

3.12 LIMITING CONDITIONS FOR OPERATION

3.12 REFUELING AND SPENT FUEL HANDLING

Applicability:

Applies to fuel handling, core reactivity limitations, and spent fuel handling.

Objective:

To assure core reactivity is within capability of the control rods, to prevent criticality during refueling, and to assure safe handling of spent fuel casks.

Specification:

A. Refueling Interlocks

The reactor mode switch shall be locked in the "Refuel" position during core alterations and;

1. The refueling interlocks shall be operable during in-vessel fuel movement for the equipment utilized in moving fuel.

If one or more of the required refueling interlocks are inoperable;

Immediately suspend fuel movement with equipment associated with the inoperable interlock(s),

-or-

Immediately insert a control rod withdrawal block and verify all control rods are fully inserted.

2. The refueling interlocks shall be operable except as specified in Specification 3.12.D and 3.12.E.

4.12 SURVEILLANCE REQUIREMENTS

4.12 REFUELING AND SPENT FUEL HANDLING

Applicability:

Applies to the periodic testing of those interlocks and instruments used during refueling and to the testing of the reactor building crane.

Objective:

To verify the operability of instrumentation and interlocks used in refueling and the operability of the reactor building crane.

Specification:

A. Refueling Interlocks

Prior to any fuel handling, with the Head off the reactor vessel, the following required refueling interlock inputs shall be functionally tested once every 7 days:

- a. All-rods-in;
- b. Refuel platform position;
- c. Refuel platform fuel grapple, fuel loaded;
- d. Refuel platform frame mounted hoist, fuel loaded;
- e. Refuel platform monorail mounted hoist, fuel loaded.

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#### B. Core Monitoring

During core alterations two SRMs shall be operable, one in the core quadrant where fuel or control rods are being moved and one in an adjacent quadrant. For an SRM to be considered operable the following conditions shall be satisfied:

1. The SRM shall be inserted to the normal operating level. (Use of special movable, dunking type detectors during initial fuel loading and major core alterations in place of normal detectors is permissible as long as the detectors are connected into the proper circuitry which contain the required rod blocks).
2. The SRM shall have a minimum of 3 cps with all rods fully inserted in the core.

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#### B. Core Monitoring

Prior to making any alterations to the core the SRMs shall be functionally tested and checked for neutron response. Thereafter, the SRMs shall be checked daily for response.

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#### D. Control Rod and Control Rod Drive Maintenance

One control rod may be withdrawn from the core for the purpose of performing control rod and/or control rod drive maintenance provided the following conditions are satisfied:

1. The reactor mode switch shall be locked in the "Refuel" position and the required refueling interlocks shall be operable.
2. Specification 3.3.A.1 shall be met, or the control rod directional control valves for a minimum of eight control rods surrounding the drive out of service for maintenance shall be disarmed electrically and sufficient margin to criticality demonstrated.
3. SRMs shall be operable in the core quadrant containing the control rod on which maintenance is being performed and in an adjacent quadrant. The requirements for an SRM to be considered operable are given in Specification 3.12.B.

### 4.12 SURVEILLANCE REQUIREMENTS

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#### D. Control Rod and Control Rod Drive Maintenance

1. Prior to performing this maintenance, core shutdown margin shall be determined in accordance with Specification 3.3.A.1 to ensure that the core can be made subcritical at any time during the maintenance with the strongest operable control rod fully withdrawn and all other operable rods fully inserted.
2. Alternately, if a minimum of eight control rods surrounding the control rod out of service for maintenance are to be fully inserted and have their directional control valves electrically disarmed, the required shutdown margin shall be met with the strongest control rod remaining in service during the maintenance period fully withdrawn.

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#### E. Extended Core Maintenance

One or more control rods may be withdrawn or removed from the reactor core provided the following conditions are satisfied:

1. The reactor mode switch shall be locked in the "Refuel" position. The refueling interlock which prevents more than one control rod from being withdrawn may be bypassed on a withdrawn control rod after the fuel assemblies in the cell containing (controlled by) that control rod have been removed from the reactor core. The required refueling interlocks shall be operable.
2. SRMs shall be operable in the core quadrant where fuel or control rods are being moved, and in an adjacent quadrant. The requirements for an SRM to be considered operable are given in Specification 3.12.B.
3. If the spiral unload/reload method of core alteration is to be used, the following conditions shall be met:
  - a. Prior to spiral unload and reload, the SRMs shall be proven operable as stated in Specification 3.12.B1 and 3.12.B2. However, during spiral unloading, the count rate may drop below 3 cps.

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#### E. Extended Core Maintenance

Prior to control rod withdrawal for extended core maintenance, that control rod's control cell shall be verified to contain no fuel assemblies.

1. This surveillance requirement is the same as that given in Specification 4.12.A.
2. This surveillance requirement is the same as that given in Specification 4.12.B.

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#### F. Fuel Movement

The reactor shall be shut down for a minimum of 24 hours prior to fuel movement within the reactor core.

#### G. Crane Operability

1. The Reactor Building crane shall be operable when the crane is used for handling of a spent fuel cask.

### 4.12 SURVEILLANCE REQUIREMENTS

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#### F. Fuel Movement

Prior to any fuel handling or movement in the reactor core, the licensed operator shall verify that the reactor has been shut down for a minimum of 24 hours.

#### G. Crane Operability

1. a. Within one month prior to spent fuel cask handling operations, an inspection of crane cables, sheaves, hook, yoke, and cask lifting trunnions will be made. These inspections shall meet the requirements of ANSI Standard B30.2, 1967. A crane rope shall be replaced if any of the replacement criteria given in ANSI B30.2.0-1967 are met.
- b. No-load mechanical and electrical tests will be conducted prior to lifting the empty cask from its transport vehicle to verify proper operation of crane controls, brakes and lifting speeds. A functional test of the crane brakes will be conducted each time an empty cask is lifted clear of its transport vehicle.

BASES:3.12 & 4.12 REFUELING

- A. During refueling operations, the reactivity potential of the core is being altered. It is necessary to require certain interlocks and restrict certain refueling procedures such that there is assurance that inadvertent criticality does not occur.

To minimize the possibility of loading fuel into a cell containing no control rod, it is required that all control rods are fully inserted when fuel is being loaded into the reactor core. This requirement assures that during refueling the refueling interlocks, as designed, will prevent inadvertent criticality. Should the interlocks be made or found to be inoperable, the specifications offer an alternative to the cessation of fuel movement, not withstanding the completion of movement of a component to a safe position. The alternative is to immediately block control rod withdrawal and then perform a verification that all control rods are fully inserted. The core reactivity limitation of Specification 3.3 limits the core alterations to assure that the resulting core loading can be controlled with the Reactivity Control System and interlocks at any time during shutdown or the following operating cycle.

The addition of large amounts of reactivity to the core is prevented by operating procedures, which are in turn backed up by refueling interlocks on rod withdrawal and movement of the refueling platform. When the mode switch is in the "Refuel" position, interlocks prevent the refueling platform from being moved over the core if a control rod is withdrawn and fuel is on a hoist.

Likewise, if the refueling platform is over the core with fuel on a hoist, control rod motion is blocked by the interlocks. With the mode switch in the refuel position, only one control rod can be withdrawn.

As discussed above, the purpose of the refueling interlocks is to prevent inadvertent criticality by ensuring that fuel is not loaded into a cell with a withdrawn control rod. The alternative identified within the specifications to continue fuel movement with inoperable interlocks satisfies this goal. The first refueling interlock safety function is to block control rod withdrawal whenever fuel is being moved in the reactor vessel. The alternative performs this function by requiring that a control rod block be placed in effect. The second refueling interlock safety function is to prevent fuel from being loaded into the vessel when a control rod is withdrawn. This function will continue to be performed by the second step of the alternative which is to verify that all control rods are fully inserted. Therefore, the alternative provides equal assurance against inadvertent criticality during fuel handling within the reactor vessel with inoperable interlocks.

The Surveillance Requirements for the refueling interlocks identify that the "required interlock inputs" shall be functionally tested. The intent of this statement is that only the interlock inputs associated with the equipment actually used to facilitate the core alteration is required to be functionally tested. For example, if the main mast is to be used for fuel movement, then the interlock inputs associated with the main mast need to be functionally tested. Conversely, if the frame mounted hoist and monorail mounted hoist, will not be utilized, then the interlock inputs associated with the frame mounted hoist and monorail mounted hoist need not be functionally tested.

BASES: 3.12 & 4.12 (Cont'd)

- B. The SRMs are provided to monitor the core during periods of station shutdown and to guide the operator during refueling operations and station startup. Requiring two operable SRMs in or adjacent to any core quadrant where fuel or control rods are being moved assures adequate monitoring of that quadrant during such alterations. The requirement of 3 counts per second provides assurance that neutron flux is being monitored. Under the special condition of complete spiral core unloading, it is expected that the count rate of the SRMs will drop below 3 cps before all the fuel is unloaded. Since there will be no reactivity additions, a lower number of counts will not present a hazard. When all of the fuel has been removed to the spent fuel storage pool, the SRMs will no longer be required. Requiring the SRMs to be operational prior to fuel removal assures that the SRMs are operable and can be relied on even when the count rate may go below 3 cps.

Prior to spiral reload, two diagonally adjacent fuel assemblies, which have previously accumulated exposure in the reactor, will be loaded into core positions next to each of the 4 SRMs to obtain the required 3 cps. Exposed fuel continuously produces neutrons by spontaneous fission of certain plutonium isotopes, photo fission, and photo disintegration of deuterium in the moderator. This neutron production is normally great enough to meet the 3 cps minimum SRM requirement, thereby providing a means by which SRM response may be demonstrated before the spiral reload begins. During the spiral reload, the fuel will be loaded in the reverse sequence that it was unloaded with the exception of the initial eight (8) fuel assemblies which are loaded next to the SRMs to provide a means of SRM response.

- C. To assure that there is adequate water to shield and cool the irradiated fuel assemblies stored in the pool, a minimum pool water level is established. This minimum water level of 36 feet is established because it would be a significant change from the normal level, well above a level to assure adequate cooling (just above active fuel).
- D. During certain periods, it is desirable to perform maintenance on a single control rod and/or control rod drive. This specification provides assurance that inadvertent criticality does not occur during such maintenance.

The maintenance is performed with the mode switch in the "Refuel" position to provide the refueling interlocks normally available during refueling operations as explained in Part A of these Bases. Refueling interlocks restrict the movement of control rods and the operation of the refueling equipment to reinforce operational procedures that prevent the reactor from becoming critical during refueling operations. During refueling operations, no more than one control rod is permitted to be withdrawn from a core cell containing one or more fuel assemblies. The refueling interlocks use the "full-in" position indicators to determine the position of all control rods. If the "full-in" position signal is not present for every control rod, then the "all-rods-in" permissive for the refueling equipment interlocks is not present and fuel loading and control rod withdrawal is prevented. The refuel position one-rod-out interlock will not allow the withdrawal of a second control rod. The requirement that an adequate shutdown margin be determined with the control rods remaining in service ensures that inadvertent criticality cannot occur during this maintenance. Disarming the directional control valves does not inhibit control rod scram capability.

BASES: 3.12 & 4.12 (Cont'd)

- E. The intent of this specification is to permit the unloading of a portion of the reactor core for such purposes as inservice inspection requirements, examination of the core support plate, control rod, control rod drive maintenance, etc. This specification provides assurance that inadvertent criticality does not occur during such operation.

This operation is performed with the mode switch in the "Refuel" position to provide the refueling interlocks normally available during refueling as explained in the Bases for Specification 3.12.A. In order to withdraw more than one control rod, it is necessary to bypass the refueling interlock on each withdrawn control rod which prevents more than one control rod from being withdrawn at a time. The requirement that the fuel assemblies in the cell controlled by the control rod be removed from the reactor core before the interlock can be bypassed ensures that withdrawal of another control rod does not result in inadvertent criticality. Each control rod essentially provides reactivity control for the fuel assemblies in the cell associated with that control rod. Thus, removal of an entire cell (fuel assemblies plus control rod) results in a lower reactivity potential of the core.

One method available for unloading or reloading the core is the spiral unload/reload. Spiral reloading and unloading encompass reloading or unloading a cell on the edge of a continuous fueled region (the cell can be reloaded or unloaded in any sequence.) The pattern begins (for reloading) and ends (for unloading) around a single SRM. The spiral reloading pattern is the reverse of the unloading pattern, with the exception that two diagonally adjacent bundles, which have previously accumulated exposure in-core, and placed next to each of the four SRMs before the actual spiral reloading begins. The spiral reload can be to either the original configuration or a different configuration.

Additionally, at least 50% of the fuel assemblies to be reloaded into the core shall have previously accumulated a minimum exposure of 1000 Mwd/T to ensure the presence of a minimum neutron flux as described in Bases Section 3.12.B.

- F. The intent of this specification is to assure that the reactor core has been shut down for at least 24 hours following power operation and prior to fuel handling or movement. The safety analysis for the postulated refueling accident assumed that the reactor had been shut down for 24 hours for fission product decay prior to any fuel handling which could result in dropping of a fuel assembly.
- G. The operability requirements of the reactor building crane ensures that the redundant features of the crane have been adequately inspected just prior to using it for handling of a spent fuel cask. The redundant hoist system ensures that a load will not be dropped for any postulated credible single component failures. Details of the design of the redundant features of the crane and specific testing requirements for the crane are delineated in the Vermont Yankee document entitled "Reactor Building Crane Modification" (December 1975).
- H. The Spent Fuel Pool Cooling System is designed to maintain the pool water temperature below 125°F during normal refueling operations. If the reactor core is completely discharged, the temperature of the pool water may increase to greater than 125°F. The RHR System supplemental fuel pool cooling may be used under these conditions to maintain the pool water temperature less than 150°F.