North Anna Unit 1/Unit 2 Fuel Assembly Inspection Program

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Inspection work was conducted at North Anna by both VaPwr personnel and an NSD crew under the supervision of PPE engineer Howard Pendley. 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	Overall Summary	D. Colburn	A. Konzel

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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 (PPE-96-088) concluded that the direct

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The following tests were scheduled to be conducted during the inspection program:

(1) RCCA Drag Tests
(2) Guide Thimble Plug Gage Exams (also referred to as 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.

Videotaping of the rod-to-nozzle gaps for each of the North Anna fuel assemblies was not completed due to time limitations. Fuel rod growth data is therefore unavailable for North Anna at this time.

2.0 Full Length RCCA Drag Tests in Spent Fuel Pool

Fuel assemblies fabricated for seven different contracts were drag tested in the spent fuel pool. The specific fuel features for each assemby are shown in Table 2.1. All of the assemblies share the following common features:

- High Burnup
- Removable Top Nozzle
- Debris Filter Bottom Nozzle

Fuel assemblies manufactured during contracts VGHF, VGIF, VRIF, VRJF and VRKF were manufactured with low pressure drop Zirc grids and have features identical to the Wolf Creek assemblies that experienced the RCCA incomplete insertion problem. Fuel assemblies manufactured during contract VRKF also have additional features to allow the assemblies to obtain higher burnup values.

Table 2.1: Fuel Features of North Anna 17x17 Fuel Assemblies

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DFBN	Debris Filter Bottom Nozzle	LPZG	Low Pressure Drop Zirc Grid
VPS	Variable Pitch Plenum Spring	ZRLC	ZIRLO Fuel Rod Cladding
ZRLT	ZIRLO Guide Thimbles/ Instrument Tube	CC	Oxide-Coated Cladding
ZRLMG	ZIRLO Mid-Grids/IFMs		

The drag test results are tabulated in Table 2.2 and are graphed in Figures 2.1, 2.2 and 2.3. As shown in Table 2.2, some fuel assemblies were recently discharged from the

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Table 2.2: North Anna Drag Test Data

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Figure 2.1: North Anna Dashpot and Guide Thimble Drag Data

Figure 2.2: North Anna Dashpot Drag and Fast Fluence Data

Figure 2.3: North Anna Guide Thimble Drag and Fast Fluence Data

a,b,c

3.0 Single Tube Probe

Fuel assemblies that show relatively high drag or dashpot interference in the RCCA drag tests were selected for single-tube probing. The objective of this test was to determine the condition of the thimbles with respect to the following:

- Are the dashpots and/or major diameters distorted?
- Are the distortions "bows" or "kinks"?
- Are the distortions localized at a particular elevation?
- Are all the thimble tubes within an assembly distorted?

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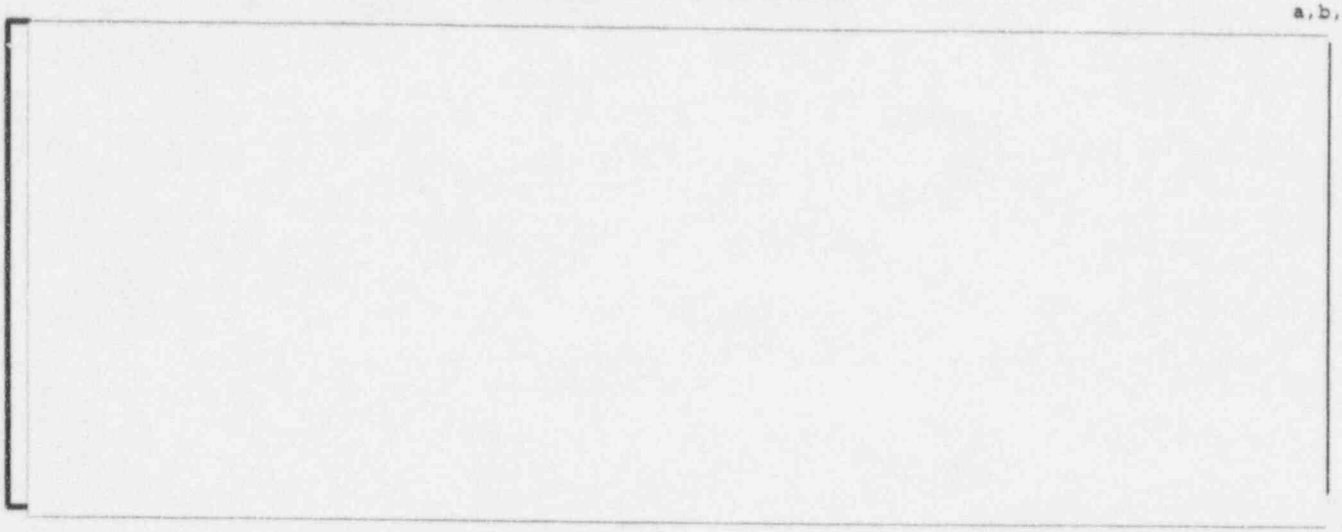

Table 3.1details the go/no-go thimble tube probe and thimble tube drag test results.

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Table 3.1: Go/No-Go Summary - Tubes Passed/ Tubes Tested ** = Not tested

4.0 Fuel Assembly Growth

Fuel assembly length measurements were performed on 16 assemblies (11 from Unit 1, and 5 from Unit 2). Measurements were made using a standard of known length and a measuring device with a dial indicator. The data was corrected for the spent fuel pool water temperature. The measured growth of the 16 assemblies is listed below in Table 4.1.

13 of the 16 assemblies are of the 17x17 Vantage-5H design and the remaining 3 are of the 17x17 standard design. The thimble tube material for assemblies 2A8, K17, K32, Y08, and X09 is standard Zircaloy-4; the remaining assemblies have thimbles made from Improved Zircaloy-4.

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Table 4.1: North Anna Fuel Assembly Growth Data

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Figure 4.1: Fuel Assembly Growth
SAP, VRA, CGE, WEP, GAE

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5.0 Overall Summary

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