Vogtle Unit 1/Unit 2 Fuel Assembly Inspection Program

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Inspection work was conducted at Vogtle by an NSD crew under the supervision of PPE engineer John Bury. Responsibility for the reduction and verification of individual portions of the inspection program was assigned to various PPE engineers. Their signatures on this document attest that (1) they have independently verified the sections assigned to them; and (2) they concur with the results documented herein. A listing of the individual data reduction and verification assignments is given below:

	Inspection Program Section	Originating Engineer	Verifying Engineer
1.0	Background & Objectives	A. Konzel	D. Colburn
2.0	Full Length RCCA Drag Tests	D. Davis	D. Colburn
3.0	Guide Thimble Plug Gage Exams	D. Colburn	D. Davis
4.0	F/A Length Measurements	H. Kunishi	A. Konzel
5.0	Rod to Nozzle Gap Measurements	H. Kunishi	A. Konzel
6.0	Overall Summary	A. Konzel	D. Colburn

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1.0 Background and Objectives

An RCCA insertion anomaly was experienced at Wolf Creek near the end of Cycle 8. The reactor tripped resulting in a SCRAM. During this SCRAM, five RCCAs failed to fully insert. Wolf Creek conducted cold drop tests after the anomaly, and three additional RCCAs did not fully insert. A subsequent inspection program concluded that the direct cause of the

a,b,c

The following tests were scheduled to be conducted during the inspection program:
(1) RCCA Drag Tests;
(2) Guide Thimble Plug Gage Exams (Single Tube Probe Tests);
(3) Fuel Assembly Length Measurements; and
(4) Fuel Rod-to-Nozzle Gap Measurements.

Fuel assembly length measurements and fuel rod-to-nozzle gap measurements were needed to establish that the growth of the fuel assemblies and fuel rods is within the anticipated range for the listed F/A burnup.

Fuel rod oxide measurements were also taken for a number of Vogtle assemblies as part of an ongoing program with Southern Nuclear. The results of the oxide exam will be provided in a separate report.

2.0 Full Length RCCA Drag Tests in Spent Fuel Pool

Fuel assemblies fabricated for five different contracts were drag tested in the spent fuel pool. Fuel assemblies manufactured for contracts GADF, GAEF, GAFF and GBCF were 17x17 optimized fuel assemblies (OFA) with the following features:

- High Burnup (HIBU)
- Removable Top Nozzle (RTN)
- Debris Filter Bottom Nozzle (DFBN)
- Intermediate Flow Mixing Grids (IFMs)
- Integral Fuel Burnable Absorbers (IFBA)

The assembly manufactured for contract GABF was a 17x17 STD assembly with the removable top nozzle feature.

Drag test results are tabulated in Table 2.1. Some assemblies were recently discharged from the reactor core, while others have been in the spent fuel pool for up to 2 cycles. Fuel assemblies 5G68 and 5G84 were not tested because the dummy RCCA would not insert completely into those assemblies. The assembly burnup values were supplied by Susan Hoxie-Key of the Southern Nuclear Operating Company.

In Figures 2.1, 2.2 and 2.3 test data from two different programs are shown. Drag testing was performed in the spent fuel pool in response to NRC Bulletin 96-01 and to assist in the root cause determination of the RCCA insertion problem.

a,b,c

Table 2.1: Vogtle Drag Test Data

a,b,c

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Table 2.1 (continued): Vogtle Drag Test Data

a,b,c

[ ]

Figure 2.1: Vogtle Dashpot and Upper Guide Thimble Withdrawal Drag Data (NRC 96-01 and Root Cause Testing)

a,b,c

Figure 2.2: Vogtle Dashpot Withdrawal Drag and Fast Fluence Data (NRC 96-01 and Root Cause Testing)

a,b,c

Figure 2.3: Vogtle Upper Guide Thimble Withdrawal Drag and Fast Fluence Data (NRC 96-01 and Root Cause Testing)

a,b,c

3.0 Single Tube Probe

The objective of this test was to determine the extent of distortion in the guide tubes of these assemblies. The probe lengths and diameters used are shown below. A total of five assemblies were probed. Each probe was lowered into the thimble tube and allowed to drop by its own weight. A "GO" was recorded if the probe hit bottom. If the probe did not hit bottom, a "NO GO" was recorded and the axial position were the probe stopped was reported.

Table 3.1: Probe Dimensional Summary a,b,c

The first number in the table below represents the number of tubes which passed the probe and the second number represents the total number of tubes tested by each probe type.

Table 3.2: Probe Test Results a,b,c

4.0 Fuel Assembly Growth

Fuel assembly length measurements were performed on a total of 14 assemblies - 1 assembly from Region "D" , 8 assemblies from Region "F", and 3 assemblies from Region "G" of Vogtle Unit 1. Two assemblies from Region "R" of Vogtle Unit 2 were also measured. The measurements were made using a standard of known length and a measuring device with a dial micrometer. The data was corrected for the spent fuel pool water temperature. Table 4.1 lists the measured assembly length and growth values of all 14 assemblies.

Assembly 5D28 has the 17x17 STD design with a removable top nozzle. The 'F', 'G' and 'R' assemblies have the 17x17 OFA design with VANTAGE 5 design features with IFMs. Thimble tube material of assembly 5D28 is standard Zircaloy-4; all thimbles in the "F", "G" and "R" assemblies contain Improved Zircaloy-4. Fuel assemblies 5F59 and 5F69 have ZIRLO fuel rods and improved Zircaloy-4 guide thimbles. a,b,c

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Table 4.1: Vogtle Fuel Assembly Growth Data a,b,c

[ ]

Figure 4.1: Recent Assembly Growth Data

a,b,c

5.0 Fuel Rod Growth

The axial gaps between each peripheral rod and the assembly nozzles were measured from the low magnification TV tapes of 14 Vogtle Unit 1 and 2 assemblies to determine fuel rod growth. Assemblies 5D28, 5F43, 5F47, 5F57, 5F59, 5F65, 5F69, 5F27, 5F41, 5G71, 5G73, and 5G84 from Unit 1 and 5R19 and 5R43 from Unit 2 were measured..

Measurements were performed using a divider and steel scale. Magnification conversion factors relating the measured gaps to the actual gaps were obtained by measuring the TV image of the height of several outer strap grid spring slots on the top and bottom grids for each assembly face, then comparing the measured slot height to the as-built dimension. This technique assumes that the irradiation growth of Inconel grids is negligible with respect to that of Zircaloy-4. Individual rod growth data is summarized in Appendix "A".

a,b,c

Figure 5.1: Assembly Average Rod Growth Data

a,b,c

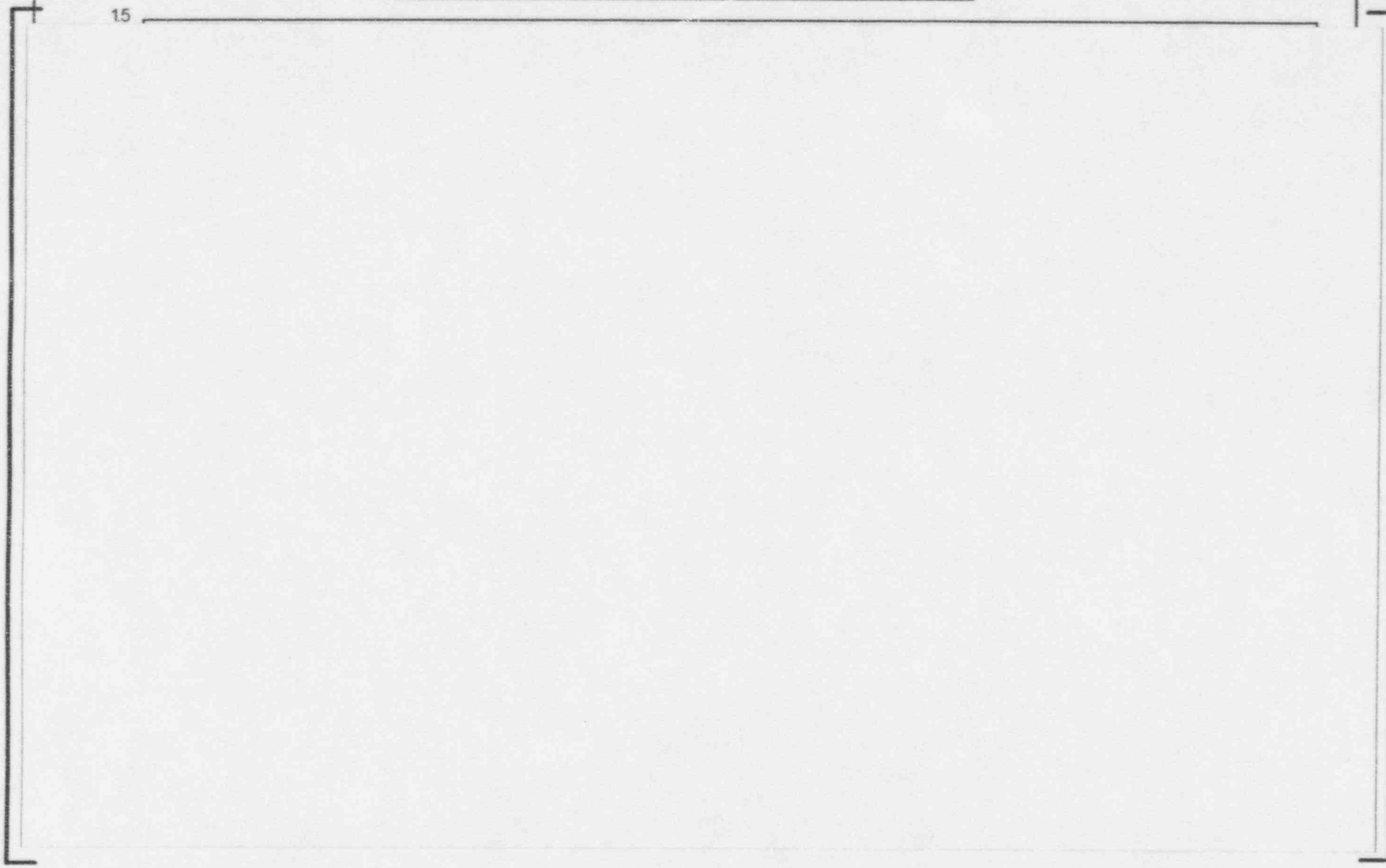

Table 5.1: Summary of Vogtle Assembly Average Rod Growth

[ ] a,b,c

6.0 Overall Summary

a,b,c

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Assemblies that were stored in the spent fuel pool for 1 or 2 cycles show no significant differences in drag values than recently discharged fuel assemblies having similar burnups.

a,b,c

[ ]

Appendix A

Fuel Rod Growth Data

for

Vogtle Units 1 & 2

VOGTLE 2

a,b,c

VOGTLE 2

a,c,e

VOGTLE 2

a,c,e

VOGTLE 2

a,c,e

VOGTLE 2

a,b,c

VOGTLE 2

VOGTLE 2

a,b,c

VOGTLE 2

a,b,c

VOGTLE 2

a,b,c

VOGTLE 2

a,b,c

VOGTLE 2

a,c,e

VOGTLE 2

a,b,c

VOGTLE 2

a,b,c

VOGTLE 2

a,b,c