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B 3.7 PLANT SYSTEMS

B 3.7.3 Control Room Emergency Outside Air Supply (CREOAS) System

BASES

BACKGROUND The CREOAS System provides a protected environment from which occupants can control the unit following an uncontrolled release of radioactivity, hazardous chemicals, or smoke. This radiologically controlled environment is termed the Control Room Envelope (CRE) and is comprised of Control Structure floor elevations 697'-0" through 783'-0" including the stairwells as described in FSAR Section 6.4 (Ref. 5).

The safety related function of the CREOAS System includes two independent and redundant high efficiency air filtration subsystems for emergency treatment of outside supply air and a CRE boundary that limits the inleakage of unfiltered air. Each CREOAS subsystem consists of an electric heater, a prefilter, an upstream high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section, a downstream HEPA filter, a CREOAS fan, a control structure heating and ventilation fan, a control room floor cooling fan, a computer room floor cooling fan, and the associated ductwork, valves or dampers, doors, barriers, and instrumentation. Prefilters and HEPA filters remove particulate matter, which may be radioactive. The charcoal adsorbers provide a holdup period for gaseous iodine, allowing time for decay. With the exception of the CREOAS fan, all other CREOAS subsystem fans operate continuously to maintain the affected compartments environment. These other ventilation fans operate independently of the CREOAS fans and are required to operate to ensure a positive pressure in the control structure is maintained utilizing filtered outside air supplied by the CREOAS fans.

The CRE is the area within the confines of the CRE boundary that contains the spaces that control room occupants inhabit to control the unit during normal and accident conditions. This area encompasses the control room, and may encompass other non-critical areas to which frequent personnel access or continuous occupancy is not necessary in the event of an accident. The CRE is protected during normal operation, natural events, and

(continued)

BASES

BACKGROUND (continued)

accident conditions. The CRE boundary is the combination of walls, floor, roof, ducting, doors, penetrations and equipment that physically form the CRE. The OPERABILITY of the CRE boundary must be maintained to ensure that the inleakage of unfiltered air into the CRE will not exceed the inleakage assumed in the licensing basis analysis of design basis accident (DBA) consequences to CRE occupants. The CRE and its boundary are defined in the Control Room Envelope Habitability Program.

Upon receipt of the initiation signal(s) (indicative of conditions that could result in radiation exposure to CRE occupants), the CREOAS System automatically switches to the pressurization/filtration mode of operation to minimize infiltration of contaminated air into the CRE. A system of dampers aligns the outside air intake to the CREOAS fan suction and filter train. Outside air is taken in at the normal ventilation intake and passed through one of the charcoal adsorber filter subsystems. The filtered air leaving the CREOAS filtration train is routed to the inlet of the other ventilation fans for distribution.

One of the CREOAS System design requirements is to maintain a habitable environment in the CRE for a 30 day continuous occupancy after a DBA without exceeding 5 rem whole body dose or its equivalent to any part of the body. A single CREOAS subsystem operating at a flow rate of ≤ 5810 cfm with an intact CRE will pressurize the CRE (which includes the control room) to greater than or equal to 0.125 inches water gauge relative to external areas adjacent to the CRE boundary to minimize infiltration of air from all surrounding areas adjacent to the CRE boundary. CREOAS System operation in maintaining CRE habitability is discussed in the FSAR, Chapters 6 and 9, (Refs. 1 and 2, respectively).

APPLICABLE SAFETY ANALYSES

The ability of the CREOAS System to maintain the habitability of the CRE is an explicit assumption for the safety analyses presented in the FSAR, Chapters 6 and 15 (Refs. 1 and 3,

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

respectively). The pressurization/filtration mode of the CREOAS System is assumed to operate following a DBA as discussed in the FSAR, Section 6.4.1 (Ref. 4). The radiological doses to the CRE occupants as a result of the various DBAs are summarized in Reference 3. No single active failure will cause the loss of outside or recirculated air from the CRE.

The CREOAS System provides protection from smoke and hazardous chemicals to the CRE occupants. The analysis of hazardous chemical releases demonstrates that the toxicity limits are not exceeded in the CRE following a hazardous chemical release (Ref. 5). The evaluation of a smoke challenge demonstrates that it will not result in the inability of the CRE occupants to control the reactor either from the control room or from the remote shutdown panels (Ref. 6).

The CREOAS System satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Two redundant subsystems of the CREOAS System are required to be OPERABLE to ensure that at least one is available, if a single active failure disables the other subsystem. Total CREOAS System failure, such as from a loss of both ventilation subsystems or from an inoperable CRE boundary, could result in exceeding a dose of 5 rem whole body or equivalent to the CRE occupants in the event of a DBA.

Each CREOAS subsystem is considered OPERABLE when the individual components necessary to limit CRE occupant exposure are OPERABLE. Both subsystems are considered OPERABLE when:

a. Both filter trains each consisting of a CREOAS fan heater, a HEPA filter, and charcoal adsorber which is not excessively restricting flow is OPERABLE; and

b. Both Control Structure Heating and Ventilation fans, Computer Room Floor Cooling fans, and Control Room Floor Cooling fans are OPERABLE; and

(continued)

BASES

LCO (continued)

c. Ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

d. Neither Smoke Removal Fan (0V104A/B) is in operation.

One subsystem is considered OPERABLE when:

a. One filter train consisting of a CREOAS fan, heater, a HEPA filter, and charcoal adsorber which is not excessively restricting flow is OPERABLE; and

b. The 'A' Control Structure Heating and Ventilation fan (0V103A) and the 'A' Computer Room Floor Cooling fan (0V115A) and the 'A' Control Room Floor Cooling fan (0V117A) are OPERABLE

OR

The 'B' Control Structure Heating and Ventilaiton fan (0V103B) and the 'B' Computer Room Floor Cooling fan (0V115B) and the 'B' Control Room Floor Cooling fan (0V117B) are OPERABLE

(These fans are not dedicated to either CREOAS subsystem. As a result when any one set of fans is not OPERABLE, one arbitrarily determined CREOAS subsystem is not OPERABLE): and

c. Ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

d. Neither Smoke Removal Fan (0V104A/B) is in operation.

In order for the CREOAS subsystems to be considered OPERABLE, the CRE boundary must be maintained such that the CRE occupant dose from a large radioactive release does not exceed the calculated dose in the licensing basis consequence analyses for DBAs, and that CRE occupants are protected from hazardous chemicals and smoke. Note the CRE can not be maintained with a smoke removal fan (0V104A or 0V104B) in operation.

(continued)

BASES

LCO (continued)

The LCO is modified by a Note allowing the CRE boundary to be opened intermittently under administrative controls. This Note only applies to openings in the CRE boundary that can be rapidly restored to the design condition, such as doors, hatches, floor plugs, and access panels. For entry and exit through doors the administrative control of the opening is performed by the person(s) entering or exiting the area. For other openings, these controls should be proceduralized and consist of stationing a dedicated individual at the opening who is in continuous communication with the operators in the CRE. This individual will have a method to rapidly close the opening and to restore the CRE boundary to a condition equivalent to the design condition when a need for CRE isolation is indicated.

APPLICABILITY

In MODES 1, 2, and 3, the CREOAS System must be OPERABLE to ensure that the CRE will remain habitable during and following a DBA, since the DBA could lead to a fission product release.

In MODES 4 and 5, the probability and consequences of a DBA are reduced because of the pressure and temperature limitations in these MODES. Therefore, maintaining the CREOAS System OPERABLE is not required in MODE 4 or 5, except for the following situations under which significant radioactive releases can be postulated:

a. During operations with a potential for draining the reactor vessel (OPDRVs);

b. During CORE ALTERATIONS; and

c. During movement of irradiated fuel assemblies in the secondary containment.

(continued)

BASES

ACTIONS

A.1

With one CREOAS subsystem inoperable, for reasons other than an inoperable CRE boundary, the inoperable CREOAS subsystem must be restored to OPERABLE status within 7 days. With the unit in this condition, the remaining OPERABLE CREOAS subsystem is adequate to perform the CRE occupant protection function. However, the overall reliability is reduced because a failure in the OPERABLE subsystem could result in loss of the CREOAS System function. The 7 day Completion Time is based on the low probability of a DBA occurring during this time period, and that the remaining subsystem can provide the required capabilities.

B.1, B.2, and B.3

If the unfiltered inleakage of potentially contaminated air past the CRE boundary and into the CRE can result in CRE occupant radiological dose greater than the calculated dose of the licensing basis analyses of DBA consequences (allowed to be up to 5 rem whole body or its equivalent to any part of the body), or inadequate protection of CRE occupants from hazardous chemicals or smoke, the CRE boundary is inoperable. Actions must be taken to restore an OPERABLE CRE boundary within 90 days.

During the period that the CRE boundary is considered inoperable, action must be initiated to implement mitigating actions to lessen the effect on CRE occupants from the potential hazards of a radiological or chemical event or a challenge from smoke. Actions must be taken within 24 hours to verify that in the event of a DBA, the mitigating actions will ensure that CRE occupant radiological exposures will not exceed the calculated dose of the licensing basis analyses of DBA consequences, and that CRE occupants are protected from hazardous chemicals and smoke. These mitigating actions (i.e., actions that are taken to offset the consequences of the inoperable CRE boundary) should be preplanned for implementation upon entry into the condition, regardless of whether entry is intentional or unintentional.

(continued)

BASES

ACTIONS (continued)

B.1, B.2, and B.3 (continued)

The 24 hour Completion Time is reasonable based on the low probability of a DBA occurring during this time period, and the use of mitigating actions. The 90 day Completion Time is reasonable based on the determination that the mitigating actions will ensure protection of CRE occupants within analyzed limits while limiting the probability that CRE occupants will have to implement protective measures that may adversely affect their ability to control the reactor and maintain it in a safe shutdown condition in the event of a DBA. In addition, the 90 day Completion Time is a reasonable time to diagnose, plan and possibly repair, and test most problems with the CRE boundary.

C.1 and C.2

In MODE 1, 2, or 3, if the inoperable CREOAS subsystem or the CRE boundary cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that minimizes accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours and in MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

(continued)

BASES

ACTIONS (continued)

D.1, D.2.1, D.2.2, and D.2.3

The Required Actions of Condition D are modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require either an entry into LCO 3.0.3 or a reactor shutdown in accordance with LCO 3.0.3.

During movement of irradiated fuel assemblies in the secondary containment, during CORE ALTERATIONS, or during OPDRVs, if the inoperable CREOAS subsystem cannot be restored to OPERABLE status within the required Completion Time, the OPERABLE CREOAS subsystem may be placed in the pressurization/filtration mode. This action ensures that the remaining subsystem is OPERABLE, that no failures that would prevent automatic actuation will occur, and that any active failure will be readily detected.

An alternative to Required Action D.1 is to immediately suspend activities that present a potential for releasing radioactivity that might require isolation of the CRE. This places the unit in a condition that minimizes the accident risk.

If applicable, CORE ALTERATIONS and movement of irradiated fuel assemblies in the secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. Also, if applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and the subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

E.1

If both CREOAS subsystems are inoperable in MODE 1, 2, or 3, for reasons other than an inoperable CRE boundary (i.e., Condition B) the CREOAS System may not be capable of performing the intended function and the unit is in a condition outside of the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

(continued)

BASES

ACTIONS (continued)

F.1, F.2, and F.3

The Required Actions of Condition F are modified by a Note indicating that LCO 3.0.3 does not apply. If moving irradiated fuel assemblies while in MODE 1, 2, or 3, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require either an entry into LCO 3.0.3 or a reactor shutdown in accordance with LCO 3.0.3.

During movement of irradiated fuel assemblies in the secondary containment, during CORE ALTERATIONS, or during OPDRVs, with two CREOAS subsystems inoperable or with one or more CREOAS subsystems inoperable due to an inoperable CRE boundary, action must be taken immediately to suspend activities that present a potential for releasing radioactivity that might require pressurization of the CRE. This places the unit in a condition that minimizes the accident risk.

If applicable, CORE ALTERATIONS and movement of irradiated fuel assemblies in the secondary containment must be suspended immediately. Suspension of these activities shall not preclude completion of movement of a component to a safe position. If applicable, actions must be initiated immediately to suspend OPDRVs to minimize the probability of a vessel draindown and subsequent potential for fission product release. Actions must continue until the OPDRVs are suspended.

SURVEILLANCE REQUIREMENTS

SR 3.7.3.1

This SR verifies that a CREOAS fan in a standby mode starts on demand from the control room and continues to operate with flow through the HEPA filters and charcoal adsorbers. Standby systems should be checked periodically to ensure that they start and function properly. As the environmental and normal operating conditions of this system are not severe, testing each subsystem once every month provides an adequate check on this system. Monthly heater operation dries out any moisture that has accumulated in the charcoal as a result of humidity in the

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.7.3.1 (continued)

ambient air. Systems with heaters must be operated for ≥ 10 continuous hours with the heaters energized. Furthermore, the 31 day Frequency is based on the known reliability of the equipment and the availability of two redundant subsystems.

SR 3.7.3.2

This SR verifies that the required CREOAS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test Frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.3.3

This SR verifies that on an actual or simulated initiation signal, each CREOAS subsystem starts and operates. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.7.1.5 overlaps this SR to provide complete testing of the safety function. The 24 month Frequency is consistent with industry practice and other filtration systems SRs.

SR 3.7.3.4

This SR verifies the OPERABILITY of the CRE boundary by testing for unfiltered air inleakage past the CRE boundary and into the CRE. The details of the testing are specified in the Control Room Envelope Habitability Program.

The CRE is considered habitable when the radiological dose to CRE occupants calculated in the licensing basis analyses of DBA consequences is no more than 5 rem whole body or its equivalent to any part of the body and the CRE occupants are protected from hazardous chemicals and smoke. This SR verifies that the unfiltered air inleakage into the CRE is no

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

greater than the flow rate assumed in the licensing basis analyses of DBA consequences. When unfiltered air inleakage is greater than the assumed flow rate, Condition B must be entered. Required Action B.3 allows time to restore the CRE boundary to OPERABLE status provided mitigating actions can ensure that the CRE remains within the licensing basis habitability limits for the occupants following an accident. Compensatory measures are discussed in Regulatory Guide 1.196, Section C.2.7.3, (Ref. 7) which endorses, with exceptions, NEI 99-03, Section 8.4 and Appendix F (Ref. 8). These compensatory measures may also be used as mitigating actions as required by Required Action B.2. Temporary analytical methods may also be used as compensatory measures to restore OPERABILITY (Ref. 9). Options for restoring the CRE boundary to OPERABLE status include changing the licensing basis DBA consequence analysis, repairing the CRE boundary, or a combination of these actions. Depending upon the nature of the problem and the corrective action, a full scope inleakage test may not be necessary to establish that the CRE boundary has been restored to OPERABLE status.

BASES

REFERENCES

1. FSAR, Chapter 6.
2. FSAR, Chapter 9.
3. FSAR, Chapter 15.
4. FSAR, Section 6.4.1.
5. FSAR, Section 6.4.
6. FSAR, Section 9.5.
7. Regulatory Guide 1.196.
8. NEI 99-03, "Control Room Habitability Assessment," June 2001.
9. Letter from Eric J. Leeds (NRC) to James W. Davis (NEI) dated January 30, 2004, "NEI Draft White Paper, Use of Generic Letter 91-18 Process and Alternative Source Terms in the Context of Control Room Habitability." (ADAMS Accession No. ML040300694).