UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 27 TO FACILITY OPERATING LICENSE NO. DPR-63

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION UNIT NO. 1

DOCKET NO. 50-220

1. Introduction

By letter dated March 22, 1978,(1) supplemented by a second letter dated January 15, 1979, Niagara Mohawk Power Corporation (the licensee) has requested an amendment to the Technical Specifications for Nine Mile Point Unit No. 1. The effect of the amendment would be to allow the unloading and reloading of the reactor core without the use of a large number of control blade guides.

2. Discussion

Normally, BWR Technical Specifications require that all but one control blade be inserted into the core during core alterations. This is no problem during normal refueling and control blade drive maintenance since only one core cell (defined as a control blade plus the four adjacent fuel assemblies) is worked on at any given time. However, a removal of the entire core would require all the fuel to be removed before any control blade was removed. This is not possible unless the plant has a full complement of control blade guides. These guides are needed to provide lateral support to control blades in defueled cells. The Nine Mile Point 1 facility does not have this many guides.

The proposed spiral unloading/reloading procedures is one of a number of unique reload sequences reviewed and approved by the staff. At Oyster Creek and Dresden 1, unique reload patterns were approved which allowed more than one control rod to be removed or withdrawn at any time in the reload sequence. In these cases, as in the subject spiral reload procedure, justification was based on adequate shutdown margin as discussed in Section 3.1.

The safety issues of spiral reload procedures are two-fold if more than one control blade is to be removed with fuel still in the core. First, the intermediate fuel and control blade arrays must be subscritical at all times, even if the highest worth blade is withdrawn. Second, there must be adequate monitoring of neutron flux levels during the core alterations. These two concerns are evaluated below.

3. Evaluation

3.1 Subcriticality of the intermediate arrays

The proposed Technical Specification will allow spiral unloading and reloading of the core. In the unloading sequence fuel cells on the perimeter of the core are unloaded first. Cells are removed sequentially in a spiral sequence with the cells closest to the center of the core removed last. During unloading of a fuel cell the control rod is removed or withdrawn. For the reasons justified below it is not necessary to replace or insert the control rod for the given fuel assembly prior to removing the next fuel cell in the spiral sequence. Therefore, during the unloading sequence more than one control rod may be absent at any point in time since control rods are not required in defueled cells. The loading sequence is the reverse of the unloading sequence with fuel loaded and control rods inserted in the center of the core first, and core perimeter cells loaded and control rods inserted last.

In the spiral loading/unloading sequence neither imbedded cavaties nor major peripheral concavities are permitted. Imbedded cavaties are precluded since the spiral sequence does not result in the removal of adjacent fuel cells. Major peripheral concavaties are precluded since more than one cell in a given core quadrant is not loaded/ unloaded prior to removal of a cell in each of the other quadrants. Since a single unloaded cell results in local flux which is less than or equal to flux prior to cell unload, the multiplication factor of intermediate fuel arrays is less than or equal to that of a fully loaded core. Since peripheral concavities are not allowed approximate core symetry is maintained with a like number of cells removed from each core quadrant at any point in the sequence. Flux peaking in any one quadrant is precluded due to an inbalance of unloaded cells in any one quadrant. Therefore, the multiplication factor for the entire core is less than or equal to that of a fully loaded core.

Multiplication factors have been analyzed for the fully loaded core and the shutdown margin of the fully loaded core is well assured by other specifications. Spiral loading/unloading of the core does not result in an increase in multiplication factors, nor a decrease of shutdown margin relative to that of the fully loaded core. Therefore, the proposed fueling sequence is acceptable from the point of view of shutdown margin.

3.2 Neutron Flux Level Monitoring

During any core alteration, and especially during core loading, it is necessary to monitor flux levels. In this manner, even in the highly unlikely event of multiple operator errors, there is reasonable assurance that any approach to criticality would be detected in time to halt operations. (In addition, an actual criticality would cause any inadvertantly withdrawn control blades to scram.)

The proposed Technical Specification would allow the use of the source range monitor (SRM) channels for this purpose. (A more common procedure is to use dunking chambers connected to certain of the SRM channels.) The difficulty with the SRM channels is that, because the SRM channels are located two or more control cells from the core center, the last intermediate arrays during unloading, and the first arrays during loading, will not contain imbedded detectors. Imbedded detectors are generally more effective monitors.

GE's spent fuel pool studies have shown(3) that 16 or more uncontrolled BWR fuel assemblies (i.e., four or more control cells) must be loaded together to achieve criticality. In the worst case allowed in the proposed spiral loading, the nearest SRM detector would be two control cells (i.e., about two feet) away from the fuel array. We have estimated that the detector sensitivity would be reduced less than a factor of 10 from that of a detector placed next to the fuel array. Thus, roughly one decade of sensitivity would be lost, at worst. This is about one fifth of the SRM's logarithmic scale. Although such a reduced sensitivity is not desirable, it is our judgement that it is still adequate considering:

- the greater reliability of the SRM compared with a dunking chamber,
- the fixed geometry of the SRM compared with the pendulum swings of a dunking chamber,
- the relatively few intermediate arrays for which the monitoring problem exists,
- the low likelihood of criticality in such a small array, and
- the presence of IRM detectors (with scram channels) immediately adjacent to the worst-case array.

Therefore, we find the proposed technical specification change to be acceptable from the point of view of flux monitoring. It should be noted, however, that this conclusion may not be valid for other, especially larger, reactors.

Based upon the assurance of shutdown margin and the adequacy of neutron flux monitoring as concluded above, we find the proposed Technical Specification change to be acceptable.

4. Environmental Considerations

We have determined that this amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that this amendment involves an action which is insignificant from the standpoint of environmental impact, and pursuant to 10 CFR §51.5(d)(4) that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

5. Conclusion

We have concluded that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: March 2, 1979

References

1. Letter, Eugene B. Thomas, Jr., (counsel for Niagara Mohawk) to E. G. Case (NRC), dated March 22, 1978.

2. Letter, Donald P. Dise (NMPC) to Director of Nuclear Reactor Regulation (NRC), dated January 15, 1979.

3. General Electric Standard Safety Analysis Report, 251-GESSAR, Section 4.3.2.7, p. 4.3-27.

ATTACHMENT TO LICENSE AMENDMENT NO. 27

FACILITY OPERATING LICENSE NO. DPR-63

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Revise Appendix A as follows:

Remove	Insert
180	180
-	184a (new page)
	184b (new page)
	184c (new page)
	184d (new page)

Marginal lines indicate area of change

3.5.1 SOURCE RANGE MONITORS

Applicability:

Applies to the operating status of the source range monitors.

Objective:

To assure the capability of the source range monitors to provide neutron flux indication required for reactor shutdown. and startup and refueling operations.

Specification:

Whenever the reactor is in the shutdown, refueling or power operating conditions (unless the IRM's or APRM's are on scale) or whenever core alterations are being made at least three SRM channels will be operable except as noted in Specification 3.5.3. To be considered operable, the following conditions must be satisfied:

a. Inserted to normal operating level and available for monitoring the core. May be withdrawn as long as a minimum count rate of 100 cps is maintained.

4.5.1 SOURCE RANGE MONITORS

Applicability:

Applies to the periodic testing of the source range monitors.

Objective:

To assure the operability of the source range monitors to monitor low-level neutron flux.

Specification:

The source range monitoring system surveillance will be performed as indicated below.

During each operating cycle - check in-core to out-of-core signal ratio and minimum count rate.

3.5.3 EXTENDED CORE AND CONTROL ROD DRIVE MAINTENANCE

Applicability:

Applies to core reactivity limitations during major core alterations.

Objective:

To assure that inadvertent criticality does not result when control rods are being removed from the core.

Specification:

Whenever, the reactor is in the refueling condition, control rods may be withdrawn from the reactor core provided the following conditions are satisfied:

4.5.3 EXTENDED CORE AND CONTROL ROD DRIVE MAINTENANCE

Applicability:

Applies to monitoring during major core alterations.

Objective:

To assure that inadvertent withdrawal of an incorrect control rod does not occur.

Specification:

Whenever the reactor is in the refuel mode and rod block interlocks are being bypassed for core unloading, one licensed operator and a member of the reactor analysis staff will verify that all the fuel from the cell has been removed before the corresponding control rod is withdrawn.

LIMITING CONDITION FOR OPERATION	SURVEILLANCE REQUIREMENT

a. The reactor mode switch shall be locked in the "Refuel" position. The refueling interlock input signal from a withdrawn control rod 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. All other refueling interlocks shall be operable, except those necessary to pull the next control rods.

b. During core alterations two SRM's shall be operable, one in and one adjacent to any core quadrant where fuel or control rods are being moved. Operable SRM's shall have a minimum of 3 counts per second except as specified in d and e below.

c. The SRM's shall be inserted to the normal operating level. Use of special movable dunking type detectors during major core alterations is permissible as long as detector is connected into the normal SRM circuit.

d. Prior to spiral unloading, the SRM's shall have an initial count rate of 3 cps. During spiral unloading, the count rate on the SRM's may drop below 3 cps.

e. During spiral reload, SRM operability will be verified by using a portable external source every 12 hours until the required amount of fuel is loaded to maintain 3 cps. As an alternative to the above, two fuel assemblies will be loaded in different cells containing control blades around each SRM to obtain the required 3 cps. Until these two assemblies have been loaded, the 3 cps requirement is not necessary.

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The intent of this specification is to permit the unloading of a significant portion of the reactor core for such purposes as removal of temporary control curtains, control rod drive maintenance, in-service inspection requirements, examination of the core support plate, etc. When the refueling interlock input signal from a withdrawn control rod is bypassed, administrative controls will be in effect to prohibit fuel from being loaded into that control cell.

These operations are performed with the mode switch in the "Refuel" position to provide the refueling interlocks normally available during refueling. In order to withdraw more than one control rod, it is necessary to bypass the refueling interlock on each withdrawn control rod. 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 insures 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 the control rod. Thus, removal of an entire cell (fuel assemblies plus control rod) results in a lower reactivity potential of the core.

The SRM's 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 SRM's, one in and one 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.

A spiral unloading pattern is one by which the fuel in the outermost cells (four fuel bundles surrounding a control blade) is removed first. Unloading continues by removing the remaining outermost fuel by cell. The center cell will be the last removed. Spiral reloading is the reverse of unloading. Spiral unloading and reloading will preclude the creation of flux traps (moderator filled cavities surrounded on all sides by fuel).

During spiral unloading, the SRM's shall have an initial count rate of 3 cps with all rods fully inserted. The count rate will diminish during fuel removal. After all the fuel is removed from a cell, the refueling interlock will be bypassed on the corresponding control rod. Prior to withdrawal of that rod, one licensed operator and a member of the reactor analysis staff will verify that the interlock bypassed is on the correct control rod. Once the control rod is withdrawn, it will be valved out of service.

Under this special condition of complete spiral core unloading, it is expected that the count rate of the SRM's will drop below 3 cps before all of 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 SRM's will no longer be required. Requiring the SRM's to be operational prior to fuel removal assures that the SRM's are operable and can be relied on even when the count rate may go below 3 cps.

During spiral reload, SRM operability will be verified by using a portable external source every 12 hours until the required amount of fuel is loaded to maintain 3 cps. As an alternative to the above, two fuel assemblies will be loaded in different cells containing control blades around each SRM to obtain the required 3 cps. Until these two assemblies have been loaded, the 3 cps requirement is not necessary.