Appendix A

Permanently Defueled Technical Specifications Bases

Facility License No. DPR-26

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B 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

BASES

LCOs	LCO 3.0.1 through LCO 3.0.2 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.
LCO 3.0.1	LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the facility is in the specified conditions of the Applicability statement of each Specification).
LCO 3.0.2	LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that: a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification and b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified. Completing the Required Actions is not required when an LCO is met or is no longer applicable, unless otherwise stated in the individual Specifications.

B 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

BASES

SRs	SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.
SR 3.0.1	SR 3.0.1 establishes the requirement that SRs must be met during the specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO. Surveillances do not have to be performed when the facility is in a specified condition for which the requirements of the associated LCO are not applicable. Surveillances do not have to be performed on variables that are outside their specified limits because the ACTIONS define the remedial measures that apply. Surveillances have to be met and performed in accordance with SR 3.0.2 to restore variables within their specified limits.
SR 3.0.2	SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances. SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers facility conditions that may not be suitable for conducting the Surveillance (e.g., other ongoing Surveillance or maintenance activities). The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The provisions of SR 3.0.2 are not intended to be used repeatedly merely as a convenience to extend Surveillance intervals beyond those specified.

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is greater, applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides adequate time to complete Surveillances that have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance.

The basis for this delay period includes consideration of facility conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility which is not intended to be used as a convenience to extend Surveillance intervals. While up to 24 hours or the limit of the specified Frequency is provided to perform the missed Surveillance, it is expected that the missed Surveillance will be performed at the first reasonable opportunity. The determination of the first reasonable opportunity should include consideration of the impact on facility risk (from delaying the Surveillance as well as any facility configuration changes required to perform the Surveillance) and impact on any analysis assumptions, in addition to facility conditions, planning, availability of personnel, and the time required to perform the Surveillance.

All missed Surveillances will be placed in the Corrective Action Program.

If a Surveillance is not completed within the allowed delay period, then the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance.

Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

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SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into a specified condition in the Applicability.

This Specification ensures that variable limits are met before entry into specified conditions in the Applicability for which these variables ensure safe handling and storage of spent fuel. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring variables within specified limits before entering an associated specified condition in the Applicability.

However, in certain circumstances, failing to meet an SR will not result in SR 3.0.4 restricting a specified condition change. When a variable is outside its specified limits, the associated SR(s) are not required to be performed, per SR 3.0.1, which states that surveillances do not have to be performed on variables that are outside their specified limits. When a variable is outside its specified limit, SR 3.0.4 does not apply to the associated SR(s) since the requirement for the SR(s) to be performed is removed. Therefore, failing to perform the Surveillance(s) within the specified Frequency does not result in an SR 3.0.4 restriction to changing specified conditions of the Applicability. SR 3.0.4 does not restrict changing specified conditions of the Applicability when a Surveillance has not been performed within the specified Frequency, provided the requirement to declare the LCO not met has been delayed in accordance with SR 3.0.3.

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the specified condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO's Applicability, would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternately, the Surveillance may be stated in the form of a Note, as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SRs' annotation is found in Section 1.4, Frequency.

B 3.7 SPENT FUEL PIT REQUIREMENTS

B 3.7.11 Spent Fuel Pit Water Level

BASES

BACKGROUND

The minimum water level in the spent fuel pit meets the assumptions of iodine decontamination factors following a fuel handling accident. The specified water level shields and minimizes the general area dose when the storage racks are filled to their maximum capacity. The water also provides shielding during the movement of spent fuel.

A general description of the spent fuel pit including the cooling and cleanup system is given in the Defueled Safety Analysis Report (DSAR), Section 3.3 (Ref. 1). The assumptions of the fuel handling accident are given in Reference 2.

APPLICABLE SAFETY ANALYSES

The minimum water level in the spent fuel pit meets the assumptions of the fuel handling accident evaluated. The radiological consequence analysis for a fuel handling accident in the fuel storage building assumes that a fuel assembly is dropped and damaged during refueling. The analysis methodology is consistent with Regulatory Guide 1.183 (Ref. 3).

Activity released from the damaged assembly is released to the outside atmosphere through the fuel-handling building ventilation system to the plant vent. No credit is taken for removal of iodine by filters, nor is credit taken for isolation of release paths. The activity released from the damaged assembly is assumed to be released to the environment over a 2-hour period. The fuel assembly fission product inventory is based on the assumption that the subject fuel assembly has been operated at 1.7 times core average power (and thus has 1.7 times the average fuel assembly fission product inventory). The decay time used in the analysis is 84 hours. In accordance with this LCO, it is assumed that there is a minimum of 23 feet of water above the spent fuel racks. With this water depth, the decontamination factor (DF) of 500 specified by Reference 3 for elemental iodine would apply. The DF was reduced to 400 for conservatism because the fuel rod pressure may exceed the assumption of 1200 psig (but would be less than 1500 psig). The DF for organic iodine and noble gases was 1.0. The elemental iodine DF was reduced further to 285 in order to be consistent with Reference 3 guidance that the overall iodine DF be equal to 200. Since Reference 3 specifies that the 0.15% iodine is in the organic form, the limit of 200 for the overall iodine DF required that the DF for elemental iodine be 285.

BASES

APPLICABLE SAFETY ANALYSES (continued)

With 23 ft of water over the damaged fuel, the assumptions of Reference 3 can be used directly. In practice, this LCO preserves this assumption for the bulk of the fuel in the storage racks. In the case of a single bundle dropped and lying horizontally on top of the spent fuel racks, however, there may be < 23 ft of water above the top of the fuel bundle and the surface, indicated by the width of the bundle. To offset this small non-conservatism, the analysis assumes that all fuel rods fail, although analysis shows that only the first few rows fail from a hypothetical maximum drop.

At Indian Point 2, the radiological consequence analyses for the fuel handling accident demonstrate compliance with the dose acceptance criterion in Reference 4.

The spent fuel pit water level satisfies Criteria 2 and 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The spent fuel pit water level is required to be ≥ 23 ft over the top of irradiated fuel assemblies seated in the storage racks. The specified water level preserves the assumptions of the fuel handling accident analysis (Ref. 2). As such, it is the minimum required for fuel storage and movement within the spent fuel pit.

The spent fuel pit minimum required level of 23 feet corresponds to an elevation of 92 feet, 2 inches.

APPLICABILITY

This LCO applies during movement of irradiated fuel assemblies in the spent fuel pit, because the potential for a release of fission products exists.

ACTIONS

A.1

When the initial conditions for prevention of an accident cannot be met, steps should be taken to preclude the accident from occurring. When the spent fuel pit water level is lower than the required level, the movement of irradiated fuel assemblies in the spent fuel pit is immediately suspended to a safe position. This action effectively precludes the occurrence of a fuel handling accident. This does not preclude movement of a fuel assembly to a safe position.

SURVEILLANCE REQUIREMENTS

SR 3.7.11.1

This SR verifies sufficient spent fuel pit water is available in the event of a fuel handling accident. The water level in the spent fuel pit must be checked periodically. The 7 day Frequency is appropriate because the volume in the spent fuel pit is normally stable. Water level changes are controlled by plant procedures and are acceptable based on operating experience.

REFERENCES

1. DSAR, Section 3.3.

2. DSAR, Section 6.2.

3. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000.

4. NUREG-0800, Standard Review Plan, US Nuclear Regulatory Commission, Section 15.0.1, "Radiological Consequences Analysis Using Alternative Source Terms," Rev. 0, July 2000.

B 3.7 SPENT FUEL PIT REQUIREMENTS

B 3.7.12 Spent Fuel Pit Boron Concentration

BASES

BACKGROUND

The Spent Fuel Pit (SFP) is used to store spent fuel removed from the reactor and new fuel ready for insertion into the reactor. The SFP has been evaluated to meet the requirements of option (b) of 10 CFR 50.68, "Criticality Accident Requirements" (Ref. 1). IP2 compliance with 10 CFR 50.68(b)(4) was confirmed by an analysis documented in Curtiss-Wright Nuclear Division, NETCO report NET-28091-003-01, Rev. 0, "Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel Pool with No Absorber Panel Credit" (Ref. 2). This analysis demonstrated that 10 CFR 50.68(b)(4) will be met during normal SFP operation and all credible accident scenarios if the following requirements are met:

a) Spent Fuel Pit boron concentration is maintained within the limits of LCO 3.7.12, "Spent Fuel Pit Boron Concentration," whenever fuel is stored in the SFP; and,

b) Fuel assembly storage location within the Spent Fuel Pit is restricted in accordance with LCO 3.7.13, "Spent Fuel Pit Storage."

A detailed description of this combination of minimum boron concentration and restrictions on fuel assembly storage location is presented in the Bases for LCO 3.7.13.

APPLICABLE SAFETY ANALYSES

Curtiss-Wright Nuclear Division, NETCO report NET-28091-003-01, Rev. 0, "Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel Pool with No Absorber Panel Credit" (Ref. 2), evaluated non-accident conditions in the SFP. Reference 2 determined that if storage location requirements in this LCO are met then the SFP will have a k_{eff} of ≤ 0.95 if filled with a soluble boron concentration of ≥ 700 ppm and will have a k_{eff} of < 1.0 if filled with un-borated water.

Reference 2 evaluated abnormal occurrences and accidents. This evaluation considered the effects of the following: a) multiple misloads; b) an assembly placed alongside a rack; c) a dropped assembly; d) a misloaded assembly; e) SFP overtemperature; f) a seismic event; and g) a SFP boron dilution accident. Reference 2 determined that the most limiting fuel handling accident is the multiple misload accident and determined k_{eff} of ≤ 0.95 if the SFP is filled with a soluble boron concentration of ≥ 2000 ppm.

BASES

APPLICABLE SAFETY ANALYSIS (continued)

NET-173-02, “Indian Point Unit 2 Spent Fuel Pool (SFP) Boron Dilution Analysis” (Ref. 3), evaluated postulated unplanned SFP boron dilution scenarios assuming an initial SFP boron concentration within the limits of LCO 3.7.12. The evaluation considered various scenarios by which the SFP boron concentration may be diluted and the time available before the minimum boron concentration necessary to ensure subcriticality for the non-accident condition (i.e., it is not assumed an assembly is misloaded concurrent with the SFP dilution event). Reference 3 determined that an unplanned or inadvertent event that could dilute the SFP boron concentration from 2000 ppm to 786 ppm is not a credible event because of the low frequency of postulated initiating events and because the event would be readily detected and mitigated by plant personnel through alarms, flooding, and operator and security rounds through the SFP area.

The concentration of dissolved boron in the SFP satisfies Criterion 2 of 10 CFR 50.36 (c)(2)(ii).

LCO

The Spent Fuel Pit boron concentration is required to be $\geq$ 2000 ppm. The specified concentration of dissolved boron in the Spent Fuel Pit preserves the assumptions used in the analyses of the potential critical accident scenarios as described in Reference 2. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the Spent Fuel Pit.

APPLICABILITY

This LCO applies whenever fuel assemblies are stored in the Spent Fuel Pit.

ACTIONS

A.1 and A.2

When the concentration of boron in the Spent Fuel Pit is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. The concentration of boron is restored simultaneously with suspending movement of fuel assemblies.

SURVEILLANCE REQUIREMENTS

SR 3.7.12.1

This SR verifies that the concentration of boron in the Spent Fuel Pit is within the required limit. As long as this SR is met, the analyzed accidents are fully addressed. The 7 day Frequency is appropriate

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SURVEILLANCE REQUIREMENTS (continued)

because no major replenishment of Spent Fuel Pit water is expected to take place over such a short period of time.

REFERENCES

1. 10 CFR 50.68, “Criticality Accident Requirements.”

2. Curtis-Wright Nuclear Division, NETCO report NET-28091-003-01, “Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel Pool (SFP) with no Absorber Panel Credit.”

3. Northeast Technology Corporation report NET-173-02, “Indian Point Unit 2 Spent Fuel Pool (SFP) Boron Dilution Analysis.”

4. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 290 to Facility Operating License No. DPR-26, September 4, 2019.

B 3.7 SPENT FUEL PIT REQUIREMENTS

B 3.7.13 Spent Fuel Pit Storage

BASES

BACKGROUND

The Spent Fuel Pit (SFP) is used to store IP2 spent fuel removed from the reactor and new fuel ready for insertion into the reactor. It is also used to store IP3 fuel that has been transferred from the IP3 SFP prior to it being placed into dry cask storage (Refs 1 and 2). Spent fuel racks (SFRs) are erected on the SFP floor to hold the fuel assemblies. The SFRs have been evaluated to meet the requirements of option (b) of 10 CFR 50.68, “Criticality Accident Requirements” (Ref. 3).

IP2 compliance with 10 CFR 50.68(b)(4) was confirmed by an analysis documented in Curtiss-Wright Nuclear Division, NETCO report NET-28091- 003-01, Rev. 0 “Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel Pool with No Absorber Panel Credit” (Ref. 4) and was approved by the NRC in Amendment 290 (Ref. 5). This analysis demonstrates that 10 CFR 50.68(b)(4) will be met during normal SFP operation and all credible accident scenarios if the following requirements are met:

a) The SFP boron concentration is maintained within the limits of LCO 3.7.12, “Spent Fuel Pit Boron Concentration,” whenever fuel is stored in the SFP; and,

b) Fuel assembly storage location within the SFP is restricted in accordance with LCO 3.7.13, “Spent Fuel Pit Storage,” based on the fuel assembly’s initial enrichment, burnup, decay of Plutonium-241 (i.e., cooling time), averaged assembly peaking factor, and number of Integral Fuel Burnable Absorbers (IFBA) rods. Note that historic fuel assemblies have been pre-categorized (Tables 3.7.13-2 and 3.7.13- 3).

Fuel assembly storage location within the Spent Fuel Pit is an essential element of the criticality analysis. The storage racks in the areas designated Region 1 have a different design than the storage racks in the areas designated Region 2 and this design difference has a significant impact on criticality calculations. Regions 1 and 2 are shown on the insert to Figure 3.7.13-1.

Region 1 consists of three racks that use the flux trap design and has 269 cell locations for the storage of fuel assemblies. The flux trap design used in Region 1 uses spacer plates in the axial direction to separate the cells. Boraflex panels are held in place adjacent to each side of the cell by picture frame sheathing. In addition, due to a damaged cell, there is one cell blocker in Region 1.

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Applicable Safety Analyses

Region 2 consists of nine racks that use an egg-crate design and has 1105 cell locations for the storage of fuel assemblies and two failed fuel canisters. The Region 2 racks consist of boxes welded into a "checkerboard" array with a storage location in each square. One Boraflex absorber panel is held to one side of each cell wall by picture frame sheathing. In addition, there is one cell blocker in Region 2 that is credited in the analysis to allow higher reactive fuel assemblies to be stored in two of its adjacent cells. Neither cell blocker can be moved while fuel is stored in the Spent Fuel Pit.

With two installed cells blockers the total number of cell locations available for the storage of fuel assemblies is 1372. However, the number of fuel assemblies that can actually be stored in Regions 1 and 2 is dependent on the fuel assembly categorization and the SFP locations allowable by Figure 3.7.13-1 and its associated notes.

The criticality analysis defines five fuel assembly reactivity categories based on minimum required burnup and the number of IFBA rods. The minimum required burnups are chosen to optimize the storage of fresh and once burnt fuel assemblies in Region 1 (Categories 1, 2, and 3), and to optimize the storage of permanently discharged assemblies in Region 2 (Categories 4 and 5).

The fuel categories are numbered from most reactive fuel (Category 1) to least reactive fuel (Category 5). The assembly's enrichment, burnup, cooling time, averaged assembly peaking factor, and number of IFBA rods are used to determine the reactivity category. The reactivity categories and their associated burnup requirements are shown in order of decreasing reactivity in Table 3.7.13-1. The averaged assembly peaking factor is the assembly burnup divided by the sum of the cycle burnups for the cycles the assembly was in the core.

The depletion analysis treats historic fuel and current and future fuel differently. Historic fuel is defined as fuel assemblies with identifiers (IDs) A through X for IP2 and A through AA for IP3. Current and future fuel is defined as fuel assemblies with IDs after X for IP2 and after AA for IP3. As the fuel designs and operating condition of historic fuel are known this fuel can be pre-categorized. This pre-categorization is included in Tables 3.7.13-2 and 3.7.13-3.

a. Categorization of historic fuel assemblies

For historic fuel assemblies, the depletion calculations utilize actual fuel assembly depletion conditions instead of bounding conditions that

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Applicable Safety Analyses

would penalize most assemblies for which the depletion conditions are known. This data includes use of inserts, burnup achieved while the insert was in the assembly, use of control rods, soluble boron level, averaged assembly peaking factor, and use of axial blankets. The fuel categorization of historic fuel is accomplished by use of batch groupings with similar characteristics. The depletion analysis is performed for each batch grouping using bounding depletion parameters. For some historic fuel assemblies the bounding parameters are overly conservative. For such assemblies, the actual depletion parameters are used. Historic fuel assemblies have been pre- categorized as shown in Appendix B to the CSA and TS Tables 3.7.13-2 and 3.7.13-3.

b. Categorization of current and future fuel assemblies

For current and future fuel assemblies bounding depletion assumptions are used. Table 3.7.13-1 provides the minimum required burnup for each reactivity category for these fuel assemblies. The notes to Table 3.7.13-1 specify the circumstances under which burnup penalties must be applied to the minimum required burnup.

Should an assembly not meet any of the fuel assembly operating requirements specified in the analysis, then the fuel must be categorized as Category 1 (or Category 4 if a full length RCCA is inserted).

c. SFP storage location by fuel assembly category

The analysis determines acceptable storage locations for each fuel assembly reactivity category as shown in Figures 3.7.13-1 and 3.7.13-2.

Figure 3.7.13-1 shows the base case arrangement of the fuel categories. Note that the base case arrangement only shows four reactivity categories since it is the most limiting reactivity arrangement.

d. Storage of non-fuel assemblies

The analysis addresses the use of the failed fuel containers, the fuel rod storage basket, assemblies with missing fuel rods, and the storage of miscellaneous materials.

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Applicable Safety Analyses

Failed fuel containers

The southeast corner of the SFP contains two 16" circular pipes that are used as failed fuel containers. The criticality analysis permits 16 fuel rods in each of these failed fuel containers. The maximum of 16 fuel rods in each of the failed fuel containers will be controlled by procedure.

Fuel rod storage basket

There is a movable fuel rod storage basket that can be used to store fuel rods. This basket can fit in a storage cell and has 52 holes for storing fuel rods. The fuel rod storage basket is classified as reactivity Category 4 and this categorization is included in Table 3.7.13-2.

Assemblies with missing fuel rods

Reconstituted fuel assemblies may be stored in the SFP provided a 4GWd/T burnup penalty is added to the MRB for those assemblies that did not have stainless steel rods installed. This requirement is included in the notes to Table 3.7.13-1.

Storage of miscellaneous materials

Water Holes and 50% Water Holes may be used to store miscellaneous materials with certain restrictions. Miscellaneous non-actinide materials, for example, empty or full trash baskets, can be stored in fuel positions of any category. However, there are some special cases where some of the material may be stored in a water hole or 50% water hole. If the miscellaneous material is any type of steel, Inconel, or absorber material (e.g., absorber coupons, stainless steel coupon trees, control rods, unburned burnable absorbers) it may displace up to 50% of the water volume at the active fuel zone (144 inches) of a water hole or 50% water hole (there are no restrictions on material above or below the active fuel zone). If the miscellaneous material is a very low absorbing material such as a void, zirconium, aluminum, cloth, plastic, concrete, etc., it cannot be placed in a water hole but may be placed in a 50% water hole so long as the 50% water hole still has 50% water volume in the active fuel zone. The restrictions that apply to Water Holes and 50% Water Holes are included in the notes to Figure 3.7.13-1.

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Applicable Safety Analyses

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Pool ANALYSES

Curtiss-Wright Nuclear Division, NETCO report NET-28091-003-01, 0 “Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel with No Absorber Panel Credit” (Ref. 4) evaluated non-accident and accident conditions in the SFP.

Reference 4 determined that if storage location requirements in this LCO are met then the SFP will have a K_{eff} of ≤ 0.95 if filled with a soluble boron concentration of ≥ 700 ppm and will have a K_{eff} of < 1.0 if filled with unborated water.

Reference 4 evaluated abnormal occurrences and accidents. This evaluation considered the effects of the following: a) multiple misloads; b) an assembly placed alongside a rack; c) a dropped assembly; d) a misloaded assembly; e) SFP overtemperature; f) a seismic event; and g) a SFP boron dilution accident. Reference 4 determined that the most limiting fuel handling accident is the multiple misload accident and determined K_{eff} of ≤ 0.95 if the SFP is filled with a soluble boron concentration of ≥ 2000 ppm.

NET-173-02, “Indian Point Unit 2 Spent Fuel Pool (SFP) Boron Dilution Analysis” (Ref. 6) evaluated postulated unplanned SFP boron dilution scenarios assuming an initial SFP boron concentration within the limits of LCO 3.7.12. The evaluation considered various scenarios by which the SFP boron concentration may be diluted and the time available before the minimum boron concentration necessary to ensure subcriticality for the non-accident condition (i.e., it is not assumed an assembly is misloaded concurrent with the SFP dilution event). Reference 6 determined that an unplanned or inadvertent event that could dilute the SFP boron concentration from 2000 ppm to 786 ppm is not a credible event because of the low frequency of postulated initiating events and because the event would be readily detected and mitigated by plant personnel through alarms, flooding, and operator rounds through the SFP area. The criticality analysis conservatively credits 700 ppm (versus an already not credible 786 ppm in the AOR) of soluble boron.

The configuration of fuel assemblies in the Spent Fuel Pit satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

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LCO

This LCO requires that each IP2 fuel assembly stored in the Spent Fuel Pit is categorized in accordance with Table 3.7.13-1 or, if pre-categorized, Table 3.7.13-2, that each IP3 fuel assembly stored in the Spent Fuel Pit is categorized in accordance with Table 3.7.13-1 or, if pre-categorized, Table 3.7.13-3, and, IP2 and IP3 fuel assembly storage locations within the Spent Fuel Pit shall be restricted to locations allowed by Figure 3.7.13-1 and its associated notes as follows:

a. Categorized fuel assemblies may be stored in any cell location of the same or lower numbered category.

b. Category 1 fuel assemblies may be stored in any cell location in Regions 1 and 2 in accordance with Figure 3.7.13-1 notes 12 and 13, respectively.

c. Category 5 fuel assemblies with an installed full length RCCA may take the reactivity credit provided by the presence of the RCCA. This credit may also be taken for Category 1 fuel assemblies that contain a full length RCCA. These assemblies may be stored in any Category 4, 3, 2, or 1 cell. Likewise, Category 2, 3, or 4 fuel assemblies that contain a full length RCCA may be stored in any Category 5, 4, 3, 2, or 1 cell.

d. Category 5 fuel assemblies that are required to have a full length RCCA installed are the subject of the LCO note. Because reactivity credit is taken for the installed RCCA it may not be placed in, or removed from, the fuel assembly while the assembly is in the RCCA credited location. Movement of the RCCA in the credited location would be a violation of the criticality analysis.

This LCO establishes restrictions on fuel assembly storage location within the SFP to ensure that the requirements of 10 CFR 50.68 are met.

APPLICABILITY

This LCO applies whenever any fuel assembly is stored in the Spent Fuel Pit.

BASES

ACTIONS

ACTIONS

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Condition of this Specification may be entered independently for each fuel assembly stored in a location not meeting the requirements of the LCO. This is acceptable since the Required Action for the Condition provides the appropriate compensatory action for each noncomplying fuel assembly.

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the configuration of fuel assemblies stored in the Spent Fuel Pit is not in accordance with the rules established by LCO 3.7.13, the immediate action is to initiate action to make the necessary fuel assembly movement(s) to bring the configuration into compliance with the rules established by LCO 3.7.13.

If unable to move irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not be applicable. If unable to move irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the action is independent of reactor operation. Therefore, inability to move fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.13.1

This SR verifies by administrative means that IP2 and IP3 fuel assemblies have been classified based on initial enrichment, burnup, cooling time, averaged assembly peaking factor, and the number of IFBA rods in accordance with Table 3.7.13-1, or if pre-categorized, Tables 3.7.13-2 or 3.7.13-3, respectively. The SR also verifies by administrative means that, based on the classification of the assembly, it is stored in accordance with Figure 3.7.13-1. This administrative verification must be completed prior to placing any fuel assembly in the SFP. This SR ensures that this LCO and Specification 4.3.1.1 will be met after the fuel assembly is inserted in the SFP.

BASES

REFERENCES

REFERENCES

1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, July 13, 2012.

2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

3. 10 CFR 50.68, "Criticality Accident Requirements."

4. Curtiss-Wright Nuclear Division, NETCO report NET-28091-0003-01, Rev. 0 "Criticality Safety Analysis for the Indian Point Unit 2 Spent Fuel Pool with No Absorber Panel Credit."

5. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 290 to Facility Operating License No. DPR-26, September 4, 2019.

6. Northeast Technology Corporation report NET-173-02, "Indian Point Unit 2 Spent Fuel Pool (SFP) Boron Dilution Analysis.

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B 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

BASES

LCOs

LCO 3.0.1 through LCO 3.0.5 establish the general requirements applicable to all Specifications and apply under the stated conditions.

LCO 3.0.1

LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met.

LCO 3.0.2

LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met, except as provided in LCO 3.0.5. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that:

a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification and

b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified.

Completing the Required Actions is not required when an LCO is met or is no longer applicable, unless otherwise stated in the individual Specifications.

The nature of some Required Actions of some Conditions necessitates that, once the Condition is entered, the Required Actions must be completed even though the associated Conditions no longer exist. The individual LCO's ACTIONS specify the Required Actions where this is the case.

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS should not be made for operational convenience. Additionally, if intentional entry into ACTIONS would result in redundant equipment being inoperable, alternatives should be used instead.

BASES

LCO 3.0.3	Not applicable.
LCO 3.0.4	LCO 3.0.4 establishes limitations on changes in specified conditions in the Applicability when an LCO is not met. It allows placing the unit in a specified condition stated in that Applicability (e.g., the Applicability desired to be entered) when conditions are such that the requirements of the LCO would not be met, in accordance with LCO 3.0.4. LCO 3.0.4. allows entry into a specified condition in the Applicability with the LCO not met when the associated ACTIONS to be entered permit continued operation in the specified condition in the Applicability for an unlimited period of time. Compliance with Required Actions that permit continued operation for an unlimited period of time in a specified condition provides an acceptable level of safety. Therefore, in such cases, entry into a specified condition in the Applicability may be made in accordance with the provisions of the Required Actions.
LCO 3.0.5	LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not comply with the applicable Required Action(s)) to allow the performance of required testing to demonstrate either: a. The OPERABILITY of the equipment being returned to service or b. The OPERABILITY of other equipment. The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the required testing to demonstrate OPERABILITY. This Specification does not provide time to perform any other preventive or corrective maintenance.

B 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

BASES

SRs

SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify the OPERABILITY of systems and components, and that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO.

Systems and components are assumed to be OPERABLE when the associated SRs have been met. Nothing in this Specification, however, is to be construed as implying that systems or components are OPERABLE when:

a. The systems or components are known to be inoperable, although still meeting the SRs; or

b. The requirements of the Surveillance(s) are known not to be met between required Surveillance performances.

Surveillances do not have to be performed when the system is in a specified condition for which the requirements of the associated LCO are not applicable, unless otherwise specified. The SRs associated with a test exception are only applicable when the test exception is used as an allowable exception to the requirements of a Specification.

Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on inoperable equipment because the ACTIONS define the remedial measures that apply. Surveillances have to be met and performed in accordance with SR 3.0.2, prior to returning equipment to OPERABLE status.

BASES

SR 3.0.1 (continued)

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment OPERABLE. This includes ensuring applicable Surveillances are not failed and their most recent performance is in accordance with SR 3.0.2. Post maintenance testing may not be possible in the specified conditions in the Applicability due to the necessary parameters not having been established. In these situations, the equipment may be considered OPERABLE provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function. This will allow operation to proceed to the specified condition where other necessary post maintenance tests can be completed.

SR 3.0.2

SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances and any Required Action with a Completion Time that requires the periodic performance of the Required Action on a "once per . . ." interval.

SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers plant operating conditions that may not be suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The exceptions to SR 3.0.2 are those Surveillances for which the 25% extension of the interval specified in the Frequency does not apply. These exceptions are stated in the individual Specifications. The requirements of regulations take precedence over the TS. As stated in SR 3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per ..." basis. The 25% extension applies to each performance after the initial performance. The initial performance of the Required Action, whether it is a particular Surveillance or some other remedial action, is considered a single action with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such an action usually verifies that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the inoperable equipment in an alternative manner.

BASES

SR 3.0.2 (continued)

The provisions of SR 3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Surveillance intervals or periodic Completion Time intervals beyond those specified.

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring affected equipment inoperable or an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is greater, applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides adequate time to complete Surveillances that have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance.

The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

When a Surveillance with a Frequency based not on time intervals, but upon specified unit conditions, operating situations, or requirements of regulations is discovered to not have been performed when specified, SR 3.0.3 allows for the full delay period of up to the specified Frequency to perform the Surveillance. However, since there is not a time interval specified, the missed Surveillance should be performed at the first reasonable opportunity.

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility which is not intended to be used as an operational convenience to extend Surveillance intervals. While up to 24 hours or the limit of the specified Frequency is provided to perform the missed Surveillance, it is expected that the missed Surveillance will be performed at the first reasonable opportunity. The determination of the first reasonable opportunity should include consideration of the impact on plant risk (from delaying the Surveillance as well as any plant configuration changes required) and impact on any analysis assumptions, in addition to unit conditions, planning,

BASES

SR 3.0.3 (continued)

availability of personnel, and the time required to perform the Surveillance. This risk impact should be managed through the program in place to implement 10 CFR 50.65(a)(4) and its implementation guidance, NRC Regulatory Guide 1.182, "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants." This Regulatory Guide addresses consideration of temporary and aggregate risk impacts, determination of risk management action thresholds, and risk management action up to and including plant shutdown. The missed Surveillance should be treated as an emergent condition as discussed in the Regulatory Guide. The risk evaluation may use quantitative, qualitative, or blended methods. The degree of depth and rigor of the evaluation should be commensurate with the importance of the component. Missed Surveillances for important components should be analyzed quantitatively. If the results of the risk evaluation determine the risk increase is significant, this evaluation should be used to determine the safest course of action. All missed Surveillances will be placed in the Corrective Action Program.

If a Surveillance is not completed within the allowed delay period, then the equipment is considered inoperable or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the equipment is inoperable, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance.

Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into the specified condition in the Applicability.

This Specification ensures that system and component OPERABILITY requirements and variable limits are met before entry into the specified conditions in the Applicability for which these systems and components ensure safe operation. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to OPERABLE status before entering an associated specified condition in the Applicability.

BASES

SR 3.0.4 (continued)

A provision is included to allow entry into the specified condition in the Applicability when an LCO is not met due to Surveillance not being met in accordance with LCO 3.0.4.

However, in certain circumstances, failing to meet an SR will not result in SR 3.0.4 restricting a specified condition change. When a system, subsystem, division, component, device, or variable is inoperable or outside its specified limits, the associated SR(s) are not required to be performed, per SR 3.0.1, which states that surveillances do not have to be performed on inoperable equipment. When equipment is inoperable, SR 3.0.4 does not apply to the associated SR(s) since the requirement for the SR(s) to be performed is removed. Therefore, failing to perform the Surveillance(s) within the specified Frequency does not result in an SR 3.0.4 restriction to changing specified conditions of the Applicability. However, since the LCO is not met in this instance, LCO 3.0.4 will govern any restrictions that may (or may not) apply to specified condition changes. SR 3.0.4 does not restrict changing specified conditions of the Applicability when a Surveillance has not been performed within the specified Frequency, provided the requirement to declare the LCO not met has been delayed in accordance with SR 3.0.3.

The provisions of SR 3.0.4 shall not prevent entry into specified conditions in the Applicability that are required to comply with ACTIONS.

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the specified condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO's Applicability, would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternately, the Surveillance may be stated in the form of a Note, as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SRs' annotation is found in Section 1.4, Frequency.

B 3.1 INTER-UNIT FUEL TRANSFER

B 3.1.1 Boron Concentration

BASES

BACKGROUND

The NRC has issued Amendment 268 for the inter-unit transfer of spent nuclear fuel (Ref. 1). The Amendment is based on evaluations conducted for each aspect of the inter-unit transfer of fuel as documented in Reference 2.

The limit on the boron concentration in the Spent Fuel Pit (SFP) and the Shielded Transfer Canister (STC) ensures that the fuel in the STC remains subcritical during postulated accidents. The soluble boron concentration offsets the reactivity addition due to the postulated accidents and is measured by chemical analysis of a representative sample of the water in each of the volumes.

APPLICABLE SAFETY ANALYSIS

As required by 10 CFR 50.68 (Ref. 3), if no credit for soluble boron in the STC is taken then, the k_{eff} of the STC fuel basket loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

Reference 2 documents the results of a criticality analysis that demonstrates that the STC k_{eff} is less than or equal to 0.95 with the STC fuel basket loaded with fuel of the highest anticipated reactivity and the STC flooded with water at a temperature corresponding to the highest reactivity. The maximum calculated reactivity, which includes a margin for uncertainty in reactivity calculations, is performed for a combination of worst case tolerances and conditions, and is shown to be less than 0.95 with a 95 percent probability at a 95 percent confidence level. Under normal conditions, the water in the STC is assumed to be pure, unborated water, while under accident conditions, the soluble boron in the water is credited. A summary of the types of accidents analyzed and the soluble boron required to ensure the maximum k_{eff} remains below 0.95 is provided in Reference 2. These acceptance criteria are in accordance with 10 CFR 50.68(b) (Ref. 3).

The double contingency principle discussed in ANSI N16.1-1975 and the April 1978 NRC letter (Ref. 4) allows credit for soluble boron under other abnormal or accident conditions because only

BASES

APPLICABLE SAFETY ANALYSIS (continued)	a single accident need be considered at one time. For example, the postulated accident scenarios include dropping a fuel assembly on top of the STC basket, or accidental misloading of a fuel assembly in the STC basket. These events could increase the potential for criticality in the STC. To mitigate these postulated criticality related accidents, boron concentration is verified to be within the limits specified in LCO 3.1.1. These events could increase the potential for criticality in the STC. The criticality accidents can only take place during or as a result of the movement of an assembly. For these accident occurrences, the presence of soluble boron in the spent fuel storage pit prevents criticality in the STC. Reference 2 describes multiple fuel assembly misloads and determined that in the limiting configuration a boron concentration of 1053 ppm was required to maintain k_{eff} less than or equal to 0.95. The concentration of dissolved boron in the STC satisfies Criterion 2 of 10 CFR 50.36.
LCO	The boron concentration of the water in the spent fuel pit containing the STC and in the STC is required to be ≥ 2000 ppm. The specified concentration of dissolved boron preserves the assumptions used in the criticality accident scenarios as described in Reference 2. This concentration also preserves the criticality assumptions of the IP2 and IP3 spent fuel pools. The LCO is modified by a Note indicating that the LCO is only applicable to the spent fuel pit when the STC is in the spent fuel pit. When the STC is not in the pit the boron concentration in the pit must continue to meet the requirements of IP3 Appendix A LCO 3.7.15 or IP2 Appendix A LCO 3.7.12.
APPLICABILITY	This LCO applies whenever one or more fuel assemblies are in the STC.
ACTIONS	<u>A.1, A.2 and A.3</u> When the concentration of boron in the STC is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately

BASES

ACTIONS (continued)

suspending the movement of fuel assemblies. The concentration of boron is restored simultaneously with suspending movement of fuel assemblies. Prior to resuming movement of fuel assemblies, the concentration of boron must be restored. This does not preclude movement of a fuel assembly to a safe position.

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1

When the concentration of boron in the STC is less than required, immediate action must be taken to preclude the occurrence of an accident or to mitigate the consequences of an accident in progress. This SR is modified by a Note indicating that the surveillance is only required to be performed if the STC is submerged in water in the spent fuel pool or if water is to be added to, or recirculated through, the STC. These are the only times when a change in STC boron concentration could potentially occur. In order to preserve the assumptions of the criticality analysis, the Note further requires that water added to, or recirculated through, the STC must meet the boron concentration requirements of LCO 3.1.1. This Note does not apply to the addition of steam to the STC (Reference 1).

This SR verifies that the concentration of boron in the spent fuel pit and the STC is within the required limit. As long as this SR is met, the analyzed accidents are fully addressed. The initial surveillance within 4 hours prior to loading fuel into the STC and the 48 hour Frequency thereafter are appropriate because no major replenishment of spent fuel pit water is expected to take place over such a short period of time and any recirculation of water or water added to the STC will be accomplished using borated water at or above the required limit.

Whenever the STC is in the spent fuel pool a measurement of spent fuel pool boron concentration is equivalent to an STC boron concentration measurement.

BASES

REFERENCES

1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, June xx, 2012.

2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

3. 10 CFR 50.68, “Criticality Accident Requirements.”

4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).

B 3.1 INTER-UNIT FUEL TRANSFER

B 3.1.2 Shielded Transfer Canister (STC) Loading

BASES

BACKGROUND

As required by plant operations IP3 spent fuel is transferred to the IP2 spent fuel pit in order to maintain adequate fuel storage capacity in the IP3 spent fuel pit. IP3 spent fuel moved to the IP2 spent fuel pit is subsequently transferred to dry cask storage at the IPEC on-site Independent Spent Fuel Storage Installation (ISFSI) as part of spent fuel inventory management in the IP2 spent fuel pit. The NRC has issued Amendments 268 and 287 for the inter-unit transfer of spent nuclear fuel (Refs. 1 and 5).

Inter-unit fuel transfer operations are conducted using the Shielded Transfer Canister (STC) and the HI-TRAC 100D transfer cask. The STC is a bolted-lid pressure vessel with an internal fuel basket that accommodates up to twelve IP3 spent fuel assemblies. The STC is loaded in the IP3 spent fuel pit, placed into the HI-TRAC transfer cask in the Fuel Storage Building (FSB) truck bay, and moved outside the truck bay on air pads or other approved conveyance. The STC/HI-TRAC assemblage is transported from outside the IP3 FSB truck bay to just outside the IP2 FSB truck bay with a Vertical Cask Transporter (VCT) and moved into the IP2 FSB truck bay on a Low Profile Transporter.

The STC is removed from the HI-TRAC using the cask handling crane and placed into the IP2 spent fuel pit. The STC lid is removed and the IP3 fuel assemblies are moved to their designated IP2 wet storage rack cell locations with the spent fuel bridge crane in accordance with IP2 Appendix A TS LCO 3.7.13.

Fuel assemblies to be transferred are selected at IP3 based on the requirements for loading in the STC. The STC fuel loading requirements are such that the fuel selected for transfer to IP2 is suitable for storage in the designated IP2 spent fuel pit storage racks within the limits of IP2 Appendix A TS LCO 3.7.13 and there are open fuel cells available. Fuel move sheets will govern the transfer of the spent fuel from IP3 to IP2.

Table 3.1.2-1 “Minimum Burnup Requirements at Varying Initial Enrichments” is used to classify each assembly as either a Type 1 assembly or a Type 2 assembly based on initial U-235 enrichment and average assembly burnup. This classification is used to determine if, and where, the fuel assembly can be placed in the STC fuel basket. In the STC design, the fuel basket is divided into

BASES

BACKGROUND (continued)

twelve cells as shown in Figure 3.1.2-1, “Shielded Transfer Canister Layout (Top View)”. Type 2 assemblies are relatively less reactive assemblies and include any assembly that meets the minimum assembly average burnup at a given initial enrichment of Table 3.1.2-1. Type 2 assemblies may be stored in any cell in the STC subject to the additional restrictions of the LCO. These additional restrictions include post-irradiation cooling time, initial enrichment, allowable average burnup and decay heat of fuel and non fuel hardware as specified in Table 3.1.2-2 “Non Fuel Hardware Post Irradiation Cooling Times and Allowable Average Burnup” and Table 3.1.2-3 ”Allowable STC Loading Configurations”.

Type 1 assemblies are relatively more reactive assemblies and include any assembly that does not meet the minimum assembly average burnup at a given initial enrichment of Table 3.1.2-1. Type 1 fuel must be placed in the outer cells of the STC subject to the additional restrictions of the LCO. These additional restrictions include post-irradiation cooling time, initial enrichment, allowable average burnup and decay heat of fuel and non fuel hardware as specified in Tables 3.1.2-2 and 3.1.2-3.

Together, the limits on Type 1 and Type 2 fuel assemblies and associated non fuel hardware ensure the criticality, shielding, structural and thermal analyses performed for the STC remain bounding.

To ensure that fuel assemblies selected for transfer can be stored in the IP2 SFP only intact fuel assemblies with initial average enrichment ≤ 4.4 wt% U-235 and discharged prior to IP3 Cycle 12 can be placed in the STC basket. IP3 fuel assemblies V43 and V48 shall not be selected for transfer.

Fuel assemblies with an initial enrichment > 5.0 wt% U-235 are not shown on Table 3.1.2-1 and cannot be placed in the STC in accordance with TS 3.1.2.

APPLICABLE SAFETY ANALYSES

The STC has been analyzed for criticality prevention, heat rejection capability, shielding, and structural integrity to ensure safe transfer operations from the time that the STC is loaded at IP3 to the time it is unloaded at IP2 (Refs. 2 and 6).

As required by 10 CFR 50.68 (Ref. 3), if no credit for soluble boron in the STC is taken then, the k_{eff} of the STC fuel basket loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

BASES

APPLICABLE SAFETY ANALYSIS (continued)

Reference 2 documents the results of a criticality analysis that demonstrates that the STC k_{eff} is less than or equal to 0.95 with the STC fuel basket loaded with fuel of the highest anticipated reactivity and the STC flooded with water at a temperature corresponding to the highest reactivity. The maximum calculated reactivity, which includes a margin for uncertainty in reactivity calculations, is performed for a combination of worst case tolerances and conditions, and is shown to be less than 0.95 with a 95 percent probability at a 95 percent confidence level. Under normal conditions, the water in the STC is assumed to be pure, unborated water, while under accident conditions, the soluble boron in the water is credited. A summary of the types of accidents analyzed and the soluble boron required to ensure the maximum k_{eff} remains below 0.95 is provided in Reference 2. These acceptance criteria are in accordance with 10 CFR 50.68(b) (Ref. 3).

The criticality analysis and the limits on fuel selection prescribed in LCO 3.1.2 ensure that the effective neutron multiplication factor (k_{eff}) of a loaded STC in its most reactive configuration remains less than 0.95.

The double contingency principle discussed in ANSI N16.1-1975 and the April 1978 NRC letter (Ref. 4) allows credit for soluble boron under other abnormal or accident conditions because only a single accident need be considered at one time. For example, the accident scenarios include dropping a fuel assembly on top of the STC basket, or accidental misloading of a fuel assembly in the STC basket. These events could increase the potential for criticality in the STC. To mitigate these postulated criticality related accidents, boron concentration is verified to be within the limits specified in LCO 3.1.1, “Boron Concentration”.

Reference 2 documents the results of a thermal analysis that shows that the fuel cladding temperature remains below the acceptance criteria of 752°F and 1058°F, for normal and accident conditions respectively, at all times during inter-unit transfer and that the design pressure and temperature of the STC are not exceeded.

Reference 2 documents the results of a structural analysis that shows that the STC and HI-TRAC maintain their structural integrity under all normal, off-normal, and credible accident conditions.

BASES

APPLICABLE SAFETY ANALYSIS (continued)	Reference 2 documents the results of a shielding analysis that shows that the dose rates from the STC during the short time it is not inside the HI-TRAC are acceptable with appropriate radiation protection controls. Dose rates from the loaded HI-TRAC are shown to be low. The configuration of fuel assemblies in the STC satisfies Criterion 2 of 10 CFR 50.36.
LCO	Fuel assemblies stored in the spent fuel pit are classified in accordance with Table 3.1.2-1 based on initial enrichment and burnup which is indicative of fuel assembly reactivity. Based on this classification, fuel assembly placement in the STC cells is restricted in accordance with the classification of the fuel and the additional constraints established by this LCO. LCO 3.1.2.b is modified by a note stating that if one or more Type 1 assemblies are in the STC, cells 1, 2, 3, and 4 must be empty, with a cell blocker installed that prevents inserting fuel assemblies and/or non fuel hardware. The restriction preserves the assumptions of the bounding criticality analysis for Type 1 fuel assemblies placed only in the peripheral fuel cells.
APPLICABILITY	This LCO applies whenever one or more fuel assemblies are in the STC.
ACTIONS	<u>A.1.1</u> When the configuration of fuel assemblies or non fuel hardware in the STC is not in accordance with this LCO, one action is to make the necessary fuel assembly or non fuel hardware movement(s) to bring the configuration of the fuel in the STC into compliance with this LCO. This action restores the STC to an analyzed configuration. <u>OR</u> <u>A.1.2</u> When the configuration of fuel assemblies or non fuel hardware in the STC is not in accordance with this LCO, an optional action to restore compliance with the LCO is to move the fuel assembly or

BASES

ACTIONS (continued)	assemblies or non fuel hardware from the STC back into the IP3 spent fuel pool in accordance with Appendix A Technical Specification LCO 3.7.16. Either action places the fuel in equally safe locations. The completion time of "Immediately" is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated and completed without delay to restore the fuel location to an analyzed configuration.
SURVEILLANCE REQUIREMENTS	<u>SR 3.1.2.1</u> This SR verifies by administrative means that the fuel assembly meets the requirements of the STC location in which it is to be placed. This SR ensures the LCO limits for fuel selection and location in the STC are met and the supporting technical analyses remain bounding for all inter-unit transfer operations. <u>SR 3.1.2.2</u> This SR verifies by visual inspection that a cell blocker is installed prior to placing a Type 1 fuel assembly and/or non fuel hardware in the STC. This SR ensures that a Type 1 fuel assembly cannot be inserted into STC cells 1, 2, 3, and 4.

REFERENCES

1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, July 13, 2012.

2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

3. 10 CFR 50.68, "Criticality Accident Requirements."

4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).

5. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 287 to Facility Operating License No. DPR-26, December 22, 2017.

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REFERENCES (continued)

6. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 10.

B 3.1 INTER-UNIT FUEL TRANSFER

B 3.1.3 Shielded Transfer Canister (STC) Initial Water Level

BASES

BACKGROUND	The NRC has issued Amendment 268 for the inter-unit transfer of spent nuclear fuel (Ref. 1). The Amendment is based on evaluations conducted for each aspect of the inter-unit transfer of fuel as documented in Reference 2. The limit on the STC initial water level ensures the STC water level is within the limits assumed in both design basis and accident analyses.
APPLICABLE SAFETY ANALYSES	The accidental misloading of a high decay heat fuel assembly, the accidental misloading of multiple assemblies, or the accidental introduction of a significant amount of air into the STC would be detected based on a comparison of predicted and as measured STC pressures as a function of time (LCO 3.1.4). The predicted STC pressure rise is based on the initial STC water level being within the specified range and is therefore an initial condition in these accident analyses. The initial STC water level is also an initial condition for other accident analyses as described in Reference 2. The STC initial water level limits satisfy Criterion 2 of 10 CFR 50.36.
LCO	As indicated in the Applicable Safety Analyses, the STC initial water level is an initial condition for the accident analyses described in Reference 2 and, therefore, must be established prior to TRANSFER OPERATIONS when the STC is in the HI-TRAC and the STC lid has been installed. This LCO preserves the assumptions of the safety analyses for the STC and HI-TRAC during TRANSFER OPERATIONS.
APPLICABILITY	Prior to TRANSFER OPERATIONS when the STC is in the HI-TRAC and the STC lid has been installed.

BASES

ACTIONS	A.1 Required Action A.1 is modified by a Note indicating that the water used for level restoration must meet the boron concentration requirement of LCO 3.1.1. This requirement preserves the assumptions of the criticality analysis.
SURVEILLANCE REQUIREMENTS	SR 3.1.3.1 This SR verifies that the STC initial water level is within limit by verifying that steam is emitted from the STC drain tube during STC water level establishment and that the required volume of water is removed from the STC. As long as this SR is met, the analyzed accident assumptions are met.
REFERENCES	1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, July 13, 2012. 2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

B 3.1 INTER-UNIT FUEL TRANSFER

B 3.1.4 Shielded Transfer Canister (STC) Pressure Rise

BASES

BACKGROUND	The NRC has issued Amendment 268 for the inter-unit transfer of spent nuclear fuel (Ref. 1). The Amendment is based on evaluations conducted for each aspect of the inter-unit transfer of fuel as documented in Reference 2. The limits on the STC pressure rise ensures that there has not been an accidental misloading of a high decay heat fuel assembly or the misloading of multiple assemblies and that there is not a significant amount of air in the STC.
APPLICABLE SAFETY ANALYSES	The accidental misloading of a high decay heat fuel assembly, the accidental misloading of multiple assemblies, or the accidental introduction of a significant amount of air into the STC would be detected based on a comparison of predicted and as measured STC pressures as a function of time. Thermal analyses have been performed (Ref. 2) that predict an STC pressure rise of no more than 0.2 psi/hour after an STC loaded with the design basis heat load is placed in the HI-TRAC and the STC is sealed. The STC pressure rise limit satisfies Criterion 2 of 10 CFR 50.36.
LCO	The STC pressure rise is required to be ≤ 0.2 psi/hour averaged over a rolling 4 hour period prior to TRANSFER OPERATIONS when the STC is in the HI-TRAC and the STC lid has been installed and the STC water level established. Pressure measurements shall be taken once upon establishing required water level and hourly thereafter over a 24 hour period. Monitoring the STC pressure rise ensures that should the pressure rise limit be exceeded, appropriate actions are taken in a timely manner to return the STC to the IP3 spent fuel pool. Also note that the 24 hour STC pressure test will also be a check on the thermal properties of the STC and HI-TRAC system, such that if there were any significant changes in the thermal properties it would be expected to show as anomalous readings during the pressure test. This LCO preserves the assumptions of the safety analyses for the STC.

BASES

APPLICABILITY

Over a 24 hour period after successful completion of LCO 3.1.3 and prior to TRANSFER OPERATIONS when the STC is in the HI-TRAC and the STC lid has been installed.

ACTIONS

A.1.1

The completion time of “Immediately” is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated and completed without delay to prevent overpressurization of the STC.

A.1.2

Required Action A.1.2 is modified by a Note indicating that the water used for recirculation must meet the boron concentration requirement of LCO 3.1.1. This requirement preserves the assumptions of the criticality analysis.

The completion time of “Immediately” is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated without delay to prevent overpressurization of the STC.

A.1.3

The completion time of “Immediately” is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated and completed without delay to prevent overpressurization of the STC.

B.1.1

The completion time of 12 hours is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated to restore fuel location to an analyzed configuration. This timeframe considers the time required to complete this action and that a vent path has been established.

B.1.2

The completion time of 24 hours is appropriate because fuel located in the STC may be in an unanalyzed condition and action is required to be initiated and completed to restore fuel location to an analyzed configuration. This timeframe considers the time required to complete this action.

BASES

ACTIONS (continued)	C.1 The completion time of 24 hours is appropriate because although the fuel located in the STC is not in an unanalyzed condition prompt action is required to develop and initiate corrective actions to return the STC to compliance with LCO 3.1.3 and LCO 3.1.4.
SURVEILLANCE REQUIREMENTS	SR 3.1.4.1 This SR verifies by direct measurement that the STC cavity pressure is within limit. As long as this SR is met, the analyzed accident assumptions are met. SR 3.1.4.2 This SR verifies that an ASME code compliant pressure relief valve or rupture disc and two channels of pressure instrumentation of the required range and accuracy are installed on the STC during performance of the SR. The pressure relief valve or rupture disc protects the STC pressure boundary until it has been demonstrated that there has not been an accidental misloading of a high decay heat fuel assembly or the misloading of multiple assemblies and that there is not a significant amount of air in the STC.
REFERENCES	1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, July 13, 2012. 2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

B 3.1 INTER-UNIT FUEL TRANSFER

B 3.1.5 Shielded Transfer Canister (STC) Unloading

BASES

BACKGROUND

The NRC has issued Amendment 268 for the inter-unit transfer of spent nuclear fuel (Ref. 1). The Amendment is based on evaluations conducted for each aspect of the inter-unit transfer of fuel as documented in Reference 2.

The limits on STC unloading ensures that the fuel in the STC and the IP2 spent fuel pool remains subcritical during normal operations and postulated accidents.

The STC is removed from the HI-TRAC using the IP2 cask handling crane and placed into the IP2 spent fuel pit. The STC lid is removed and the IP3 fuel assemblies are moved to their designated IP2 wet storage rack cell locations with the spent fuel bridge crane in accordance with IP2 Appendix A TS LCO 3.7.13.

Fuel assemblies to be transferred are selected at IP3 based on the requirements for loading in the STC as specified in LCO 3.1.2. The STC fuel loading requirements are such that the fuel selected for transfer to IP2 is suitable for storage in the IP2 spent fuel pit within the limits of IP2 Appendix A TS LCO 3.7.13 and there are open fuel cells available. Fuel move sheets will govern the transfer of the spent fuel from IP3 to IP2.

APPLICABLE SAFETY ANALYSES

The STC has been analyzed for criticality prevention, heat rejection capability, shielding, and structural integrity to ensure safe transfer operations from the time that the STC is loaded at IP3 to the time it is unloaded at IP2 (Ref. 2).

As required by 10 CFR 50.68 (Ref. 3), if no credit for soluble boron in the STC is taken then, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

Reference 2 documents the results of a criticality analysis that demonstrates that the STC k_{eff} is less than or equal to 0.95 with the STC fuel basket loaded with fuel of the highest anticipated reactivity and the STC flooded with water at a temperature corresponding to the highest reactivity. The maximum calculated reactivity, which includes

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BASES

APPLICABLE SAFETY ANALYSIS (continued)

a margin for uncertainty in reactivity calculations, is performed for a combination of worst case tolerances and conditions, and is shown to be less than 0.95 with a 95 percent probability at a 95 percent confidence level. Under normal conditions, the water in the STC is assumed to be pure, unborated water, while under accident conditions, the soluble boron in the water is credited. A summary of the types of accidents analyzed and the soluble boron required to ensure the maximum k_{eff} remains below 0.95 is provided in Reference 2. These acceptance criteria are in accordance with 10 CFR 50.68(b) (Ref. 3).

The criticality analysis and the limits on fuel selection prescribed in LCO 3.1.2 ensure that the effective neutron multiplication factor (k_{eff}) of a loaded STC in its most reactive configuration remains less than 0.95. In addition, the criticality analysis and the limits on fuel selection prescribed in Appendix A TS LCO 3.7.13 ensure that k_{eff} remains below 0.95 if the spent fuel pool is flooded with borated water and below 1.0 if flood with unborated water both at the 95 percent probability, 95 percent confidence level.

The double contingency principle discussed in ANSI N16.1-1975 and the April 1978 NRC letter (Ref. 4) allows credit for soluble boron under other abnormal or accident conditions because only a single accident need be considered at one time. For example, the accident scenarios include dropping a fuel assembly on top of the STC basket, or accidental misloading of a fuel assembly in the STC basket. These events could increase the potential for criticality in the STC. To mitigate these postulated criticality related accidents, boron concentration is verified to be within the limits specified in LCO 3.1.1, “Boron Concentration”.

Reference 2 documents the results of a thermal analysis that shows that the fuel cladding temperature remains below the acceptance criteria of 752°F and 1058°F, for normal and accident conditions respectively, at all times during inter-unit transfer and that the design pressure and temperature of the STC are not exceeded.

Reference 2 documents the results of a structural analysis that shows that the STC and HI-TRAC maintain their structural integrity under all normal, off-normal, and credible accident conditions.

BASES

APPLICABLE SAFETY ANALYSIS (continued)	Reference 2 documents the results of a shielding analysis that shows that the dose rates from the STC during the short time it is not inside the HI-TRAC are acceptable with appropriate radiation protection controls. Dose rates from the loaded HI-TRAC are shown to be low. The configuration of fuel assemblies in the STC satisfies Criterion 2 of 10 CFR 50.36.
LCO	LCO 3.1.5 governs the presence of the STC in the IP2 spent fuel pit. The STC arrives at IP2 with its bolted lid in place, which preserves the fuel types and fuel locations established at IP3 when the STC was loaded. Once the STC lid is removed at IP2, this LCO requires that a transferred fuel assembly be in one of three places: 1. In an approved IP2 spent fuel pit storage rack location per Appendix A TS LCO 3.7.13, or 2. In an authorized STC fuel basket cell, or 3. In transit between these two locations. This LCO preserves the assumptions of the safety analyses for the STC and the IP2 spent fuel pit. This LCO is modified by two notes. Note 1 specifies that only IP3 spent fuel assemblies are permitted to be in the STC because the STC design and analysis are based on IP3 fuel assemblies. Therefore, loading of IP2 fuel assemblies in the STC is not authorized. Note 2 specifies that once each IP3 spent fuel assembly is removed from the STC and placed in an IP2 spent fuel pit storage rack location and released from the spent fuel bridge crane, it may not be returned to the STC. This note prevents loading IP3 fuel out of the IP2 spent fuel pit for transfer back to the STC. This is not an authorized evolution.
APPLICABILITY	The LCO is applicable whenever the STC is in the IP2 spent fuel pit.
ACTIONS	<u>A.1</u> When any IP3 spent fuel assembly transferred to the IP2 spent fuel pit is not in one of the three authorized locations, LCO 3.1.5 is

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ACTIONS (continued)

not met. Required Action A.1 specifies that action begin immediately to restore compliance with the LCO. The affected fuel assemblies must be placed in an authorized location without delay.

The completion time of "Immediately" is appropriate because fuel located in the STC or the spent fuel pit racks may be in an unanalyzed condition and action is required to be initiated and completed without delay to restore fuel location to an analyzed configuration.

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1

SR 3.1.5.1 requires that any IP3 fuel assembly being returned to the STC be verified by administrative means to have been returned to the same STC fuel basket cell location from which it was removed. This SR ensures that the loading pattern authorized when the STC was loaded at IP3 is preserved.

This SR does not apply for placing the IP3 fuel assembly in a IP2 spent fuel pit cell location because that process is governed by IP2 Appendix A TS LCO 3.7.13 and a fuel move sheet is required to place the IP3 fuel assembly in an approved location in the IP2 spent fuel pit storage racks.

REFERENCES

1. Safety Evaluation by the Office of Nuclear Reactor Regulation Related to Amendment No. 268 to Facility Operating License No. DPR-26, June xx, 2012.

2. Holtec Report HI-2094289, Licensing Report on the Inter-Unit Transfer of Spent Nuclear Fuel at Indian Point Energy Center, Revision 6.

3. 10 CFR 50.68, "Criticality Accident Requirements."

4. Double contingency principle of ANSI N16.1-1975, as specified in the April 14, 1978 NRC letter (Section 1.2) and implied in the proposed revision to Regulatory Guide 1.13 (Section 1.4, Appendix A).