U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
REGION IV

Report No. 99900004/79-01 Program No. 51500

Company: General Atomic Company
Post Office Box 81608
San Diego, California 92138

Inspection Conducted: February 26 - March 1, 1979.

Inspector: W. M. McNeill 3/19/79
W. M. McNeill, Contractor Inspector, Vendor Inspection Branch — Date

Approved by: D. E. Whitesell 3/19/79
D. E. Whitesell, Chief, Component Section I, Vendor Inspection Branch — Date

Summary

Inspection on February 26 - March 1, 1979 (99900004/79-01)

Areas Inspected: Implementation of 10 CFR 50, Appendix B, including enrichment and impurity controls, and coated particle attributes. The inspection involved twenty-eight (28) inspector hours on site by one (1) NRC inspector.

Results: The following six (6) deviations were identified.

Deviations: Enrichment and Impurity Controls - four (4) examples are cited where certain design activities were not being implemented as prescribed as required by Criterion V of Appendix B, and the QA Manual (See Enclosure, Item A); Enrichment and Impurity Controls - Analytical Chemistry Laboratory procedures had not been reviewed as prescribed by the implementing procedure, as required by Criterion V of Appendix B, and the QA Manual (See Enclosure, Item B); Enrichment and Impurity Controls - balances were found which were not being calibrated in accordance with the implementing procedure as required by Criterion V of Appendix B, and the QA Manual (See Enclosure, Item C); Particle Attributes - Procedure QDI 28-2 wavied the specification requirement to evaluate the structure of fuel kernels as required by the QA Manual (See Enclosure, Item D); Particle

Attributes - a best straight line was not drawn through the calibration points on the test plot of the density vs. gradient position as prescribed by the implementing document, as required by Criterion V of Appendix B, and instructions QDI 29-5 (See Enclosure, Item E); Particle Attributes - the acceptance criteria for the weight checks of the reference density balls, were not included in QDI 29-5 as required by Criterion V of Appendix B, and the QA Manual (See Enclosure, Item F).

DETAILS SECTION

A. Persons Contacted

*R. J. Boden, Engineer
*F. D. Carpenter, Manager, Quality Systems Department
*C. L. Chaney, Staff Scientist
*T. R. Colandrea, Director of QA Division
*A. E. Dohna, Project Engineer, QA
E. M. Knox, Manager, Analytical Chemistry Laboratory
F. H. Lofftus, Quality Engineer
J. M. Obenschain, Quality Engineer
*G. W. Rankin, Manager, Fuel Manufacturing
C. Richardson, Technician
G. M. Scott, Quality Engineer
E. C. Snooks, Staff Scientist
*J. S. Steibel, Project Engineer
E. D. Weldon, Staff Technician

*Denotes those attending the Exit Interview.

B. Enrichment and Impurity Controls

1. Objectives

The objectives of the inspection were to verify that:

a. Material flow procedures and practices cover manufacturing operations for all inputs of material in any form from UO_2 to completed fuel particles.

b. Enriched material is controlled, inspection and checked at each stage during manufacturing and processing to prevent enrichment mixup or contamination.

c. Final enrichment checks, and chemical analyses, are made on the particles, or rods, to detect any signficant enrichment deviations, or contamination, and to give reasonable assurance that the particles and rods meet specifications and contractural requirements.

2. Method of Accomplishment

The preceding objectives were accomplished by:

a. Review of the Quality Assurance Manual dated August 5, 1977, Section 5, 10, 11, and 14, which established the general requirements for enrichment and impurity controls.

b. Review of the Quality Assurance Program Document Fort St. Vrain Nuclear Generating Station, QAPD-1900, Issue A, and High Temperature Gas-Cooled Reactor (HTGR) Fuel Specifications, GA 10600, Revision K, and Change Notices 004448, 004447, and 004407, which establish the specific requirements for enrichment and impurity controls.

c. Review of Spectrographic Procedure Number GA-A 12440 dated March 15, 1973, for the analysis of fuels and materials for Fort St. Vrain Nuclear Power Reactor.

d. Inspection of the Jarrel-Ash Spectrograph and the supporting equipment, e.g. balances, test standards, test plates, logs, and reports.

e. Inspection of the Oxygen analysis equipment, the Leco Sulfur Analyzer, Titanium analysis equipment, and the supporting equipment, test standards, logs, and test reports.

3. Findings

a. Deviations

See Enclosure, Items A to C.

b. Unresolved Items

None.

c. Comments

The scope of this inspection included the review of detailed procedures for individual product characteristics, or attributes, e.g. iron content. Time did not allow for inspection of the sampling plans, and reports, necessary for the final product or lot acceptance.

C. Particle Attributes

1. Objectives

The objectives of this area of the inspection were to verify that:

a. The inspections made of particle attributes, give reasonable assurance that the particles meet specifications and contractural requirements.

b. The manufacturer's inspection system is capable of detecting cracked, defective, or otherwise unacceptable particles, and reject or otherwise control their utilization.

2. Method of Accomplishment

The preceding objectives were accomplished by:

a. Review of the Quality Assurance Manual dated August 5, 1977, Sections 5, 10, 11, and 14, which established the general requirements for particle attribute controls.

b. Review of the Quality Assurance Program Document Fort St. Vrain Nuclear Generating Station, QAPD-1900, Issue A, and HTGR Fuel Specifications, GA 10600, Revision R, and Change Notices 004448, 004447, and 004407, which established the specific requirements for particle attribute controls.

c. Review of the following detailed procedures for the evaluation of particle characteristics:

(1) X-Ray Analysis for Uranium and Thorium (Solution Method), QC-SG-13, Revision C.

(2) Titrimetric Determination of Uranium - Modified Davies - Gray Method, QDI 26-22, Revision A.

(3) Evaluation of Outer Isotropic Coated Material, QDI 28-5, Revision C.

(4) Determination of Phosphorous in Uranium and Thorium Oxides, QDI 28-20, Revision A.

(5) Determination of Carbon Bulk density by Pycnometry - Bumback, QDI 28-27, Revision A.

(6) Evaluation of Coating Thickness and Defective Particles by X-Ray, QDI 29-2, Revision A.

(7) Density by Mercury Penetrameter Method, QDI 29-3, Revision B.

(8) Evaluation of Coating Density by the Gradient Column Technique, QDI 29-5, Revision A.

(9) Analysis of Carbon via Induction Heating, QDI 290-7, Revision A.

(10) Determination of Optical Anisotropy Factors COAF and BAF_0, OP442714, Revision B.

d. Inspection of the spectrograph, Leco Carbon Analyzer, and other laboratory equipment used with the above procedures, test standards, logs, and test reports.

3. Findings

a. Deviations

See Enclosure, Items D to F.

b. Unresolved Items

None.

c. Comments

(1) The scope of this inspection covered the detailed procedures for individual product characteristics or attributes, e.g. density of coatings. Time did not allow for the inspection of the sampling plans and reports necessary for final product or lot acceptance.

(2) In the gradient density test method, balls of known density are used as bench marks or reference points. The position of the reference density balls within a

controlled medium is measured and ploted on a graph for each test. The graph relates density to gradient position. Failure to use a line of best fit, can introduce a small, but significant error. Verification that the glass density balls have not changed is accomplished by a weight check.

D. Review of Manufacturing Activities

1. Objectives

The objectives of this area of the inspection were to review the work load in terms of existing capacity, identification of principal contracts and unique differences between contracts in fuel assembly design, manufacture, and QC/QA requirements. In addition, the objectives were to identify any systematic or generic problems with fuel fabricated by the manufacturer. And, the objectives were to identify anticipated changes in fuel manufacturing and processing or in scope of supply.

2. Method of Accomplishment

The preceding objectives were accomplished by:

a. Discussion with management and technical personnel on the above subjects.

b. Observation of shop manufacturing activities on the above subjects.

3. Findings

General Atomic (GA) is currently fabricating segment eight (8) fuel, the second reload for Fort St. Vrain. The first six (6) segments is the initial core. Fabrication is done by campaigns of each basic process. Presently the campaign is centered on fabrication of the trisocoated particles. Rod fabrication will begin within 2-3 months, and last till late summer. Fuel assembly fabrication will begin in late summer probably last until the end of the year. Inspections will be planned around each of these campaigns for the HTGR fuel. G.A. begins fabrication with Uranium and Thorium oxides which are converted to kernels of carbides. These are then coated with an inner layer of pyrolitic carbon, a silicon carbide layer, and an outer layer of pyrolitic carbon.

These particles are molded into rods which are then loaded into graphite blocks, for the fuel assembly. Inspections by GA concentrates on controlling characteristics such as size, density, shape, and the chemistry of the particles and their coating. The size, uniformity, and homogenity of rods are verified; and the identification and plugging of fuel assemblies, is also verified by quality control.

E. Exit Interview

The inspector met with management representatives (denoted in paragraph A) at the conclusion of the inspection on March 1, 1979. The inspector summarized the scope and findings of the inspection. The management representatives had no comment in response to the items discussed by the inspector.