Initiation Function are available and are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 since these are the OPERATIONAL CONDITIONS in which the RWCU System Isolation automatic Functions are required to be OPERABLE.

Reactor Core Isolation Cooling and High Pressure Coolant Injection Systems Isolation

5.a, 6.a, 5.b, 6.b. RCIC and HPCI Steam Line Δ Pressure (Flow) - High

Steam Line Δ Pressure (Flow) - High 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 flow to prevent or minimize core damage. The isolation action, along with the scram function of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46. Specific credit for these 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 RCIC and HPCI Steam Line Δ Pressure (Flow) - High signals are initiated from transmitters (two for HPCI and two for RCIC) that are connected to the system steam lines. Two channels of both RCIC and HPCI

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Steam Line Δ Pressure (Flow) - High Functions are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

To eliminate the possibility of spurious system isolations, the RCIC and HPCI systems incorporate a time delay, which will prevent short term flow peaks from initiating a system isolation but will not interfere with the leak detection and isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

5.c, 6.c. RCIC and HPCI Steam Supply Pressure - Low

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 and are not assumed in any transient or accident analysis in the UFSAR. However, they also provide a diverse signal to indicate a possible system break. These instruments are included in Technical Specifications (TS) because of the potential for risk due to possible failure of the instruments preventing RCIC and HPCI initiations (Ref. 3).

The RCIC and HPCI Steam Supply Pressure - Low signals are initiated from transmitters (four for HPCI and four for RCIC) that are connected to the system steam line. Four channels of both RCIC and HPCI Steam Supply Line Pressure - Low Functions are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

5.d, 6.d. RCIC and HPCI Turbine Exhaust Diaphragm Pressure - High

High turbine exhaust diaphragm pressure indicates that the pressure may be too high to continue operation of the associated system's turbine. That is, one of two exhaust diaphragms has ruptured and pressure is reaching turbine casing pressure limits. These isolations are for equipment protection and are not assumed in any transient or accident analysis in the UFSAR. These instruments are included in the TS because of the potential for risk due to possible failure of the instruments preventing RCIC and HPCI initiations (Ref. 3).

The RCIC and HPCI Turbine Exhaust Diaphragm Pressure - High signals are initiated from transmitters (four for HPCI and four for RCIC) that are connected to the area between the rupture diaphragms on each system's turbine exhaust line. Four channels of both RCIC and HPCI Turbine Exhaust Diaphragm Pressure - High Functions are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5.e, 5.f, 5.g, 5.h, 6.e, 6.f, 6.g. 6.h. RCIC and HPCI Area and Differential Temperature - High

Area ambient and differential temperatures 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 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.

Pump Room Area and Differential Temperature - High signals are initiated from sensor/switches that are appropriately located to protect the system that is being monitored. Two channels for each RCIC and HPCI Pump Room Temperature - High and Pump Room Ventilation Ducts Δ Temperature - High Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

Ambient temperature sensor/switches detect temperature increases in the steam supply piping areas. Two channels for each RCIC and HPCI Pipe Routing Area Temperature - High Function and six channels for each RCIC and HPCI Torus Compartment Temperature - High Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

5.i, 6.i. Drywell Pressure - High

High drywell pressure can indicate a break in the RCPB. The RCIC and HPCI isolation of the turbine exhaust is provided to prevent communication with the drywell when high drywell pressure exists. A potential leakage path exists via the turbine exhaust. The isolation is delayed until the system becomes unavailable for injection (i.e., low steam line pressure). The isolation of the RCIC and HPCI turbine exhaust by Drywell Pressure - High is indirectly assumed in the UFSAR accident analysis because the turbine exhaust leakage path is not assumed to contribute to offsite doses.

High drywell pressure signals are initiated from pressure transmitters that sense the pressure in the drywell. Four channels of both RCIC and HPCI Drywell Pressure - High Functions are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

5.j, 6.j. Manual Initiation

The Manual Initiation push button channels introduce signals into the RCIC and HPCI systems' isolation logics that are redundant to the automatic protective instrumentation and provide manual isolation capability. There is

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

no specific UFSAR safety analysis that takes credit for these Functions. They are retained for overall redundancy and diversity of the isolation function as required by the NRC in the plant licensing basis.

There is one manual initiation push button for each of the HPCI and RCIC systems.

One channel of both RCIC and HPCI Manual Initiation Functions is available and is required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 since these are the OPERATIONAL CONDITIONS in which the RCIC and HPCI systems' Isolation automatic Functions are required to be OPERABLE.

Shutdown Cooling System Isolation

7.a. Reactor Vessel Water Level - Low, Level 3

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, isolation of some reactor vessel interfaces occurs to begin isolating the potential sources of a break. The Reactor Vessel Water Level - Low, Level 3 Function associated with RHR Shutdown Cooling System isolation is not directly assumed in safety analyses because a break of the RHR Shutdown Cooling System is bounded by breaks of the recirculation and MSL. The RHR Shutdown Cooling System isolation on Level 3 supports actions to ensure that the RPV water level does not drop below the top of the active fuel during a vessel draindown event caused by a leak (e.g., pipe break or inadvertent valve opening) in the RHR Shutdown Cooling System.

Reactor Vessel Water Level - Low, Level 3 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 (two channels per trip system) of the Reactor Vessel Water Level - Low, Level 3 Function are available and are required to be OPERABLE to ensure that no single instrument failure can preclude the isolation function.

The Reactor Vessel Water Level - Low, Level 3 Function is required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 to prevent this potential flow path from lowering the reactor vessel level to the top of the fuel.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

7.b. Reactor Vessel (RHR Cut-in Permissive) Pressure - High

The Reactor Vessel (RHR Cut-in Permissive) Pressure - High 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.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The Reactor Vessel (RHR Cut-in Permissive) Pressure - High signals are initiated from four transmitters. Four channels of Reactor Vessel (RHR Cut-in Permissive) Pressure - High Function are available and are required to be OPERABLE. The Function is only required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3, since these are the only OPERATIONAL CONDITIONS in which the reactor can be pressurized; thus, equipment protection is needed.

The valve groups actuated by this Function are listed in Table 3.3.2-1.

7.c. Manual Initiation

The Manual Initiation push button channels introduce signals into the RHR shutdown cooling isolation logic that are redundant to the automatic protective instrumentation and provide manual isolation capability. There is no specific UFSAR safety analysis that takes credit for this Function. It is retained for overall redundancy and diversity of the isolation function as required by the NRC in the plant licensing basis.

There are two push buttons for the logic, one manual initiation push button per trip system.

Two channels of the Manual Initiation Function are available and are required to be OPERABLE in OPERATIONAL CONDITIONS 1, 2, and 3 since these are the OPERATIONAL CONDITIONS in which the RHR System Shutdown Cooling Mode Isolation automatic Functions are required to be OPERABLE.

ACTIONS

3.3.2.b

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 for Functions 1.b, 2.b, 7.a and 7.b and 24 hours for Functions other than Functions 1.b, 2.b, 7.a and 7.b has been shown to be acceptable (Refs. 5 and 6) 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 Action 3.3.2.b.1.b or 3.3.2.b.1.c. 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 Action required by Table 3.3.2-1 must be taken.

If there are no OPERABLE channels for a trip function in one trip system, and the inoperable channels cannot be restored to OPERABLE status within one hour, the inoperable channels must be placed in the tripped condition per Action 3.3.2.b.1.a. Alternately, if it is not desired to place the channels in trip, the Action required by Table 3.3.2-1 must be taken.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

ACTIONS (continued)

Footnote (e) to Table 3.3.2-1 modifies the minimum OPERABLE channels per trip function requirement to state that sensors are arranged per valve group, not per trip system. Where the trip function actuates a single valve group, Action 3.3.2.b applies for all cases in which less than the minimum required number of channels are OPERABLE. For trip functions annotated by footnote (e), Action 3.3.2.b.1.a applies when neither isolation logic (inboard or outboard) meets the minimum OPERABLE channels requirement.

For trip functions 1.c, 2.c and 2.d, a minimum of three OPERABLE channels per trip system are required. For these trip functions, three radiation monitoring channels input to four two-out-of-three PCIS initiation logics. When one RFE-RMS or one RBE-RMS channel is inoperable, Action 3.3.2.b.1.c applies. When more than one RFE-RMS or more than one RBE-RMS channel is inoperable, Action 3.3.2.b.1.a applies because a sufficient number of inputs would not be available to satisfy the actuation logic for any PCIS channel.

SURVEILLANCE REQUIREMENTS

Specified surveillance intervals and surveillance and maintenance outage times have been determined in accordance with References 5 and 6.

When necessary, one channel may be inoperable for brief intervals to conduct required surveillance. Some of the trip settings may have tolerances explicitly stated where both the high and low values are critical and may have a substantial effect on safety. The setpoints of other instrumentation, where only the high or low end of the setting have a direct bearing on safety, are established at a level away from the normal operating range to prevent inadvertent actuation of the systems involved.

Except for the MSIVs, the safety analysis does not address individual sensor response times or the response times of the logic systems to which the sensors are connected. Selected sensor response time testing requirements were eliminated based upon Reference 7, NEDO-32291, "System Analyses for Elimination of Selected Response Time Testing Requirements," as approved by the NRC and documented in the SER (letter to R.A. Pinelli from Bruce A. Boger, dated December 28, 1994). The Isolation System Instrumentation Response Times are located in UFSAR Table 7.3-16.

REFERENCES

1. UFSAR, Section 6.3.

2. UFSAR, Chapter 15.

3. NEDO-31466, "Technical Specification Screening Criteria Application and Risk Assessment," November 1987.

4. UFSAR, Section 15.7.4.

3/4.3.2 ISOLATION ACTUATION INSTRUMENTATION

REFERENCES (continued)

5. NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," as approved by the NRC and documented in the SER (letter to S.D. Floyd from C.E. Rossi dated June 18, 1990).

6. NEDC-30851P-A Supplement 2, "Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," as approved by the NRC and documented in the SER (letter to D.N. Grace from C.E. Rossi dated January 6, 1989).

7. NEDO-32291, "System Analyses for Elimination of Selected Response Time Testing Requirements," as approved by the NRC and documented in the SER (letter to R.A. Pinelli from Bruce A. Boger, dated December 28, 1994).

3/4.3.3 EMERGENCY CORE COOLING SYSTEM ACTUATION INSTRUMENTATION

The emergency core cooling system actuation instrumentation is provided to initiate actions to mitigate the consequences of accidents that are beyond the ability of the operator to control. This specification provides the OPERABILITY requirements, trip setpoints and response times that will ensure effectiveness of the systems to provide the design protection. ECCS actuation instrumentation is eliminated from response time testing requirements based on NEDO-32291, "System Analyses for Elimination of Selected Response Time Testing Requirements," as approved by the NRC and documented in the SER (letter to R.A. Pinelli from Bruce A. Boger, dated December 28, 1994). The Emergency Core Cooling System Response Times are located in UFSAR Table 7.3-17.

Specified surveillance intervals and surveillance and maintenance outage times have been determined in accordance with NEDC-30936P-A, "BWR Owners' Group Technical Specification Improvement Methodology (With Demonstration for BWR ECCS Actuation Instrumentation)," Parts 1 and 2. The safety evaluation reports documenting NRC approval of NEDC-30936P-A are contained in letters to D. N. Grace from A. C. Thadani (Part 1) and C. E. Rossi (Part 2) dated December 9, 1988. Although the instruments are listed by system, in some cases the same instrument may be used to send the actuation signal to more than one system at the same time.

Operation with a trip set less conservative than its Trip Setpoint but within its specified Allowable Value is acceptable on the basis that the difference between each Trip Setpoint and the Allowable Value is an allowance for instrument drift specifically allocated for each trip in the safety analyses.