## 19. ALTERATION OF THE REACTOR CORE (CORE ALTERATION)

The addition, removal, relocation or movement of fuel, sources, incore instruments* or reactivity controls within the reactor pressure vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of the movement of a component to a safe conservative position.

* Routine replacement of incore detectors (e.g. LPRMs, Traversing Incore Probes, etc.) that are not otherwise required to be OPERABLE does not constitute CORE ALTERATIONS.

## 20. REACTOR VESSEL PRESSURE

Unless otherwise indicated, reactor vessel pressures listed in the Technical Specifications are those measured by the reactor vessel steam space detectors.

## 21. THERMAL PARAMETERS

a. Minimum Critical Power Ratio (MCPR) - The value of critical power ratio (CPR) for that fuel bundle having the lowest CPR.

b. Critical Power Ratio (CPR) - The ratio of that fuel bundle power which would produce boiling transition to the actual fuel bundle power.

c. Transition Boiling - Transition boiling means the boiling regime between nucleate and film boiling. Transition boiling is the regime in which both nucleate and film boiling occur intermittently with neither type being completely stable.

d. Limiting Control Rod Pattern - A limiting control rod pattern for rod withdrawal error (RWE) exists when a) core thermal power is greater than or equal to 30% of rated and less than 90% of rated ($30\% \leq P < 90\%$) and the MCPR is less than 1.70, or b) core thermal power is greater than or equal to 90% of rated ($P \geq 90\%$) and the MCPR is less than 1.40.

e. Linear Heat Generation Rate - The heat output per unit length of fuel pin.

f. Fraction of Rated Power (FRP) - The fraction of rated power is the ratio of core thermal power to rated thermal power of 1658 MWth.

g. Total Peaking Factor (TPF) - The ratio of local LHGR for any specific location on a fuel rod divided by the core average LHGR associated with the fuel bundles of the same type operating at the core average bundle power.

h. Maximum Total Peaking Factor (MTPF) - The largest TPF which exists in the core for a given class of fuel for a given operating condition.

34. VENTING

VENTING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during the process. Vent, used in system names, does not imply a VENTING process.

35. PROCESS CONTROL PROGRAM (PCP)

The PROCESS CONTROL PROGRAM shall generally describe the essential process controls and checks used to assure that a process for solidifying radioactive waste from a liquid system produces a product that is acceptable for burial according to 10 CFR Part 61.56.

36. MEMBER(S) OF THE PUBLIC

Member(s) of the Public are persons who are not occupationally associated with Iowa Electric Light and Power Company and who do not normally frequent the DAEC site. The category does not include contractors, contractor employees, vendors, or persons who enter the site to make deliveries or to service equipment.

37. SITE BOUNDARY

The Site Boundary is that line beyond which the land is neither owned, nor leased, nor otherwise controlled by IELP. UFSAR Figure 1.2-1 identifies the DAEC Site Boundary. For the purpose of implementing radiological effluent technical specifications, the Unrestricted Area is that land (offsite) beyond the Site Boundary.

38. ANNUAL

Occurring every 12 months.

For the purpose of designating surveillance test frequencies, annual surveillance tests are to be conducted at least once per 12 months.

39. CORE OPERATING LIMITS REPORT

Core Operating Limits Report is the DAEC-specific document that provides cycle-specific operating limits for the current operating reload cycle. These cycle-specific operating limits shall be determined for each reload cycle in accordance with TS 6.11.2. Plant operation within these limits is addressed in individual technical specifications.

40. SHUTDOWN MARGIN

SHUTDOWN MARGIN is the amount of reactivity by which the reactor is subcritical or would be subcritical assuming all control rods are inserted, except for the analytically strongest worth control rod, which is fully withdrawn, with the core in its most reactive state during the OPERATING CYCLE.

LIMITING CONDITIONS FOR OPERATION

3.9 CORE ALTERATIONS

Applicability:

Applies to fuel handling and core reactivity limitations during refueling and CORE ALTERATIONS.

Objective:

To ensure that core reactivity is within the capability of the control rods and to prevent criticality during refueling.

Specification:

A. Refueling Interlocks

1. The reactor mode switch shall be locked in the "Shutdown" or "Refuel" position during CORE ALTERATIONS.

a. The reactor mode switch may be placed in the RUN, Startup/Hot Standby, and Shutdown position to test the switch interlock functions provided:

1) All control rods remain fully inserted in core cells containing one or more fuel assemblies except for the control rod that is being exercised to test interlock functions, and

2) No other CORE ALTERATIONS are in progress.

b. The refueling interlocks shall be OPERABLE except as specified in Specification 3.9.A.4.

2. Fuel shall not be loaded into the reactor core unless all control rods are fully inserted except as specified in Specification 3.9.A.4.

SURVEILLANCE REQUIREMENT

4.9 CORE ALTERATIONS

Applicability:

Applies to the periodic testing of those interlocks and instrumentation used during refueling and CORE ALTERATIONS.

Objective:

To verify the operability of instrumentation and interlocks used in refueling and CORE ALTERATIONS.

Specification:

A. Refueling Interlocks

1. Prior to any fuel handling with the head off the reactor vessel, those refueling interlocks applicable to the equipment being used shall be functionally tested. They shall be tested at weekly intervals thereafter until no longer required. They shall also be tested following any repair work associated with the interlocks.

a. The fuel grapple hoist load switch shall be set at ≤ 400 lbs.

b. If the frame-mounted auxiliary hoist, the monorail-mounted auxiliary hoist, or the service platform hoist is to be used for handling fuel with the head off the reactor vessel, the load limit switch on the hoist to be used shall be set at ≤ 400 lbs.

2. Observe that any control rod drive mechanism which has been uncoupled from and subsequently re-coupled to its control rod does not go to the overtravel position.

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| 3. Single Control Rod/Drive Mechanism Withdrawal or Removal | 3. Single Control Rod/Drive Mechanism Withdrawal or Removal |
| With fuel in the reactor pressure vessel, one<br>- control rod, or<br>- control rod drive mechanism, or<br>- control rod and the associated control drive mechanism<br>may be withdrawn or removed from the core provided 3.9.A.3.a, b, c and d are satisfied until a control rod and associated control rod drive mechanism are re-installed and the control rod is fully inserted. | Prior to withdrawal or removal of one<br>- control rod, or<br>- control rod drive mechanism, or<br>- control rod and the associated control rod drive mechanism<br>from the core (and at least daily thereafter), verify that the conditions stated in 3.9.A.3.a, and b, and c, and d are met until no longer required. |
| a. One of the following conditions are met:<br>1) The four fuel assemblies are removed from the core cell surrounding the control rod and/or control rod drive mechanism undergoing withdrawal or removal, or<br>2) the directional control valves are electrically disarmed on at least the other control rods in the 5 x 5 array centered on the control rod and/or control rod drive mechanism undergoing withdrawal or removal. | |

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| | |

b. One of the following reactivity conditions are met:

1) The reactivity margin requirements in Specification 3.3.A.1 are met except that:

a) The control rod selected for withdrawal or removal may be assumed to be the highest worth rod required to be assumed fully withdrawn for verification of SHUTDOWN MARGIN, <u>and</u>

b) The control rod selected for withdrawal or removal need not be assumed to be untrippable or stuck,

<u>or</u>

2) it can be verified by demonstration or analysis that the core is subcritical with a margin of at least 0.38% $\Delta$ k/k at any time.

c. The conditions for Core and Containment Cooling systems as required by Specification 3.5.G are met.

d. All other control rods are fully inserted in the core.

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| 4. <u>Multiple Control Rods/Drive Mechanisms Withdrawal or Removal</u> | 4. <u>Multiple Control Rods/Drive Mechanisms Withdrawal or Removal</u> |
| With fuel in the reactor pressure vessel, any number of<br>- control rods, <u>or</u><br>- control rod drive mechanisms, <u>or</u><br>- control rods and associated control rod drive mechanisms<br><br>may be withdrawn or removed from the core provided the following conditions are satisfied until all control rods and control rod drive mechanisms are re-installed and all control rods are fully inserted in the core. | Prior to withdrawal or removal of<br>- control rods, <u>or</u><br>- control rod drive mechanisms, <u>or</u><br>- control rods and associated control rod drive mechanisms<br><br>from the core (and at least daily thereafter), verify that the conditions stated in 3.9.A.4.a, <u>and</u> b, <u>and</u> c, <u>and</u> d, <u>and</u> e are met until no longer required. |
| a. The reactor mode switch is locked in the "Refuel" position and all "Refueling Interlocks" are OPERABLE except that the Refuel position "One-Rod-Out" Interlock function may be bypassed for control rods and/or control rod drive mechanisms undergoing withdrawal or removal after the four fuel assemblies have been removed as specified below. | |
| b. The four fuel assemblies are removed from the core cell surrounding control rods and/or control rod drive mechanisms undergoing withdrawal or removal. | |
| c. One of the following reactivity conditions are met:<br>1) The reactivity margin requirements in Specification 3.3.A.1 are met, <u>or</u><br>2) it can be verified by demonstration or analysis that the core is subcritical with a margin of at least 0.38% $\Delta k/k$ at any time. | |
| d. The conditions for Core and Containment Cooling systems as required by Specification 3.5.G are met. | |
| e. All other control rods are fully inserted in the core unless the surrounding four fuel assemblies have been removed from the core cell. | |

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| B. Core Monitoring | B. Core Monitoring |
| 1. 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, except as specified in Specifications 3.9.B.2 and 3.9.B.3. For an SRM to be considered OPERABLE, the following conditions shall be satisfied: | 1. The SRMs shall be functionally tested prior to CORE ALTERATIONS and daily thereafter as long as CORE ALTERATIONS are underway. |
| a. The SRMs shall be inserted to the normal operating level. (Use of special movable, dunking type detectors during CORE ALTERATIONS in place of normal detectors is permissible as long as the detector is connected to the normal SRM circuit.) | |
| b. The SRMs shall have a minimum of 3 cps with all rods fully inserted in the core. | |
| 2. Prior to spiral unloading, the SRMs shall be proven OPERABLE as stated in Specifications 3.9.B.1; however, during spiral unloading the count rate may drop below 3 cps when the last bundles remaining in the core that surround the SRMs are being unloaded. | 2. The SRMs shall be checked for neutron response prior to spiral unloading and daily as long as fuel is in the core. |
| 3. Prior to spiral reloading, two to four fuel assemblies which have previously accumulated exposure in the reactor shall be loaded next to each of the 4 SRMs to obtain the required 3 cps. Until these assemblies have been loaded, the 3 cps requirement is not necessary. | |

| LIMITING CONDITIONS FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|

C. Spent Fuel Pool Water Level

1. Whenever irradiated fuel is stored in the spent fuel pool, the pool water level shall be maintained at a level of at least 36 feet.

a. Whenever the spent fuel storage pool water level is found to be less than 36 feet the following actions shall be taken:

1) Immediately suspend movement of irradiated fuel assemblies in the spent fuel storage pool and place any load suspended in or above the spent fuel pool or reactor vessel into a safe configuration, <u>and</u>

2) Immediately take action to establish SECONDARY CONTAINMENT INTEGRITY.

D. Auxiliary Electrical Equipment - CORE ALTERATIONS

1. CORE ALTERATIONS shall not be performed unless all of the following conditions are satisfied:

a. At least one off-site power source and either the startup or standby transformers are OPERABLE and capable of supplying power to the 4kV emergency buses.

b. One diesel-generator is OPERABLE with:

1) its associated standby gas treatment system train OPERABLE, <u>and</u>

2) its associated main control room ventilation standby filter unit subsystem OPERABLE.

C. Spent Fuel Pool Water Level

1. Whenever irradiated fuel is stored in the spent fuel pool, the water level shall be recorded daily.

3.9 BASES:

1. Refueling Interlocks

The refueling interlocks are designed to back up procedural core reactivity controls during refueling operations. The interlocks prevent an inadvertent criticality during refueling operations when the reactivity potential of the core is being altered.

To minimize the possibility of loading fuel into a cell containing no control rod, it is required that all control rods (excluding those bypassed as per 3.9.A.4.a) 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.

The refueling interlocks reinforce operational procedures that prohibit taking the reactor critical under certain situations encountered during refueling operations by restricting the movement of control rods and the operation of refueling equipment.

The refueling interlocks include circuitry which senses the condition of the refueling equipment and the control rods. Depending on the sensed condition, interlocks are actuated which prevent the movement of the refueling equipment or withdrawal of control rods (rod block).

Circuitry is provided which senses the following conditions:

1. All rods inserted.

2. Refueling platform positioned near or over the core.

3. Refueling platform hoists are fuel-loaded (fuel grapple, frame mounted hoist, monorail mounted hoist).

4. Fuel grapple not full up.

5. Service platform hoist fuel-loaded.

6. One rod withdrawn.

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. When the mode switch is in the refuel position, only one control rod can be withdrawn. The refueling interlocks, in combination with core nuclear design and refueling procedures, limit the probability of an inadvertent criticality. The nuclear characteristics of the core assure that the reactor is subcritical even when the highest worth control rod is fully withdrawn. The combination of refueling interlocks for control rods and the refueling platform provide redundant methods of preventing inadvertent criticality even after procedural violations. The interlocks on hoists provide yet another method of avoiding inadvertent criticality.

Fuel handling is normally conducted with the fuel grapple hoist. The total load on this hoist when the interlock is required consists of the weight of the fuel grapple and the fuel assembly. This total is approximately 900 lbs., in comparison to the load-trip setting of 400 lbs. Provisions have also been made to allow fuel handling with either of the three auxiliary hoists and still maintain the refueling interlocks. The 400 lb. load-trip setting on these hoists is adequate to trip the interlock when one of the more than 600-lb. fuel bundles is being handled.

| During certain periods, it is desirable to perform maintenance on more than one
| control rod and/or control rod drive at the same time. The maintenance is performed with the mode switch in the "refuel" position to provide the refueling interlocks
| normally available during refueling operations. In order to withdraw another control rod after withdrawal of the first rod, it is necessary to bypass the

refueling interlock on the first control rod which prevents more than one control rod from being withdrawn at the same time. The requirement that an adequate shutdown margin be verified (by either demonstration or analysis) ensures that inadvertent criticality cannot occur during this maintenance. The adequacy of the shutdown margin is verified by demonstration or analysis that the core is shut down by a margin of 0.38 percent $\Delta k/k$ with the strongest operable control rod fully withdrawn, or at least 0.38 percent $\Delta k/k$ shutdown margin is available if the remaining control rods have had their directional control valves disarmed. Disarming the directional control valves does not inhibit control rod scram capability.

Specification 3.9.A.4 allows unloading of a significant portion of the reactor core. This operation is performed with the mode switch in the "refuel" position to provide the refueling interlocks normally available during refueling operations. 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 provides primary 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. The requirements for SRM operability during these core alterations assure sufficient core monitoring.

2. Core Monitoring

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 and insures that startup is conducted only if the source range flux level is above the minimum assumed in the control rod drop accident.

During spiral unloading, it is not necessary to maintain 3 cps because core alterations will involve only reactivity removal and will not result in criticality.

The loading of two to four bundles around the SRMs before attaining the 3 cps is permissible because any square 2 x 2 array of fuel bundles will have a k-effective of less than 0.95, even under maximum reactivity conditions (i.e., no control material is present and the bundles are at their maximum reactivity exposure) provided that:

1. a minimum of 12 inches of water exists between the array of fuel bundles and any surrounding bundles, and
2. their maximum reactivity exposure corresponds to individual k-infinity values that are not in excess of 1.31.

3. Spent Fuel Pool Water Level

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. The minimum water level above the top of the fuel is established to provide adequate shielding and is well above the level to assure adequate cooling.

4.9 BASES:

1. Refueling Interlocks

Complete functional testing of all refueling interlocks before any refueling outage will provide positive indication that the interlocks operate in the situations for which they were designed. By loading each hoist with a weight less than or equal to the fuel assembly, positioning the refueling platform and withdrawing control rods, the interlocks can be subjected to valid operational tests. Where redundancy is provided in the logic circuitry, tests can be performed to assure that each redundant logic element can independently perform its functions.

2. Core Monitoring

Requiring the SRMs to be functionally tested prior to CORE ALTERATIONS assures that the SRMs will be operable at the start of that alteration. The daily response check of the SRMs ensures their continued operability.

# SAFETY ASSESSMENT

## 1. INTRODUCTION

By letter dated November 15, 1991, Iowa Electric Light and Power Company requested changes to the Duane Arnold Energy Center (DAEC) Technical Specifications (TS) to a) revise the requirements applicable to loading fuel assemblies adjacent to Source Range Monitors (SRMs) when establishing the minimum required SRM count rate prior to spiral reloading of the core, b) add LCO and Surveillance Requirements which incorporate requirements already specified in DAEC procedures, other DAEC TS sections, and provide consistency with BWR Standard Technical Specifications (NUREG-0123), c) make administrative and minor editorial changes including reorganization, renumbering, denoting of defined terms, etc. to clarify and provide consistency with other DAEC TS sections, recently-docketed DAEC TS submittals and BWR Standard Technical Specifications.

## 2. EVALUATION

The Technical Specifications for the DAEC currently require that, prior to spiral reloading of the core, two diagonally adjacent fuel assemblies, with previously accumulated exposure in the reactor, must be loaded into their previous core positions next to each of the four SRMs to establish the minimum required SRM count rate. The requested change involves revising the SRM loading requirements to permit loading any fuel assemblies with previously accumulated exposure in the reactor rather than the same fuel assemblies. This change still assures that the core remains subcritical before valid SRM response is established prior to spiral reloading of the core and reduces the number of required fuel assembly moves.

The addition of LCO and Surveillance Requirements incorporates requirements already specified in DAEC procedures, other DAEC TS sections, and BWR Standard Technical Specifications. The administrative and editorial changes improve clarity of requirements and provide consistency with other DAEC TS sections, recently-docketed DAEC TS submittals and BWR Standard Technical Specifications.

Based on the above information, we conclude that this request is acceptable.