Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

March 16, 1993

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Document Control Desk

Subject: Byron Station Unit 1
Cycle 6 Fuel Assembly Reconstitution
NRC Docket No. 50-454

Dear Dr. Murley:

During the current refueling outage prior to Unit 1 Cycle 6, Byron Station identified one failed fuel rod in assembly G74F. The failed rod, located at assembly lattice location B6, was subsequently replaced with a stainless steel filler rod. This fuel assembly is a once-burned assembly with an approximate burnup of 22.6 GWD/MTU and is scheduled for reinsertion into the Cycle 6 core at location F-01.

As in the past, Commonwealth Edison's fuel reconstitution has been limited to fuel designs that have been analyzed with applicable NRC Staff-approved codes and methods. This "reconstitution" facilitates the removal of defective fuel rods and reuse of the reconstituted assemblies, thus contributing to the goal of defect-free fuel performance and reactor operation. It also benefits the utility by allowing the continued use of the reconstituted fuel assemblies, which are targeted for reload, without requiring replacement assemblies and reload redesign late in the refueling outage. This contributes to a more orderly, as-planned outage with less likelihood of critical path impact. Savings are also gained in reload design costs and fuel assembly replacement costs.

Utilizing the original loading pattern, it had been demonstrated that the reload core, with the reconstituted VANTAGE5 fuel assembly (G74F), would perform consistent with current nominal design parameters, Technical Specifications and related bases, and current Technical Specification setpoints. In addition, reanalysis or evaluation has shown

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that the results of all applicable postulated events addressed in the Byron Updated Final Safety Analysis Report would remain within allowable limits. This evaluation was performed using NRC approved design and accident evaluation methodology described in Section 6 of the Byron Station Technical Specifications. The reconstitution evaluation, as described in the attached summary, will be documented as part of the Reload Safety Evaluation (RSE) for Byron Unit 1 Cycle 6 and will be summarized in the Byron Unit 1 Cycle 6 Reload Letter and Operating Limits Report. The technical and analytical methods, applied by CECo and its fuel vendor Westinghouse, conform to the Westinghouse Topical, WCAP-13060, "Westinghouse Fuel Assembly Reconstitution Evaluation Methodology".

During the installation of the core upper internals, three fuel assemblies were damaged. This event has prompted a slight modification to the original core loading pattern in order to replace the damaged assemblies. The reconstituted assembly, itself, was not damaged or relocated in the subsequent redesign. Commonwealth Edison has done a preliminary evaluation of the modified core loading pattern and has concluded that there is no adverse impact on the reconstituted assembly or reload core. The assemblies selected to replace the assemblies damaged by the upper internals are less reactive. Current evaluations and analyses show that the redesigned core should be comparable to the original core design and will satisfy all limits as verified through our safety parameter review. Commonwealth Edison will perform a final validation of the use of the reconstituted assembly, G74F, in the redesigned core and will document these conclusions in the standard Byron Unit 1 Cycle 6 Reload Letter and Operating Limits Report that will be issued prior to unit startup (Mode 2).

This reconstitution has been performed consistent with the current Byron Technical Specifications and is being provided for your Staff's information.

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To the best of my knowledge and belief, the statements contained herein are true and correct. In some respects, these statements are not based on my personal knowledge but upon information received from other Commonwealth Edison and contractor employees. Such information has been reviewed in accordance with Company practice and I believe it to be reliable.

Please direct any questions regarding this matter to this office.

Respectfully,

Joseph A. Bauer

Joseph A. Bauer
Nuclear Licensing Administrator

Attachment A

cc: A. Bert Davis, Regional Administrator - RIII
J.B. Hickman, Project Manager - NRR
L.E. Phillips, Chief, Reactor Systems Section - NRR
H. Peterson, Senior Resident Inspector - Byron
Office of Nuclear Facility Safety - IDNS

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Attachment A

CECo Reload Safety Evaluation Process for a Reload Core With Limited Fuel Reconstitution

I. Introduction

To ensure that limited reconstitution with inert filler rods does not create an unanalyzed core condition or otherwise constitute an unreviewed safety question, Commonwealth Edison Company, for each core which has been modified through reconstitution:

1. Revises the detailed core models to fully model the specific filler rod characteristics using the NRC approved methods specified in Section 6 of each unit's Technical Specifications.

2. Re-verifies that the key core neutronic and thermal/hydraulic parameters developed in item 1 satisfy their respective safety analysis limits.

3. Reconfirms and documents the acceptable conclusions of the Reload Safety Evaluation (RSE) by issuing a supplementary memo. The typical final product is a revised RSE.

For Byron Unit 1 Cycle 6, the reload core will contain a once burned (approximately 22.6 GWD/MTU) VANTAGE5 fuel assembly (G74F) that has been reconstituted with a single stainless steel filler rod in place of a damaged fuel rod at assembly lattice location B6. This assembly will be located in peripheral core position F-01.

II. Summary of Technical Evaluation and Justification

1.0 Mechanical Design

Assembly Design

The vendor, Westinghouse, has determined from fuel assembly mechanical design and fuel coolability viewpoints, that the mechanical criteria potentially impacted are:

1. Fuel Assembly Holddown Force, and
2. Fuel Assembly Structural Response to Seismic/LOCA loads.

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The impact of a reconstituted fuel assembly on holddown spring forces has been evaluated. The slightly lighter stainless steel replacement rod results in a small increase in the net upward force on the assembly. The fuel assembly will not lift due to this increased net upward force during normal operating and transient conditions.

The fuel assembly is designed to perform satisfactorily under design loads throughout its lifetime. The loads, deflections and stresses resulting from the combined effects of normal operation and faulted condition loads are considered in the fuel assembly evaluation. The effect of the one replacement rod on the fuel assembly's mechanical properties and loads has been assessed by the fuel vendor to ensure that the reconstituted assembly meets all the established criteria. The introduction of the replacement rod will not adversely impact the performance of the existing fuel assembly.

The effect of seismic and asymmetric LOCA loads on the reconstituted fuel assembly has been assessed by the fuel vendor. The reconstituted assembly's structural capability is enhanced by using the replacement rod. The reconstituted assembly design withstands the faulted condition loads better than the existing standard non-reconstituted fuel assembly design.

In view of the affected mechanical design considerations, the vendor has concluded that the reconstituted assembly design is acceptable for both normal and faulted condition operations.

Fuel Rod Design

As the fuel rod was replaced with a stainless steel rod, there is a slight increase in the core average linear heat generation rate. The affected fuel rod design criteria has been identified and addressed using NRC approved fuel performance models. This slight increase in rod average power results in a negligible impact on available margins for the Byron fuel rod design criteria.

In addition, as part of the Westinghouse reload design methods, cycle specific fuel rod design evaluations are performed using the NRC approved Westinghouse fuel performance models. The impact of using a reconstituted fuel assembly with an inert filler rod was evaluated as part of this cycle specific design process.

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2.0 Nuclear Design

The nuclear design evaluation was performed using NRC approved codes and methods. The neutronic effects of fuel reconstitution are evaluated on a cycle specific basis.

The model reflects the specific configuration and core location of the reconstituted assembly with a stainless steel rod. The nuclear design models are generated using the current NRC approved design methodology. From the depletion results, each key safety parameter was evaluated and verified consistent with the safety analysis assumptions. Based on a cycle specific design analysis, it has been demonstrated that all nuclear design criteria are met for the core with the use of the reconstituted assembly G74F.

3.0 Thermal and Hydraulic Design

The thermal-hydraulic (T/H) evaluation of fuel rod reconstitution is performed using NRC approved codes and methods. The evaluation assesses the safety significance of fuel rod reconstitution and assures that a reconstituted core meets the design criteria for the existing fuel designs.

Fuel rod reconstitution affects predictions of departure from nucleate boiling (DNB) in hot channels due to a local power reduction and resultant enthalpy and flow changes. The DNB design basis is applicable to a reconstituted core. The design basis is that there will be at least a 95 percent probability that DNB will not occur on the limiting fuel rods during normal operation and operational transients and any transient conditions arising from faults of moderate frequency (Condition I and II events) at a 95 percent confidence level. In order to meet this basis, the minimum DNB ratio (DNBR) should be above the Safety Limit DNBR specified by a DNB correlation.

A reconstituted core is bounded by a regular core and it is conservatively assumed that the filler rods in the reconstituted fuel assembly produce the same power as the peak rods in that assembly for the DNB analysis. This is extremely conservative because the actual power results in a much lower enthalpy rise. Additionally, the reconstituted fuel assemblies have a negligible effect on DNB margins of adjacent fuel assemblies in the core.

Fuel rod reconstitution with a limited number of filler rods does not have any adverse effects on the existing DNB margin in Westinghouse fuel assemblies. A cycle specific evaluation has been performed, and confirmed the conservative assumption that the reconstituted assembly is bounded by a regular assembly in DNB analyses.

4.0 LOCA Evaluation

The NRC approved reload methodology is followed to assure that fuel parameters significant to the Large and Small Break LOCA analyses remain bounded or acceptable.

An evaluation of the potential effects of fuel assembly reconstitution on the LOCA analyses has been performed. In order to reconstitute with the one stainless steel filler rod while retaining overall core power, a very small increase in the average linear heat rate will be expected for the remaining fuel rods.

For this Byron reconstitution campaign, the total effect on Peak Clad Temperature (PCT) of a reconstituted fuel assembly with one stainless steel filler rod was not significant. This small PCT change, which has been evaluated for the specific cycle, will be reported by Commonwealth Edison to show conformance with the 10CFR50.46 acceptance criteria, as part of the annual 10CFR50.46 reporting requirements.

Other LOCA Considerations:

1. Blowdown reactor vessel and loop forces

The substitution of the one stainless steel filler rod for one failed fuel rod does not affect the results of the blowdown hydraulic forcing function analysis since it is assumed that no fluid areas/volumes are affected and that the stainless steel rod is more resistant to the hydraulic loads than the fuel rod that was replaced.

2. Post-LOCA long term core cooling subcriticality requirement

The Westinghouse licensing position for satisfying the requirements of 10CFR Part 50 Section 50.46 Paragraph (b) Item (5) "Long Term Cooling" is defined in WCAP-8339. The Westinghouse commitment is that the reactor will remain shutdown by borated ECCS water residing in the sump following a LOCA (Westinghouse Technical Bulletin NSID-TB-86-08, "Post-LOCA Long Term Cooling: Boron Requirements",

October 31, 1986). Since credit for the control rods is not taken for large break LOCA, the borated Emergency Core Cooling System (ECCS) water provided by the accumulators and the RWST must have a concentration that, when mixed with other sources of borated and non-borated water, will result in the reactor core remaining subcritical assuming all control rods out.

The substitution of the one stainless steel filler rod for the damaged fuel rod will not affect the post-LOCA long term core cooling calculations since the core boron concentration, the amount of fluid added to the core post-LOCA, and the boron concentration of the composite fluid is unchanged. Furthermore, the long term core cooling of the core is unaffected since the filler rod is only as hot as the fluid surrounding it (ideal heat transfer assumed) and is no hotter than the fuel rods themselves.

3. Boron precipitation during long term core cooling

Boron precipitation is dependent upon the core power history, the RCS, RWST, and accumulator water volumes and boron concentrations.

Since none of these parameters are affected by the replacement of the fuel rod with one stainless steel filler rod, the fuel reconstitution has no effect on the post-LOCA boron precipitation.

LOCA Summary Conclusion

The effect of the use of the stainless steel filler rod on the LOCA analyses of record has been assessed. In all instances, the potential effect on the calculated consequences is negligible.

In conclusion, the operation of the Byron Unit 1 plant in Cycle 6 with the one stainless steel filler rod is acceptable from a LOCA analysis perspective.

5.0 Non-LOCA Transient Analyses

It has been demonstrated for Cycle 6 that the Byron Unit 1 core design parameters generated for the reload safety evaluation remain valid and bounding for re-design including the specific inputs for reconstitution. No non-LOCA safety limits will be exceeded and the conclusions of the FSAR and the original reload evaluation remain bounding.

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6.0 Steam Generator Tube Rupture (SGTR) Anal_sis

Fuel reconstitution does not affect any assumptions or recovery procedures associated with the SGTR analyses. Therefore, the conclusions presented for the existing FSAR analyses remain valid.

7.0 Containment Integrity Analysis

Containment response in the Byron plant is dependent upon mass/energy release calculations resulting from LOCA. Since no additional mass/energy release is predicted, the containment analysis of record remains valid.

8.0 Summary

The present reload safety evaluation methods applied by Commonwealth Edison and its vendor, Westinghouse, demonstrate that limited reconstitution will not impact reload design safety criteria for Byron Unit 1 Cycle 6 operation.