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Public Service Company of Colorado
P. O. Box 361, Platteville, CO 80651

June 20, 1978
Fort St. Vrain
Unit No. 1
P-78102

Mr. William Gammill, Asst. Director
Standardization and Advanced Reactors
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket #50-267

Subject: Test Fuel Element Post Irradiation Examination Program

Gentlemen:

In your letter of May 10, 1978, it was indicated that PSC's request to install eight test fuel elements in the Fort St. Vrain reactor, submitted January 9, 1978 in correspondence P-78004, had been reviewed and had been found to be acceptable by the staff. Your letter of May 10, 1978, also indicated that formal approval to insert the test fuel elements in the reactor would be withheld pending submittal of a Post Irradiation Examination (PIE) Program for these elements.

Please find attached forty (40) copies of the requested PIE Program for the test fuel elements. The PIE program is submitted as Appendix A to the "Safety Analysis Report for Fort St. Vrain Reload 1 Test Fuel Elements FTE-1 through FTE-8" that was submitted in our correspondence dated January 9, 1978, reference number P-78004.

It should be noted that the documented PIE Program is presently being funded by the Department of Energy (DOE). Any changes in the DOE funding would require changes in the described PIE Program.

With submittal of this requested PIE Program for the test fuel elements all requirements for approval for insertion of these elements in the reactor have been met. PSC therefore requests the NRC approve the request forwarded in our correspondence P-78004, dated January 9, 1978, and issue the necessary Technical Specification change.

If there are any questions, please let me know.

Add: K. Hertner

Very truly yours,

J. K. Fuller
Vice President
Engineering and Planning

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At the time of the first, second, fourth, and sixth refuelings, one element will be returned to San Diego for destructive PIE. This destructive fuel PIE will consist of:

- Selective gamma-scanning for relative power, flux and burnup distribution.
- Analysis of temperature, burn-up, and flux monitors
- Fuel rod metrology
- Graphite metrology
- Fuel performance measurements for amoeba effect via metalography and TRIGA activation

Data evaluation and documentation of the PIE results will be forwarded to the NRC as they become available.

As previously indicated, the above described PIE program is presently being funded by DOE. If such funding should be withdrawn or modified before the described program is completed, the Public Service Company of Colorado would be available to discuss a modified post-irradiation examination program if such a continuing program is necessary.

Very truly yours,

PUBLIC SERVICE COMPANY OF COLORADO

J. K. Fuller
Vice President
Engineering and Planning

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TABLES (Continued)

FIGURES

APPENDIX A

PROPOSED POST-IRRADIATION EXAMINATION (PIE)

The proposed post-irradiation examination (PIE) work scope for FTE-1 through FTE-8 under DOE funding is presented in this appendix. The work will be done providing adequate DOE funding and equipment is available at the time of element withdrawal from the core. The work scope is geared towards test techniques presently available or under development at General Atomic. Use of a different hot cell facility will require modifications of the work scope. Withdrawal of DOE funding will necessitate modifications of part or all of the PIE program.

The examinations will consist of some or all of the following tasks in accordance with Table A-1.

(1) Visual Inspection

The fuel element will be inspected with television cameras for significant outer surface phenomena such as missing portions, macrocracks, large distortions, discoloration, dust deposits, or gross oxidation. The inspection will be done within the hot service facility at FSV and will be recorded on videotape.

(2) Graphite Block Metrology

Detailed axial and diametrical length and bow measurements will be carried out within the hot service facility at FSV utilizing a metrology robot device, which is a remotely operated x-y-z-θ coordinate measurement system, presently under development at General Atomic. Data will be recorded on magnetic tape and will be compared with pre-irradiation measurements to establish irradiation induced graphite strain and bow.

(7) Fuel Rod Examination and Physical Property Measurements

Individual fuel rods will be inspected stereoscopically for surface effects and compared with photographic records taken prior to assembly into the fuel elements. Axial and radial dimensions will be measured and compared with preirradiation measurements to determine irradiation-induced strain. Additional physical properties like coefficient of thermal expansion, bonding force between fuel rods and graphite, and strength might be measured on selected rods, subject to availability of adequate test techniques within the GA hot cell facilities.

(8) Nondestructive and Destructive Strain, Stress and Strength Examination of Graphite Components

Selected portions of the structural graphite material will be submitted to nondestructive and destructive strain, stress and strength examinations to establish residual stress distributions and strength margin. Strain information will be used to establish heat transfer gaps between graphite and fuel rods.

(9) Fluence/Temperature/Burnup Monitor Examination

Selected monitor capsules will be disassembled and the monitors will be analyzed for fast and thermal fluence, end-of-life irradiation temperatures and fissile and fertile fuel burnup and isotopic abundancies. These measurements will be used to normalize relative fission product profiles obtained from gamma spectroscopic examinations to develop axial and radial power, burnup and fluence distributions within the fuel element for refinement of nuclear and thermal predictions.

(10) Nondestructive Burnup Determination on Fuel Rods

Selected fuel rods underwent delayed neutron activation analysis for uranium content prior to irradiation. These rods will undergo gamma spectrometric examination and results will be correlated with destructive burnup examinations done under item 9 to establish a nondestructive burnup technique and to complement the performance mapping of the fuel element, described in item 9.

As discussed in Chapter 4 of the FTE Safety Analysis Report, FTEs 1, 3, and 5 contain the same driver fuel as FTEs 2, 4, and 6, i.e., TRISO-coated ThO_2 and TRISO-coated UC_2 candidate FSV reload and Lead Plant HTGR fuel. Destructive PIE of these three test elements can supply supplemental data on the performance of these fuels if a need becomes apparent from the nondestructive examination of these elements or from the destructive examination of FTEs 2, 4, and 6. In addition, all of the test elements have H-451 type graphite blocks, which is also a candidate material for FSV reloads and for the Lead Plant HTGR. Destructive PIE of FTEs 1, 3, 5, 7, and 8 can provide supplemental performance data for H-451 graphite if that obtained from FTEs 2, 4, and 6 require tests at intermediate fluence levels or if the nondestructive examination of FTEs 1, 3, 5, 7, and 8 indicate abnormal performance. Cure-in-place effects upon graphite performance can be established from the examination of FTE-6, FTE-7, and FTE-8, which contain either cured-in-place fuel (FTE-6) or FSV reference cured-in-bed fuel (FTE-7 and FTE-8).

4/8/86

Note to: J. McKnight.
Docketing, 042

From: K. Heitner
P-234

Subj: Docket No 50-267
PSC Letter
dated 6/20/78
(P-78102)

We have had trouble locating this in the files - Please docket the attached copy so NRC records are complete.

Thanks
Ken Heitner