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Data Compilation for AGR-1 Pre-Production Test: NUCO350-75T-Z

Revision 0

John D. Hunn, Richard A. Lowden, and Peter J. Pappano

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J. D. Hunn, R. A. Lowden, and P. J. Pappano
Oak Ridge National Laboratory

This document is a compilation of characterization data for compact lot NUCO350-75T-Z. This compact lot was fabricated using particle composite NUCO350-75T, which was a composite of three batches of TRISO-coated 350 μm natural uranium oxide/uranium carbide kernels (NUCO). The compacts and coated particles were produced as part of a development effort at ORNL for the Advanced Gas Reactor Fuel Development and Qualification (AGR) program. The kernels were obtained from BWXT and were identified as composite G73B-NU-69300. The BWXT kernel lot G73B-NU-69300 was riffled into sublots for characterization and coating. The ORNL identification for these kernel sublots was NUCO350-## (where ## was a series of integers beginning with 01).

NUCO350-75T-Z was produced as part of the ORNL AGR development effort and is not fully representative of a final product. This compact lot was the first run through of the entire ORNL AGR-1 irradiation test fuel production process involving coating, characterization, and compacting. It was performed using 350 μm NUCO kernels as surrogates for the 350 μm low enrichment (19.7%) uranium oxide/uranium carbide kernels that will be used for AGR-1 irradiation tests. The results of this exercise were used to fine tune the irradiation test fuel production process and as a basis for the decision to proceed with the production of the baseline fuel for the AGR-1 irradiation test. Although it was not required that the materials during this development phase meet a product specification, the properties were compared to the then current revision of the AGR-1 Fuel Product Specification and Characterization Guidance, INL EDF-4380, Rev. 4 for purposes of feedback and decision making.

Note that the average kernel weight was remeasured late in the pre-production test to improve the accuracy of the reported value. It changed from $(2.39\pm0.03)\cdot10^{-4}$ grams per kernel to $(2.308\pm0.009)\cdot10^{-4}$ grams per kernel. This resulted in significant correction to the calculated average kernel volume and buffer densities and some minor corrections to other reported values previously distributed in progress reports to the AGR program. The data in this summary has been updated to show the new average kernel weight, average kernel volume, and buffer densities. A record of the original measured values is included in section 11. Values that were not significantly changed by the change in average kernel weight were left as originally recorded.

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1 Product ID's Associated with NUCO350-75T

Kernels

NUCO350-## (from BWXT G73B-NU-69300)

Buffer coating process qualification

NUCO350-64B
NUCO350-61B
NUCO350-72B
NUCO350-73B (composite of 64B+61B+72B)

IPyC coating process qualification

NUCO350-63I
NUCO350-56I
NUCO350-69I
NUCO350-74I (composite of 63I+56I+69I)

TRISO coated particles

NUCO350-43T
NUCO350-48T
NUCO350-40T
NUCO350-75T (composite of 43T+48T+40T)

Compacts

NUCO350-75T-Z (01-36)

2 Coating process conditions

The following pages contain coating process conditions for all coated particle batches associated with the NUCO350-75T coated particle composite.

Note: The product specifications shown in the summary coating run sheets are from INL EDF-4380, Rev. 4 of the AGR-1 Fuel Product Specification and Characterization Guidance issued on 11/8/05. The coating runs listed in this section were performed over a period encompassing Rev. 3 (draft 7/18/05, issued 8/31/05) through a draft version of Rev. 4. Over this period, the coating specification evolved as information became available through the coating development process. During this period, the buffer coating temperature product specification was changed to 1450±25°C in Rev. 4 from ~1275°C (with no specified tolerance) in Rev. 3. The as-processed buffer coating temperature of 1350°C satisfied the Rev. 3 specification in use at the time the coated particles were fabricated.

Buffer qualification

NUCO350-64B
NUCO350-61B
NUCO350-72B

IPyC Qualification

NUCO350-63I
NUCO350-56I
NUCO350-69I

TRISO Batches

NUCO350-43T
NUCO350-48T
NUCO350-40T

Summary for Baseline Buffer Qualification Run – NUCO350-64B

Coating Run No.		NUCO350-64B
Description:		Baseline NUCO processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-64
Operator:		R. A. Lowden
Date:		08/02/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 62 -71
Kernel Batch Wt.		61.89 g
Coated Particle Batch Wt.		84.76 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1265 ± 25°C	
Time		
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/2/05
Verified by:	James H. Miller	Date:	8-31-05
QAS:	M. C. Fox	Date:	2/22/06

Summary for Baseline Buffer Qualification Run – NUCO350-61B

Coating Run No.		NUCO350-61B
Description:		Baseline NUCO processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-61
Operator:		R. A. Lowden
Date:		08/02/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 72 - 81
Kernel Batch Wt.		62.05 g
Coated Particle Batch Wt.		84.29 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1265 ± 25°C	
Time		
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/2/05
Verified by:	James H. Miller	Date:	8-31-05
QAS:		Date:	2/22/06

Summary for Baseline Buffer Qualification Run – NUCO350-72B

Coating Run No.		NUCO350-72B
Description:		Baseline NUCO processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-72
Operator:		R. A. Lowden
Date:		08/03/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 82 - 91
Kernel Batch Wt.		62.29 g
Coated Particle Batch Wt.		85.06 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1265 ± 25°C	
Time		
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/3/05
Verified by:	James H. Miller	Date:	8-31-05
QAS:	M. C. [illegible]	Date:	2/22/06

Summary for Baseline IPyC Qualification Run – NUCO350-63I

Coating Run No.	NUCO350-63I	
Description:	Baseline NUCO processing conditions	
Procedure:	AGR-COAT-SOP-01, Rev. 1	
Kernel Lot No.	NUCO350-63	
Operator:	R. A. Lowden	
Date:	08/03/2005	
Data Location:	B002514, Coating Log, Volume 2, pp. 92 - 101	
Kernel Batch Wt.	62.32 g	
Coated Particle Batch Wt.	108.77 g	
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		13.33 min
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/3/05
Verified by:	James H. Miller	Date:	8-31-05
QAS:	M. C. [illegible]	Date:	2/22/06

Summary for Baseline IPyC Qualification Run – NUCO350-56I

Coating Run No.		NUCO350-56I
Description:		Baseline NUCO processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-56
Operator:		R. A. Lowden
Date:		08/08/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 102 -111
Kernel Batch Wt.		62.13 g
Coated Particle Batch Wt.		110.44 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		13.33 min
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/8/05
Verified by:	James H. Miller	Date:	8-31-05
QAS:	M. C. Lee	Date:	2/22/06

Summary for Baseline IPyC Qualification Run – NUCO350-69I

Coating Run No.	NUCO350-69I	
Description:	Baseline NUCO processing conditions	
Procedure:	AGR-COAT-SOP-01, Rev. 1	
Kernel Lot No.	NUCO350-69	
Operator:	R. A. Lowden	
Date:	08/09/2005	
Data Location:	B002514, Coating Log, Volume 2, pp. 112 -121	
Kernel Batch Wt.	62.68 g	
Coated Particle Batch Wt.	109.65 g	
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		5 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		13.33 min
SiC		
Coating gases	H_2 + MTS	
TGF		
CGF	0.015 ± 0.005	
Temperature	1500 ± 25°C	
Time		
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	
TGF		
CGF	0.30 ± 0.03	
CGR	0.85 ± 0.085	
Temperature	1290 ± 40°C	
Time		
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/9/05
Verified by:	James H. Walter	Date:	8-31-05
QAS:	M.C. Dan	Date:	2/22/06

Summary for Baseline Coating Run – NUCO350-43T

Coating Run No.		NUCO350-43T
Description:		Baseline AGR-1 processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-43
Operator:		R. A. Lowden
Date:		8/17/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 134 -143
Kernel Batch Wt.		62.66 g
Coated Particle Batch Wt.		191.03 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		6 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		14 min
SiC		
Coating gases	H_2 + MTS	H_2 + MTS
TGF		16,945 sccm
CGF	0.015 ± 0.005	0.014
Temperature	1500 ± 25°C	1500°C
Time		140 min
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		14,740 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1290 ± 40°C	1300°C
Time		10.75` min
Comments/Notes:		

Operator:	Richard A Lowden	Date:	8/17/05
Verified by:	James H. Miller	Date:	10-19-05
QAS:	M.C. Jon	Date:	2/22/06

Sizing & Removal of Aspherical Particles for NUCO350-43T

Summary for Sizing of Kernels or Coated Particles

Procedure:		AGR-ROLLER-SOP-01, Rev. 0		
Operator:		J. H. Miller		
Kernel/Coated Particle ID:		NUCO350-43T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 17		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
08/30/2005	192.47	176.47	15.91	(0.09)
Comments:				
Operator:	James H. Miller	Date:	8-30-05	
Verified by:	Richard A. Lowden	Date:	12/15/05	
QAS:	M. C. [illegible]	Date:	2/22/06	

Summary for Tabling of Kernels or Coated Particles

Procedure:		AGR-TABLE-SOP-01, Rev. 1		
Operator:		J. H. Miller		
Kernel/Coated Particle ID:		NUCO350-43T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 23		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
09/01/2005	174.70	168.57	6.12	(0.01)
Comments:				
Operator:	James H. Miller	Date:	9-1-05	
Verified by:	Richard A. Lowden	Date:	9/1/05	
QAS:	M. C. [illegible]	Date:	2/22/06	

Summary for Baseline Coating Run – NUCO350-48T

Coating Run No.		NUCO350-48T
Description:		Baseline AGR-1 processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-48
Operator:		R. A. Lowden
Date:		8/17/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 144 -153
Kernel Batch Wt.		62.44 g
Coated Particle Batch Wt.		194.58 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		6 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		14 min
SiC		
Coating gases	H_2 + MTS	H_2 + MTS
TGF		16,945 sccm
CGF	0.015 ± 0.005	0.014
Temperature	1500 ± 25°C	1500°C
Time		140 min
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		14,740 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1290 ± 40°C	1300°C
Time		10.75` min
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/17/05
Verified by:	James H. Miller	Date:	10-19-05
QAS:	M. C. Pan	Date:	2/22/06

Sizing & Removal of Aspherical Particles for NUCO350-48T

Summary for Sizing of Kernels or Coated Particles

Procedure:		AGR-ROLLER-SOP-01, Rev. 0		
Operator:		J. H. Miller		
Kernel/Coated Particle ID:		NUCO350-48T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 19		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
08/30/2005	193.21	188.52	4.69	(0.00)
Comments:				
Operator:	James H. Miller	Date:	8-30-05	
Verified by:	Richard A Lowden	Date:	12/15/05	
QAS:	M. C. [illegible]	Date:	2/22/06	

Summary for Tabling of Kernels or Coated Particles

Procedure:		AGR-TABLE-SOP-01, Rev. 1		
Operator:		J. H. Miller		
Kernel/Coated Particle ID:		NUCO350-48T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 22		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
08/31/2005	188.35	182.96	5.34	(0.05)
Comments:				
Operator:	James H. Miller	Date:	8-31-05	
Verified by:	Richard A Lowden	Date:	9/1/05	
QAS:	M. C. [illegible]	Date:	2/22/06	

Summary for Baseline Coating Run – NUCO350-40T

Coating Run No.		NUCO350-40T
Description:		Baseline AGR-1 processing conditions
Procedure:		AGR-COAT-SOP-01, Rev. 1
Kernel Lot No.		NUCO350-40
Operator:		R. A. Lowden
Date:		8/30/2005
Data Location:		B002514, Coating Log, Volume 2, pp. 154 -163
Kernel Batch Wt.		62.36 g
Coated Particle Batch Wt.		190.35 g
	AGR-1 Parameter	**As-Processed**
Buffer		
Coating gases	C_2H_2 + Ar	C_2H_2 + Ar
TGF		8530 sccm
CGF	0.60 ± 0.10	0.61
Temperature	1450 ± 25°C	1350°C
Time		6 min
IPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		9430 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1265 ± 25°C	1265°C
Time		14 min
SiC		
Coating gases	H_2 + MTS	H_2 + MTS
TGF		16,945 sccm
CGF	0.015 ± 0.005	0.014
Temperature	1500 ± 25°C	1500°C
Time		140 min
OPyC		
Coating gases	Ar + C_2H_2 + C_3H_6	Ar + C_2H_2 + C_3H_6
TGF		14,740 sccm
CGF	0.30 ± 0.03	0.30
CGR	0.85 ± 0.085	0.85
Temperature	1290 ± 40°C	1300°C
Time		10.75` min
Comments/Notes:		

Operator:	Richard A. Lowden	Date:	8/30/05
Verified by:	James H. Walter	Date:	10-19-05
QAS:	M. C. Jan	Date:	2/22/06

Sizing & Removal of Aspherical Particles for NUCO350-40T

Summary for Sizing of Kernels or Coated Particles

Procedure:		AGR-ROLLER-SOP-01, Rev. 0		
Operator:		J. H. Miller		
Kernel/Coated Particle ID:		NUCO350-40T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 20 - 21		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
08/31/2005	188.74	177.88	10.91	+0.05
Comments:				
Operator:	James H. Miller	Date:	8-31-05	
Verified by:	Richard A Lowden	Date:	10/19/05	
QAS:	M.C. [illegible]	Date:	2/22/06	

Summary for Tabling of Kernels or Coated Particles

Procedure:		AGR-TABLE-SOP-01, Rev. 1		
Operator:		R. A. Lowden		
Kernel/Coated Particle ID:		NUCO350-40T		
Kernel/Coated Particle Description:		Baseline, full TRISO on 350 μm NUCO		
Data Location:		B002163, Sizing & Tabling, p. 24		
Date	Batch Weight (g)	Sized Batch Weight (g)	Scrap (g)	Loss (g)
09/01/2005	177.88	172.97	4.89	(0.02)
Comments:				
Operator:	Richard A Lowden	Date:	9/1/05	
Verified by:	James H. Miller	Date:	10-19-05	
QAS:	M.C. [illegible]	Date:	2/22/06	

3 Blend of coated particle composites

Three batches of TRISO-coated particles were blended into composite NUCO350-75T. The mass of each batch added to the composite is shown in the following table.

TRISO batch ID	Amount added to NUCO350-75T composite (g)
NUCO350-43T	163.4297
NUCO350-48T	177.7137
NUCO350-40T	167.8707
Total	509.0141

Three batches of Buffer/IPyC-coated particles were blended into composite NUCO350-74I. The mass of each batch added to the composite is shown in the following table.

TRISO batch ID	Amount added to NUCO350-74I composite (g)
NUCO350-63I	100.5042
NUCO350-56I	102.7235
NUCO350-69I	101.9190
Total	305.1467

Three batches of Buffer-coated particles were blended into composite NUCO350-73B. The mass of each batch added to the composite is shown in the following table.

TRISO batch ID	Amount added to NUCO350-73B composite (g)
NUCO350-64B	58.4071
NUCO350-61B	57.7439
NUCO350-72B	58.0779
Total	174.2289

4 Compacting process conditions

Introduction

NUCO350-75T TRISO particles were overcoated and compacted as part of a qualification test for the compacting process. The NUCO350-75T particles were characterized prior to being given to the compacting group. The batch of particles was riffled into aliquots of ~20 g and subsequently labeled NUCO350-75T-Y## (## = 01 to 10). Ten aliquots were overcoated to make 36 NUCO350-75T-Z compacts for characterization. This section provides the AGR-1 process conditions specified in INL EDF-4380, Rev. 3, AGR-1 Fuel Product Specification and Characterization Guidance, and a summary table of the process conditions used in making the compacts.

AGR-1 Process Conditions

The AGR-1 process limits from EDF-4380, Rev. 3 are listed below.

AGR-1 Process Limits: Molding Pressure <20 MPa.

Carbonization parameters: <350ºC/hr. in He
Hold at 950±50ºC for 1.0±0.4 hrs.
Furnace cool.

Heat treatment parameters: ~20ºC/min. in vacuum
Hold at 1650-1850ºC for 60±10 min.
Furnace cool at ~20ºC/min. to below 700ºC.

Table 1 shows the process conditions used in molding the compacts, carbonizing the compacts, and heat treating the compacts. In the carbonization regime, the furnace was allowed to cool under no power, i.e., after holding at 950°C for 1 hour, power was turned off. In the heat treatment run, the furnace was cooled under power until the furnace temperature reached 700°C. The rate of cooling was 19°C/min.

Conclusion

The NUCO350-75T-Z compact lot was made in accordance with the AGR-1 process limits listed in EDF-4380, Rev. 3.

Table 1. Summary of process conditions used in making NUCO350-75T-Z compacts

	Carbonization Parameter					Heat-treatment Parameters			
Compact ID	Molding Pressure (MPa)	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere	Heating Rate (°C/min.)	Max. Temp. (°C)	Hold Time (hrs.)	Atmosphere
NUCO350-75T-Z01	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z02	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z03	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z04	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z05	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z06	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z07	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z08	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z09	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z10	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z11	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z12	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z13	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z14	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z15	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z16	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z17	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z18	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z19	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z20	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z21	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z22	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z23	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z24	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z25	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z26	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z27	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z28	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z29	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z30	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z31	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z32	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z33	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z34	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z35	<4.65	5	950	1	flowing He	20	1800	1	vacuum
NUCO350-75T-Z36	<4.65	5	950	1	flowing He	20	1800	1	vacuum

Task Manager Verification:	Peter J. Pappano	**Date:** 28Feb06
QA Review:	Mark C. Thompson	**Date:** 2/28/06

5 Characterization of kernel composite

This section contains data on the kernel composite used for NUCO350-75T. It was obtained according to product inspection plan AGR-CHAR-PIP-01R1. Some of the kernel data in this section was used as input for subsequent measurements of coating properties (e.g., buffer density and burn-leach defects). This is only a partial analysis of the kernel composite and was not used for product acceptance. Characterization of the kernel composite for acceptance according to the fuel specification, INL EDF-4380, is documented in the BWXT data package for G73B-NU-69300. The BWXT kernel lot G73B-NU-69300 was riffled into sublots for characterization and coating. The ORNL identification for these kernels was NUCO350-## (where ## were a series of integers beginning with 01). Initial characterization was performed on samples from NUCO350-26 and later additional characterization was performed on samples from NUCO350-42. Both of these riffled sublots were representative of the entire kernel lot G73B-NU-69300.

Note that the average kernel weight was remeasured to improve the accuracy of the reported value. It changed from $(2.39\pm0.03)\cdot10^{-4}$ grams per kernel to $(2.308\pm0.009)\cdot10^{-4}$ grams per kernel. This resulted in significant correction to the calculated average kernel volume. The data in this section has been updated to show the new average kernel weight and average kernel volume. A record of the original measured values is included in section 11.

The following page shows the inspection report form (IRF-01). Following IRF-01 are the individual data report forms for the measurements that were performed.

Inspection Report Form IRF-01: BWXT NUCO Kernel Composite 69300

Procedure: AGR-CHAR-PIP-01 Rev. 1

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	k or t value	INL EDF-4380 Rev. 4			
Average kernel diameter (µm)	344.9	15	4202	1.645	mean 350 ± 10	A = x - ts/√n ≥ 340	344.5	DRF-06 DRF-09
						B = x + ts/√n ≤ 360	345.3	
				2.38	dispersion ≤0.01 < 300 ≤0.01 > 400	C = x - ks > 300	309.2	
						D = x + ks < 400	380.6	
Kernel ellipticity (Dmax/Dmin)	1.022		4202		dispersion ≤0.10 ≥1.05	≤1 in 50 or ≤7 in 142	186	DRF-06 DRF-09
Kernel envelope density (Mg/m³)	10.800	0.006	5	2.132	mean ≥10.4	A = x - ts/√n ≥ 10.4	10.79	DRF-15 DRF-22

Comments

186 kernels with ellipticity ≥1.05 out of 4202 kernels measured passes the dispersion specification acceptance criteria of ≤387 in 4202.
This composite would pass an ellipticity control limit of ≥1.038 at 10% tolerance limit with 95% confidence level.
This composite would pass an ellipticity control limit of ≥1.05 at 5% tolerance limit with 95% confidence level.

QC Supervisor — Date: 2-20-06

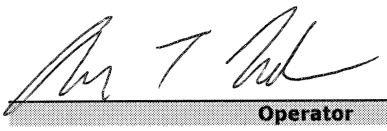
QA Reviewer — Date: 2/22/06

Data Report Form DRF-06: Imaging of Kernel Diameter and Ellipticity Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-06 Rev. 0
Operator:	Andrew Nelson
Sample ID:	NUCO350-26B
Sample Description:	350 um NUCO kernels from BWXT 69300 Composite
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05052501

DMR Calibration Expiration Date:	3/25/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 760 µm in Stage Micrometer Image:	760.6 µm

Mean average weight/particle (g):	2.39E-04
Weight of sample of particles (g):	1.408
Approximate number of particles in sample:	5891



Operator

5/25/2005

Date

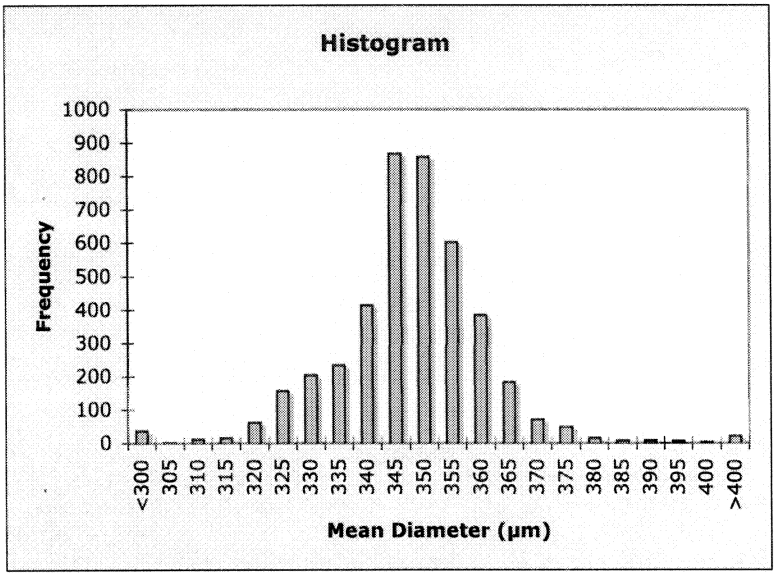
Data Report Form DRF-09A: Measurement of Kernel Diameter

Procedure:	AGR-CHAR-DAM-09 Rev. 0
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05052501
Sample ID:	NUCO350-26B NUCO kernels
Sample Description:	350 um NUCO kernels from BWXT 69300 Composite
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05052501_output

Number of kernels analyzed:	4202
Mean of the average diameter of each kernel (µm):	344.9
Standard deviation in the average diameter of each kernel (µm):	15

Distribution of the average kernel diameter (top binned)

Mean Diameter	*Frequency*
<300	36
305	1
310	11
315	15
320	61
325	156
330	204
335	233
340	412
345	867
350	858
355	603
360	383
365	182
370	71
375	48
380	16
385	8
390	7
395	5
400	3
>400	22



Andrew K. Kercher
Operator

May 31, 2005
Date

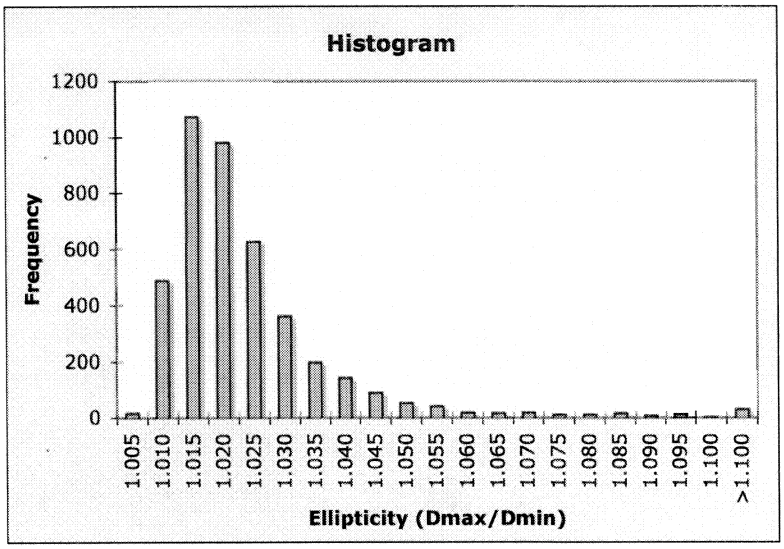
Data Report Form DRF-09B: Measurement of Kernel Ellipticity (Dmax/Dmin)

Procedure:	AGR-CHAR-DAM-09 Rev. 0
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05052501
Sample ID:	NUCO350-26B NUCO kernels
Sample Description:	350 um NUCO kernels from BWXT 69300 Composite
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05052501_output

Number of kernels analyzed:	4202
Number of kernels with ellipticity >1.05:	186
Average kernel ellipticity:	1.022

Distribution of the ellipticity (top binned)

Ellipticity (D)	*Frequency*
1.005	15
1.010	486
1.015	1069
1.020	979
1.025	627
1.030	361
1.035	197
1.040	141
1.045	89
1.050	52
1.055	42
1.060	19
1.065	17
1.070	19
1.075	11
1.080	12
1.085	15
1.090	8
1.095	11
1.100	2
>1.100	30



A. K. Kercher
Operator

May 31, 2005
Date

Data Report Form DRF-15: Measurement of Average Kernel Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-15 Rev. 2
Operator:	S. D. NUNN
Kernel Lot ID:	NUCO350-26
Kernel Lot Description:	NUCO KERNEL COMPOSITE 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05052601\S05052601R1_DRF15R2

Mean average weight/kernel (g):	2.31E-04
Uncertainty in mean average weight/kernel (g):	8.69E-07

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05052601L	S0502602L	S05052603L	S05052604L	S05052605L
Weight of kernels (g):	12.8272	12.9542	12.9410	12.9793	12.9624
Approximate number of kernels:	55577	56127	56070	56236	56163
Uncertainty in number of kernels:	209	211	211	212	211
Envelope volume of sample (cc):	1.187	1.200	1.199	1.202	1.199
Average envelope volume/kernel (cc):	2.14E-05	2.14E-05	2.14E-05	2.14E-05	2.14E-05
Sample envelope density (g/cc):	10.805	10.792	10.797	10.799	10.807

Mean average envelope volume/kernel (cc):	2.137E-05
Uncertainty in mean envelope volume/kernel (cc):	5.47E-09
Mean sample envelope density (g/cc):	10.800
Standard deviation in sample envelope density (g/cc):	0.006

S. D. Nunn
Operator

2/14/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	John Hunn
Particle Lot ID:	NUCO350-42-A
Particle Lot Description:	BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W06020302_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	3.13E-02	2.84E-02	3.40E-02	3.48E-02	3.40E-02
Number of particles:	136	123	149	149	147
Average weight/particle (g):	2.30E-04	2.31E-04	2.28E-04	2.34E-04	2.31E-04

Mean average weight/particle (g):	2.308E-04
Uncertainty in mean average weight/particle (g):	8.69E-07

John Hunn
Operator

2-3-06
Date

6 Characterization of buffer on interrupted batches

This section contains data on the buffer coating density and other properties for particles removed from the coater after deposition of only the buffer layer. It was obtained according to product inspection plan AGR-CHAR-PIP-02R2. The buffer on these particles was deposited under similar conditions as the buffer on the particles in composite NUCO350-75T and was representative of the buffer on the particles in that composite. Density measurements were made on these interrupted batches because it was not feasible to measure the buffer density after all coating layers were applied.

Note that the average kernel weight was remeasured to improve the accuracy of the reported value. It changed from $(2.39\pm0.03)\cdot10^{-4}$ grams per kernel to $(2.308\pm0.009)\cdot10^{-4}$ grams per kernel. This resulted in significant correction to the calculated average kernel volume and buffer densities. The data in this summary has been updated to show the new average kernel weight, average kernel volume, and buffer densities. A record of the original measured values is included in section 11. The new values for buffer density were about 10% higher than the originally reported values, putting the mean densities at the upper limit of the range specified in INL EDF-4380, Rev. 4. In two cases, the new buffer density failed to meet the acceptance criteria. Section 11 shows the originally reported values which were used in the decision to proceed with the coating of the NUCO350-75T TRISO particles using the buffer deposition conditions in section 2.

The following page shows the inspection report form (IRF-02A). Following IRF-02A are the individual data report forms for the measurements that were performed. Additional data at the end of this section is provided for information only.

Inspection Report Form IRF-02A: Interrupted Coating Batches - Buffer Density

Procedure:	AGR-CHAR-PIP-02 Rev. 2
Batch 1 ID:	NUCO350-64B
Batch 1 description:	Buffer on BWXT kernel composite 69300
Batch 2 ID:	NUCO350-61B
Batch 2 description:	Buffer on BWXT kernel composite 69300
Batch 3 ID:	NUCO350-72B
Batch 3 description:	Buffer on BWXT kernel composite 69300
Composite ID:	NUCO350-73B
Composite description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	t value (t)	INL EDF-4380 Rev. 4				
Batch 1: Buffer envelope density	1.21	0.03	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.18	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.24	pass	
Batch 2: Buffer envelope density	1.24	0.04	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.20	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.28	fail	
Batch 3: Buffer envelope density	1.22	0.05	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.17	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.27	fail	
Composite buffer envelope density	1.21	0.04	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.17	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.25	pass	

Comments

Standard deviations are √5 times the uncertainties in buffer density (standard errors) reported on DRF-16.
Coating thickness measured for information only.
Average thickness of buffer was 110 µm based on average envelope volume of 9.42E-5 cc (effective diameter of 564 µm) and average kernel diameter of 345 µm.
Average thickness of buffer was 109 µm based on average outer diameter of 563 µm obtained per DAM-10 and average kernel diameter of 345 µm.
Data updated to reflect recent remeasurement of average kernel weight (W06020302).

John Klumm — QC Supervisor

2-14-06 — Date

Accept for buffer density (Yes or No):	Not Applicable

M. C. Pan — QA Reviewer

2/22/06 — Date

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	J.D. Hunn and S.D. Nunn
Buffer-coated kernel batch ID:	NUCO350-64B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080302\S05080302R1_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	7.00E-07
Mean average weight/bare kernel (g):	2.31E-04
Uncertainty in mean average weight/bare kernel (g):	8.69E-07
Mean average envelope volume/bare kernel (cc):	2.14E-05
Uncertainty in envelope volume/bare kernel (cc):	5.47E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080302L	S05080801L	S05080802L	S05080803L	S05080804L
Weight of buffer-coated kernels (g):	4.1385	4.1703	4.1990	4.2017	4.1848
Approximate number of b-c kernels:	12933	13032	13122	13130	13078
Uncertainty in number of b-c kernels:	28	29	29	29	29
Total envelope volume of sample (cc):	1.224	1.228	1.245	1.248	1.238
Av. envelope volume/b-c kernels (cc):	9.46E-05	9.42E-05	9.49E-05	9.50E-05	9.46E-05
Sample envelope density (g/cc):	3.382	3.396	3.373	3.367	3.382

Mean average envelope volume/b-c kernel (cc):	9.47E-05
Uncertainty in envelope volume/b-c kernel (cc):	1.4E-07

Buffer density:	1.21E+00
Uncertainty in buffer density:	1.54E-02

S.D. Nunn
Operator

2/14/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Dixie Barker
Particle Lot ID:	NUCO350-64B
Particle Lot Description:	Buffer on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05080301_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	3.34E-02	3.14E-02	3.86E-02	4.06E-02	3.62E-02
Number of particles:	104	98	121	128	113
Average weight/particle (g):	3.21E-04	3.20E-04	3.19E-04	3.17E-04	3.20E-04

Mean average weight/particle (g):	3.20E-04
Uncertainty in mean average weight/particle (g):	7.00E-07

Dixie Barker
Operator

8-3-05
Date

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-61B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080901\S05080901AR1_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	9.24E-07
Mean average weight/bare kernel (g):	2.31E-04
Uncertainty in mean average weight/bare kernel (g):	8.69E-07
Mean average envelope volume/bare kernel (cc):	2.14E-05
Uncertainty in envelope volume/bare kernel (cc):	5.47E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080901L	S05080902L	S05080903L	S05080904L	S05080905L
Weight of buffer-coated kernels (g):	4.2536	4.2901	4.2776	4.2169	4.0996
Approximate number of b-c kernels:	13293	13407	13368	13178	12811
Uncertainty in number of b-c kernels:	38	39	39	38	37
Total envelope volume of sample (cc):	1.234	1.250	1.248	1.231	1.197
Av. envelope volume/b-c kernels (cc):	9.29E-05	9.33E-05	9.34E-05	9.34E-05	9.34E-05
Sample envelope density (g/cc):	3.446	3.431	3.428	3.425	3.425

Mean average envelope volume/b-c kernel (cc):	9.33E-05
Uncertainty in envelope volume/b-c kernel (cc):	1.1E-07

Buffer density:	1.24E+00
Uncertainty in buffer density:	1.77E-02

S. D. Nunn
Operator

2/14/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Dixie Barker
Particle Lot ID:	NUCO350-61B
Particle Lot Description:	Buffer on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05081701_DRF22.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	3.55E-02	3.84E-02	4.54E-02	4.44E-02	3.92E-02
Number of particles:	111	121	143	138	122
Average weight/particle (g):	3.20E-04	3.17E-04	3.17E-04	3.22E-04	3.21E-04

Mean average weight/particle (g):	3.20E-04
Uncertainty in mean average weight/particle (g):	9.24E-07

Dixie Barker
Operator

8-11-05
Date

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-72B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080906\S05080906R1_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	1.47E-06
Mean average weight/bare kernel (g):	2.31E-04
Uncertainty in mean average weight/bare kernel (g):	8.69E-07
Mean average envelope volume/bare kernel (cc):	2.14E-05
Uncertainty in envelope volume/bare kernel (cc):	5.47E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080906L	S05080907L	S05080908L	S05080909L	S05080910L
Weight of buffer-coated kernels (g):	4.3142	4.4196	4.2568	4.2748	4.3303
Approximate number of b-c kernels:	13482	13811	13303	13359	13532
Uncertainty in number of b-c kernels:	62	63	61	61	62
Total envelope volume of sample (cc):	1.267	1.302	1.253	1.259	1.274
Av. envelope volume/b-c kernels (cc):	9.39E-05	9.43E-05	9.42E-05	9.43E-05	9.41E-05
Sample envelope density (g/cc):	3.406	3.394	3.397	3.394	3.400

Mean average envelope volume/b-c kernel (cc):	9.42E-05
Uncertainty in envelope volume/b-c kernel (cc):	6.2E-08

Buffer density:	1.22E+00
Uncertainty in buffer density:	2.35E-02

S. D. Nunn
Operator

2/14/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Dixie Barker
Particle Lot ID:	NUCO350-72B
Particle Lot Description:	Buffer on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05080401_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	3.15E-02	3.21E-02	3.30E-02	3.19E-02	2.69E-02
Number of particles:	98	102	102	100	84
Average weight/particle (g):	3.21E-04	3.15E-04	3.24E-04	3.19E-04	3.20E-04

Mean average weight/particle (g):	3.20E-04
Uncertainty in mean average weight/particle (g):	1.47E-06

Dixie Barker
Operator

8-4-05
Date

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-73B
Batch Description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\vnc-agr\AGR\Porosimeter\S05081001\S05081001R1_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.18E-04
Uncertainty in mean average weight/b-c kernel (g):	7.29E-07
Mean average weight/bare kernel (g):	2.31E-04
Uncertainty in mean average weight/bare kernel (g):	8.69E-07
Mean average envelope volume/bare kernel (cc):	2.14E-05
Uncertainty in envelope volume/bare kernel (cc):	5.47E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05081001L	S05081002L	S05081003L	S05081004L	S05081005L
Weight of buffer-coated kernels (g):	4.3279	4.4597	4.2871	4.3528	4.4245
Approximate number of b-c kernels:	13610	14024	13481	13688	13914
Uncertainty in number of b-c kernels:	31	32	31	31	32
Total envelope volume of sample (cc):	1.268	1.313	1.259	1.279	1.302
Av. envelope volume/b-c kernels (cc):	9.31E-05	9.36E-05	9.34E-05	9.34E-05	9.35E-05
Sample envelope density (g/cc):	3.414	3.397	3.406	3.403	3.399

Mean average envelope volume/b-c kernel (cc):	9.34E-05
Uncertainty in envelope volume/b-c kernel (cc):	8.1E-08

Buffer density:	1.21E+00
Uncertainty in buffer density:	1.58E-02

S. D. Nunn
Operator

2/14/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Andrew K. Kercher
Particle Lot ID:	NUCO350-73B
Particle Lot Description:	Composite of Buffer on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05080901_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	4.31E-02	3.32E-02	5.09E-02	2.40E-02	3.99E-02
Number of particles:	135	105	160	75	126
Average weight/particle (g):	3.19E-04	3.16E-04	3.18E-04	3.20E-04	3.17E-04

Mean average weight/particle (g):	3.18E-04
Uncertainty in mean average weight/particle (g):	7.29E-07

Andrew K. Kercher
Operator

August 9, 2005
Date

For Information Only

The information in the remainder of this section reports results of measurements not required by the fuel specification and is provided for information only.

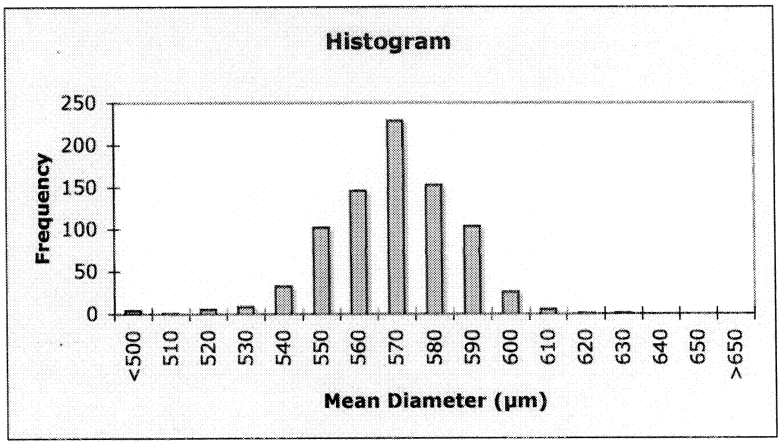
Data Report Form DRF-10A: Measurement of Particle Diameter

Procedure:	AGR-CHAR-DAM-10 Rev. 1
Operator:	Andy Nelson
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05080501\
Sample ID:	NUCO350-73B-H
Sample Description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05080501_output\

Number of particles analyzed:	816
Mean of the average diameter of each particle (μm):	564
Standard deviation in the average diameter of each particle (μm):	19

Distribution of the average particle diameter (top binned)

Mean Diameter (μm)	*Frequency*
<500	4
510	1
520	5
530	8
540	33
550	102
560	145
570	229
580	153
590	103
600	26
610	5
620	1
630	1
640	0
650	0
>650	0



Operator

8/16/2005
Date

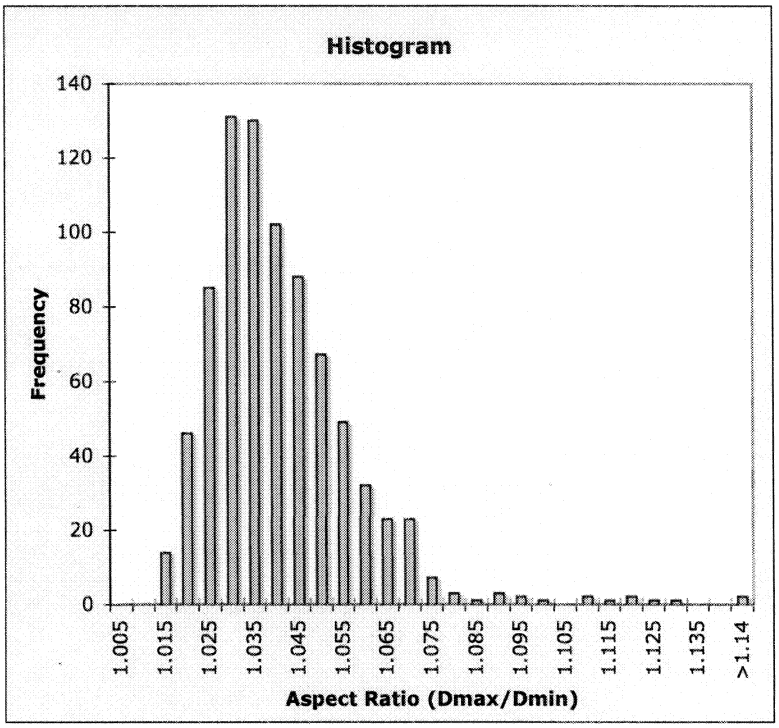
Data Report Form DRF-10B: Measurement of Particle Aspect Ratio (Dmax/Dmin)

Procedure:	AGR-CHAR-DAM-10 Rev. 1
Operator:	Andy Nelson
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05080501\
Sample ID:	NUCO350-73B-H
Sample Description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05080501_output\

Number of particles analyzed:	816
Number of particles with aspect ratio > 1.14	2
Average particle aspect ratio:	1.039

Distribution of the aspect ratio (top binned)

Aspect Ratio (D)	*Frequency*
1.005	0
1.010	0
1.015	14
1.020	46
1.025	85
1.030	131
1.035	130
1.040	102
1.045	88
1.050	67
1.055	49
1.060	32
1.065	23
1.070	23
1.075	7
1.080	3
1.085	1
1.090	3
1.095	2
1.100	1
1.105	0
1.110	2
1.115	1
1.120	2
1.125	1
1.130	1
1.135	0
1.140	0
>1.14	2



Operator

8/14/2005

Date

7 Characterization of IPyC on interrupted batches

This section contains data on the inner pyrocarbon (IPyC) coating density and other properties for particles removed from the coater after deposition of only the buffer and IPyC layers. It was obtained according to product inspection plan AGR-CHAR-PIP-02R2. The IPyC on these particles was deposited under similar conditions as the IPyC on the particles in composite NUCO350-75T and was representative of the IPyC on the particles in that composite. Density measurements were made on these interrupted batches because it was not feasible to measure the IPyC density after all coating layers were applied.

The following page shows the inspection report form (IRF-02B). Following IRF-02B are the individual data report forms for the measurements that were performed. Additional data at the end of this section is provided for information only.

Inspection Report Form IRF-028: Interrupted Coating Batches - IPyC Density

Procedure:	AGR-CHAR-PIP-02 Rev. 2
Batch 1 ID:	NUCO350-63I
Batch 1 description:	IPyC/Buffer on BWXT kernel composite 69300
Batch 2 ID:	NUCO350-56I
Batch 2 description:	IPyC/Buffer on BWXT kernel composite 69300
Batch 3 ID:	NUCO350-69I
Batch 3 description:	IPyC/Buffer on BWXT kernel composite 69300
Composite ID:	NUCO350-74I
Composite description:	Composite (63I+56I+69I) IPyC/Buffer on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	k or t value	INL EDF-4380 Rev. 4				
Batch 1: IPyC sink/float density	1.9347	0.0099	21	1.725	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.931	pass	DRF-03
						B = x + ts/√n ≤ 1.95	1.938	pass	
				3.262	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.902	pass	
						D = x + ks < 2.00	1.967	pass	
Batch 2: IPyC sink/float density	1.9165	0.0097	22	1.721	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.913	pass	DRF-03
						B = x + ts/√n ≤ 1.95	1.920	pass	
				3.233	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.885	pass	
						D = x + ks < 2.00	1.948	pass	
Batch 3: IPyC sink/float density	1.9140	0.0079	20	1.729	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.911	pass	DRF-03
						B = x + ts/√n ≤ 1.95	1.917	pass	
				3.295	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.888	pass	
						D = x + ks < 2.00	1.940	pass	
Composite IPyC sink/float density	1.9115	0.0180	22	1.721	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.905	pass	DRF-03
						B = x + ts/√n ≤ 1.95	1.918	pass	
				3.233	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.853	pass	
						D = x + ks < 2.00	1.970	pass	

Comments
Batch 1 density was higher than expected. Repeat of measurement gave 1.927±0.013g/cc.
Batch 1 IPyC did not separate as readily. Measurement of composite was probably weighted toward material from batches 2 and 3.
Coating thicknesses measured for information only.
95% confidence interval for Buffer thickness in composite = (105.4µm, 107.4µm) with <1% ≤55µm.
95% confidence interval for IPyC thickness in composite = (34.8µm, 35.4µm) with >1% ≤30µm and <1% ≥56µm.

QC Supervisor

8-25-05
Date

Accept for IPyC density (Yes or No):	Not Applicable

QA Reviewer

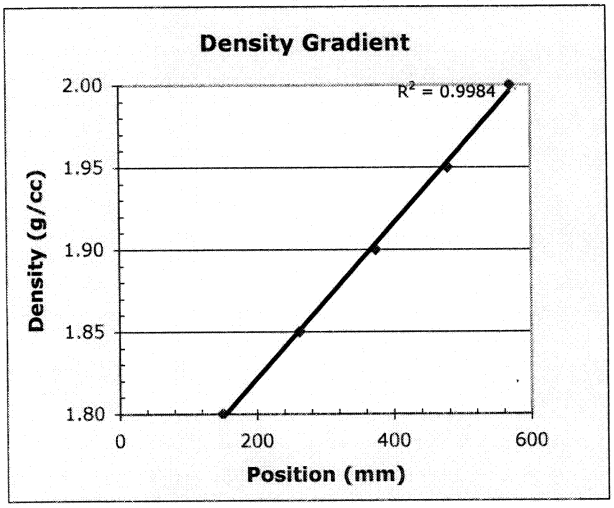
2/22/06
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05080401__DRF03R1.xls
Sample ID:	NUCO350-63I-B
Sample Description:	IPyC/Bufffer on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.0 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	145.21	154.50	149.86
1.850	258.70	266.90	262.80
1.900	370.28	376.33	373.31
1.950	475.20	482.72	478.96
2.000	566.96	573.70	570.33

Linear Fit			
slope	StDev	intercept	StDev
4.73E-04	2.88E-06	1.73E+00	1.14E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	396.11	1.9174	0.0016
2	396.11	1.9174	0.0016
3	404.05	1.9211	0.0016
4	405.85	1.9220	0.0016
5	414.12	1.9259	0.0017
6	415.75	1.9266	0.0017
7	418.08	1.9278	0.0017
8	421.34	1.9293	0.0017
9	433.79	1.9352	0.0017
10	438.11	1.9372	0.0017
11	439.97	1.9381	0.0017
12	442.24	1.9392	0.0017
13	445.10	1.9405	0.0017
14	447.33	1.9416	0.0017
15	449.03	1.9424	0.0017
16	449.64	1.9427	0.0017
17	449.94	1.9428	0.0017
18	450.39	1.9430	0.0017
19	449.33	1.9425	0.0017
20	457.43	1.9464	0.0017
21	464.59	1.9498	0.0018
22			
23			
24			
25			
Average Density		1.9347	0.0004
Standard Deviation		0.0099	

Dixie Barker
Operator

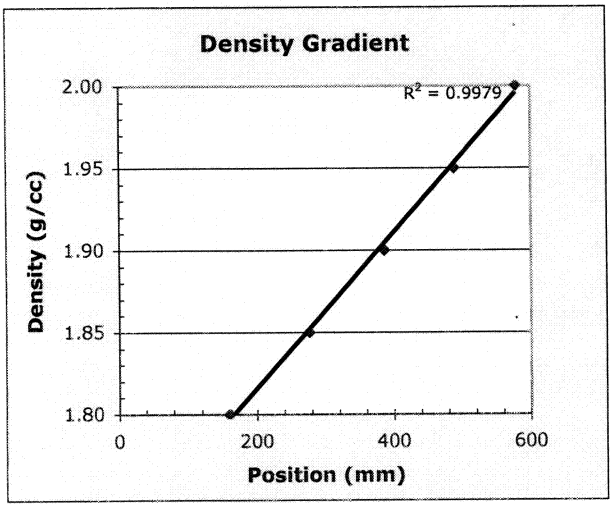
8-4-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	J. D. Hunn
Filename:	\\mc-agr\AGR\DensityColumn\D05081001_DRF03R1.xls
Sample ID:	NUCO350-56I-B
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.0 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	155.59	164.41	160.00
1.850	272.00	280.37	276.19
1.900	382.91	388.54	385.73
1.950	484.15	490.86	487.51
2.000	575.49	582.49	578.99

Linear Fit			
slope	StDev	intercept	StDev
4.77E-04	3.13E-06	1.72E+00	1.19E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	346.31	1.8850	0.0016
2	396.21	1.9088	0.0017
3	398.09	1.9097	0.0017
4	401.05	1.9111	0.0017
5	401.50	1.9114	0.0017
6	401.88	1.9115	0.0017
7	403.12	1.9121	0.0017
8	404.85	1.9130	0.0017
9	405.67	1.9133	0.0017
10	406.75	1.9139	0.0017
11	411.35	1.9160	0.0018
12	412.81	1.9167	0.0018
13	419.78	1.9201	0.0018
14	420.34	1.9203	0.0018
15	420.47	1.9204	0.0018
16	421.90	1.9211	0.0018
17	425.07	1.9226	0.0018
18	428.46	1.9242	0.0018
19	430.46	1.9252	0.0018
20	431.15	1.9255	0.0018
21	437.05	1.9283	0.0018
22	448.26	1.9336	0.0018
23			
24			
25			
Average Density		1.9165	0.0004
Standard Deviation		0.0097	

John Hunn
Operator

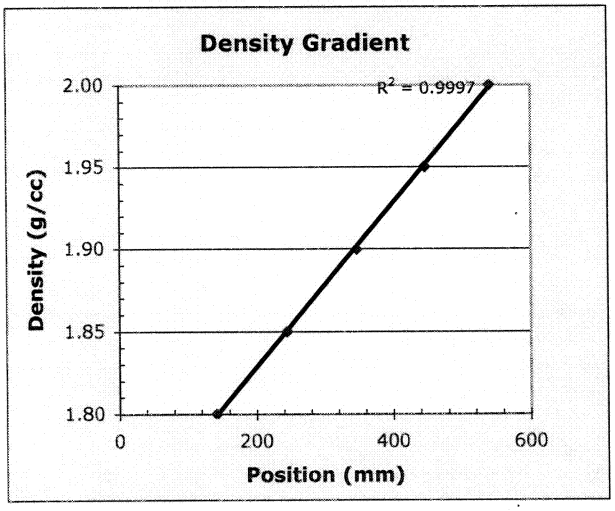
8-10-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05081501_DRF03R1.xls
Sample ID:	NUCO350-69I-B
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.4 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	137.45	147.03	142.24
1.850	240.98	248.96	244.97
1.900	343.94	349.38	346.66
1.950	441.95	449.56	445.76
2.000	536.78	544.03	540.41

Linear Fit			
slope	StDev	intercept	StDev
5.01E-04	3.24E-06	1.73E+00	1.21E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	348.14	1.9021	0.0017
2	355.92	1.9060	0.0017
3	358.01	1.9070	0.0017
4	358.42	1.9072	0.0017
5	355.04	1.9055	0.0017
6	364.90	1.9105	0.0017
7	368.46	1.9123	0.0017
8	371.72	1.9139	0.0017
9	373.37	1.9147	0.0017
10	378.47	1.9173	0.0017
11	380.67	1.9184	0.0017
12	381.27	1.9187	0.0017
13	384.65	1.9204	0.0017
14	387.09	1.9216	0.0017
15	387.46	1.9218	0.0017
16	391.18	1.9236	0.0018
17	392.15	1.9241	0.0018
18	393.01	1.9246	0.0018
19	339.33	1.8977	0.0016
20	368.73	1.9124	0.0017
21			
22			
23			
24			
25			
Average Density		1.9140	0.0004
Standard Deviation		0.0079	

Dixie Barker
Operator

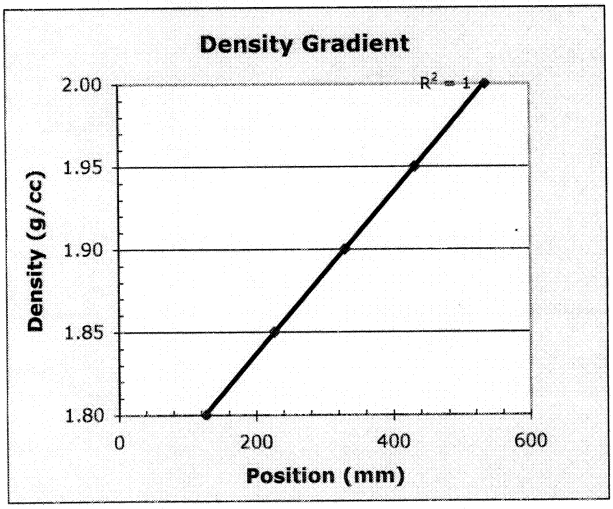
8-15-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05081702_DRF03R1.xls
Sample ID:	NUCO350-74I-B
Sample Description:	Composite (63I+56I+69I) IPyC/Buffer on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	22.9 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	122.27	130.95	126.61
1.850	223.47	231.44	227.46
1.900	327.17	332.72	329.95
1.950	428.43	435.52	431.98
2.000	532.30	539.59	535.95

Linear Fit			
slope	StDev	intercept	StDev
4.89E-04	3.00E-06	1.74E+00	9.98E-04



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	276.37	1.8736	0.0013
2	277.30	1.8741	0.0013
3	293.94	1.8822	0.0013
4	309.60	1.8898	0.0014
5	325.33	1.8975	0.0014
6	338.96	1.9042	0.0014
7	341.89	1.9056	0.0014
8	350.53	1.9098	0.0015
9	352.40	1.9108	0.0015
10	358.72	1.9138	0.0015
11	359.48	1.9142	0.0015
12	362.59	1.9157	0.0015
13	372.32	1.9205	0.0015
14	374.40	1.9215	0.0015
15	375.26	1.9219	0.0015
16	380.98	1.9247	0.0015
17	381.68	1.9251	0.0015
18	384.49	1.9264	0.0015
19	388.72	1.9285	0.0015
20	392.67	1.9304	0.0015
21	395.28	1.9317	0.0016
22	393.31	1.9307	0.0015
23			
24			
25			
Average Density		1.9115	0.0003
Standard Deviation		0.0180	

Dixie Barker
Operator

8-17-05
Date

For Information Only

The information in the remainder of this section reports results of measurements not required by the fuel specification and is provided for information only.

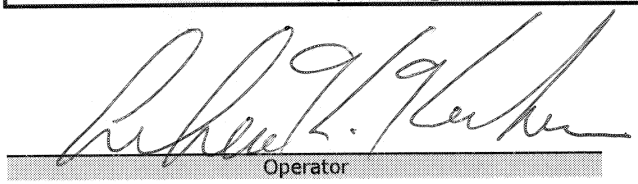
Summary of coating thickness measurements

		Buffer thickness (μm)	IPyC thickness (μm)
Batch 1	NUCO350-63I-C	105	35.2
Batch 2	NUCO350-56I-C	108	35.2
Batch 3	NUCO350-69I-C	104	35.1
Average		105	35.2
Composite	NUCO350-74I-C	106	35.1

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-63I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Mount Number(s):	M05081501 -- second mount (first mount was overpolished)
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05081601\

DMR Calibration Expiration Date:	3/24/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 500 µm in Stage Micrometer Image:	500.4 µm



Operator

August 16, 2005

Date

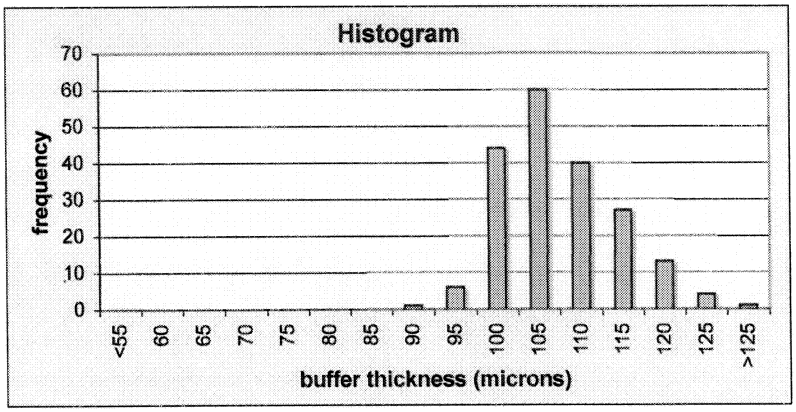
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081601\
Sample ID:	NUCO350-631-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081601_output\

Number of buffer layers analyzed:	196
Mean of the average buffer thickness of each particle (μm):	105.0
Standard deviation in the average buffer thickness of each particle (μm):	6.9

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	0
90	1
95	6
100	44
105	60
110	40
115	27
120	13
125	4
>125	1



Andrew K. Kercher
Operator

August 18, 2005
Date

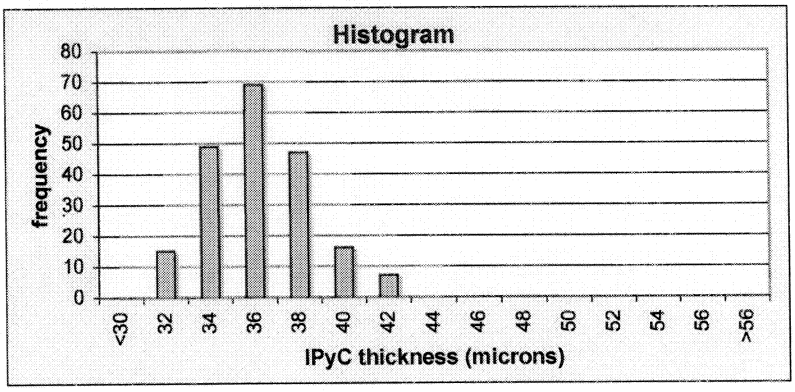
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081601\
Sample ID:	NUCO350-63I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081601_output\

Number of inner pyrocarbon layers analyzed:	203
Mean of the average IPyC thickness of each particle (μm):	35.2
Standard deviation in the average IPyC thickness of each particle (μm):	2.3

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	15
34	49
36	69
38	47
40	16
42	7
44	0
46	0
48	0
50	0
52	0
54	0
56	0
>56	0



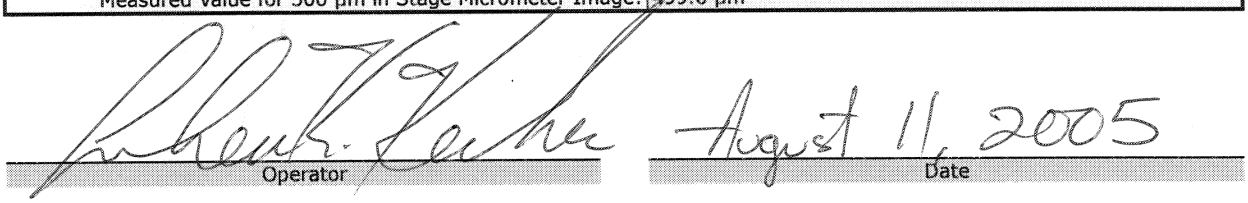
Andrew K. Kercher — Operator

August 18, 2005 — Date

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-561-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Mount Number(s):	M05081001
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05081101\

DMR Calibration Expiration Date:	3/24/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 500 µm in Stage Micrometer Image:	499.6 µm



Operator Date

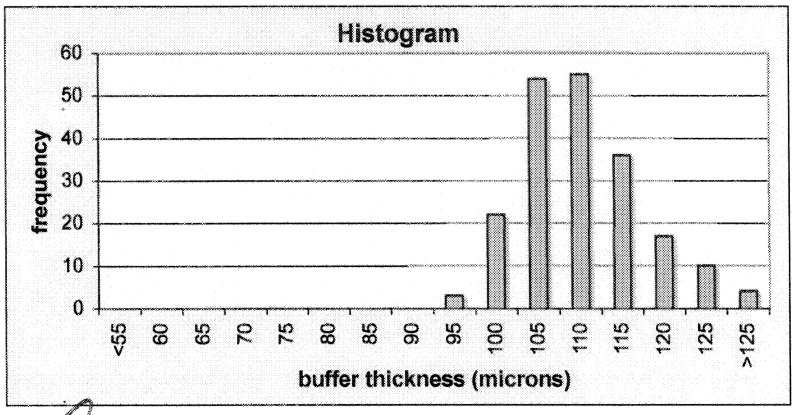
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081101\
Sample ID:	NUCO350-56I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081101_output

Number of buffer layers analyzed:	201
Mean of the average buffer thickness of each particle (μm):	107.7
Standard deviation in the average buffer thickness of each particle (μm):	7.5

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	0
90	0
95	3
100	22
105	54
110	55
115	36
120	17
125	10
>125	4



Andrew K. Kercher
Operator

August 17, 2005
Date

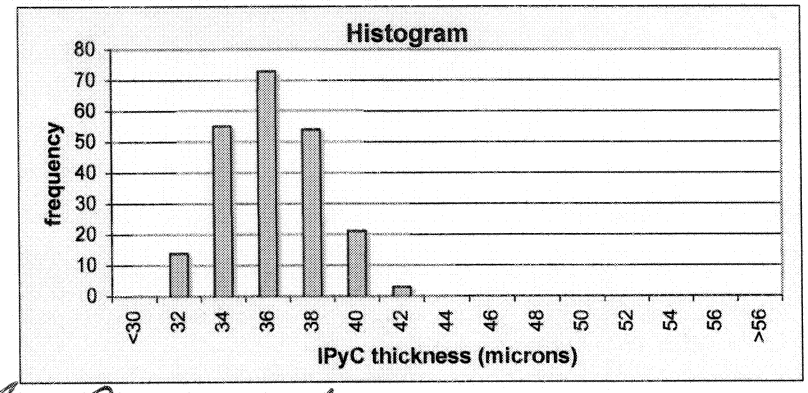
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081101\
Sample ID:	NUCO350-56I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081101_output

Number of inner pyrocarbon layers analyzed:	220
Mean of the average IPyC thickness of each particle (μm):	35.2
Standard deviation in the average IPyC thickness of each particle (μm):	2.2

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	14
34	55
36	73
38	54
40	21
42	3
44	0
46	0
48	0
50	0
52	0
54	0
56	0
>56	0



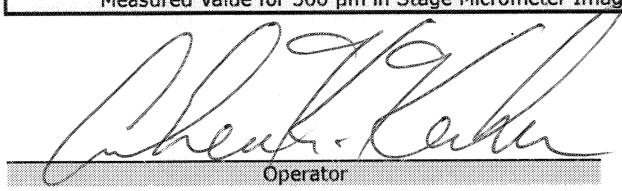
Andrew K. Kercher
Operator

August 17, 2005
Date

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-69I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Mount Number(s):	M05081002
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05081501\

DMR Calibration Expiration Date:	3/24/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 500 µm in Stage Micrometer Image:	499.6 µm



Operator

August 15, 2005

Date

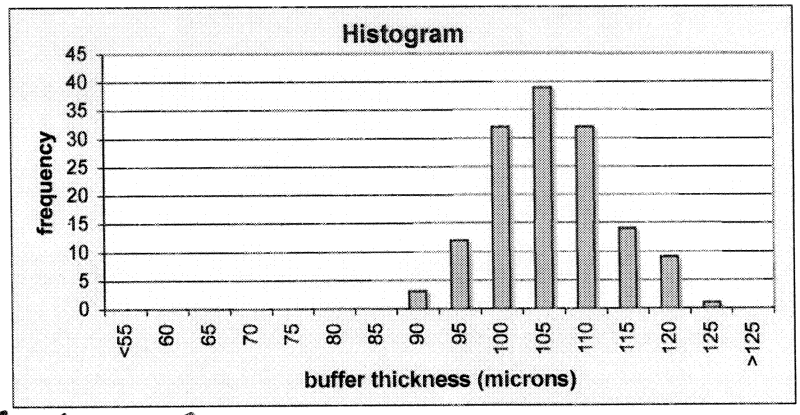
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081501\
Sample ID:	NUCO350-69I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081501_output\

Number of buffer layers analyzed:	142
Mean of the average buffer thickness of each particle (μm):	103.5
Standard deviation in the average buffer thickness of each particle (μm):	6.9

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	0
90	3
95	12
100	32
105	39
110	32
115	14
120	9
125	1
>125	0



Andrew K. Kercher — Operator

August 17, 2005 — Date

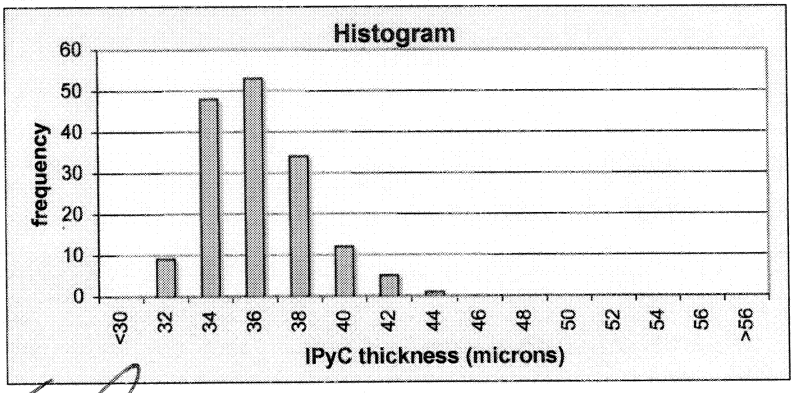
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081501\
Sample ID:	NUCO350-69I-C
Sample Description:	IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081501_output\

Number of inner pyrocarbon layers analyzed:	162
Mean of the average IPyC thickness of each particle (μm):	35.1
Standard deviation in the average IPyC thickness of each particle (μm):	2.3

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	9
34	48
36	53
38	34
40	12
42	5
44	1
46	0
48	0
50	0
52	0
54	0
56	0
>56	0



Operator

August 17, 2005
Date

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-74I-C
Sample Description:	Composite (63I+56I+69I) IPyC/Buffer on BWXT kernel 69300
Mount Number(s):	M05081601
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\

DMR Calibration Expiration Date:	3/24/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 500 µm in Stage Micrometer Image:	500. µm

Andrew K. Kercher
Operator

August 16, 2005
Date

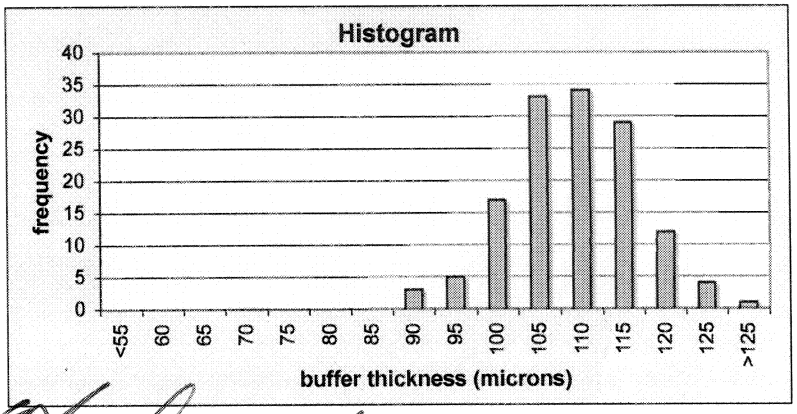
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081701\
Sample ID:	NUCO350-741-C
Sample Description:	Composite (631+561+691) IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081701_output\

Number of buffer layers analyzed:	138
Mean of the average buffer thickness of each particle (µm):	106.4
Standard deviation in the average buffer thickness of each particle (µm):	7.4

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (µm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	0
90	3
95	5
100	17
105	33
110	34
115	29
120	12
125	4
>125	1



Operator

August 19, 2005
Date

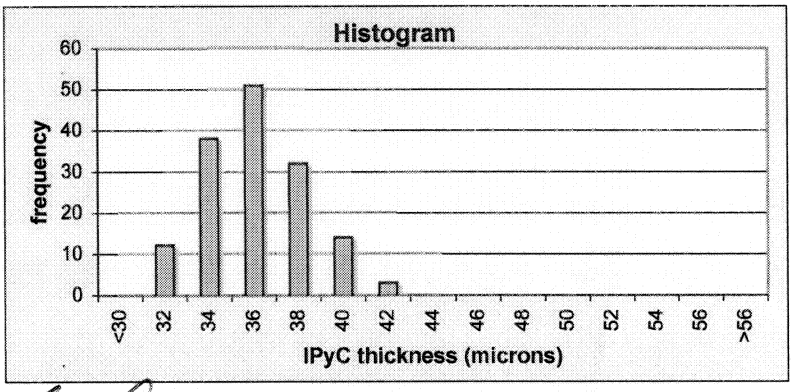
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081701\
Sample ID:	NUCO350-74I-C
Sample Description:	Composite (63I+56I+69I) IPyC/Buffer on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05081701_output\

Number of inner pyrocarbon layers analyzed:	150
Mean of the average IPyC thickness of each particle (μm):	35.1
Standard deviation in the average IPyC thickness of each particle (μm):	2.2

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	12
34	38
36	51
38	32
40	14
42	3
44	0
46	0
48	0
50	0
52	0
54	0
56	0
>56	0



Andrew K. Kercher — August 19, 2005

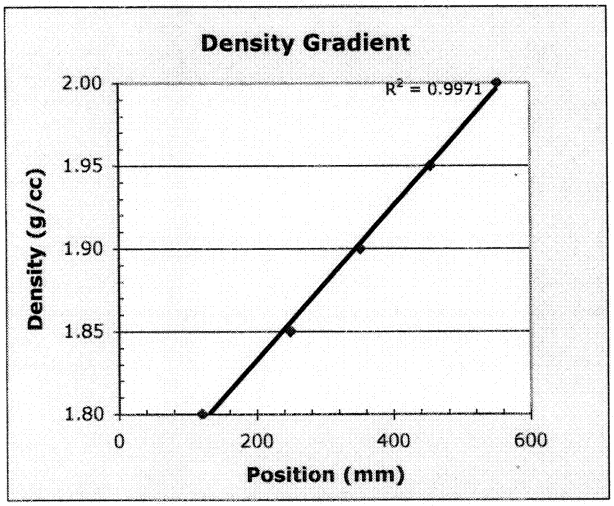
Operator Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05082201_DRF03R1.xls
Sample ID:	NUCO350-63I-B
Sample Description:	IPyC/Buffer Coated BWXT kernel composite 69300-repeat measurement
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.5 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	115.96	125.38	120.67
1.850	245.66	254.02	249.84
1.900	348.98	354.50	351.74
1.950	451.03	458.13	454.58
2.000	549.18	555.93	552.56

Linear Fit			
slope	StDev	intercept	StDev
4.68E-04	3.05E-06	1.74E+00	1.06E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	341.06	1.8977	0.0015
2	357.55	1.9055	0.0015
3	376.90	1.9145	0.0016
4	381.13	1.9165	0.0016
5	383.07	1.9174	0.0016
6	390.06	1.9207	0.0016
7	395.79	1.9234	0.0016
8	399.38	1.9250	0.0016
9	401.57	1.9261	0.0016
10	407.43	1.9288	0.0016
11	409.73	1.9299	0.0016
12	410.91	1.9304	0.0016
13	415.29	1.9325	0.0017
14	422.82	1.9360	0.0017
15	423.02	1.9361	0.0017
16	425.83	1.9374	0.0017
17	426.13	1.9376	0.0017
18	427.94	1.9384	0.0017
19	430.14	1.9394	0.0017
20	451.73	1.9496	0.0017
21			
22			
23			
24			
25			
Average Density		1.9271	0.0004
Standard Deviation		0.0125	

Dixie Barker
Operator

8-22-05
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Dixie Barker
Particle Lot ID:	NUCO350-74I-D
Particle Lot Description:	Composite of IPyC/Buffer on BWXT composite 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05081702_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	5.08E-02	5.64E-02	5.88E-02	7.04E-02	7.50E-02
Number of particles:	123	137	144	172	181
Average weight/particle (g):	4.13E-04	4.12E-04	4.08E-04	4.09E-04	4.14E-04

Mean average weight/particle (g):	4.11E-04
Uncertainty in mean average weight/particle (g):	1.12E-06

Dixie Barker
Operator

8-11-05
Date

Data Report Form DRF-31: Measurement of Open Porosity using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-31 Rev. 0
Operator:	S. D. Nunn
Coated particle batch ID:	NUCO350-74I-E
Batch Description:	IPyC coated BWXT NUCO composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05081701\S05081701_DRF31R0.xls

Mean average weight/particle (g):	4.11E-04
Uncertainty in mean average weight/particle (g):	1.12E-06

Weight of particles (g):	4.2228
Approximate number of particles:	10274
Uncertainty in number of particles:	28
Total envelope volume of sample (cc):	1.415
Average envelope volume/particle (cc):	1.38E-04
Sample envelope density (g/cc):	2.984

Average particle diameter (microns):	6.41E+02
Average surface area/particle (cm2):	1.29E-02
Total sample surface area (cm2):	1.33E+02
Intruded mercury volume from 250-10,000 psia (cc):	1.71E-02
Open porosity (ml/m2):	1.29E+00

S. D. Nunn
Operator

12/7/05
Date

8 Characterization of TRISO-coated particle batches

This section contains data on the TRISO-coated batches used for NUCO350-75T. It was obtained according to product inspection plan AGR-CHAR-PIP-03R1 with some exceptions involving what samples were taken from each batch and what measurements were performed. Missing OPyC fraction was not determined and all samples were not riffled according to the PIP-03R1 procedure based on a program decision to accelerate schedule by proceeding immediately to compositing the coated particles for compacting.

The following pages show the inspection report form (IRF-03) for each batch used in the NUCO350-75T composite. Following each IRF-03 are the individual data report forms for the measurements that were performed.

Inspection Report Form IRF-03: Coated Particle Batches

Procedure:	AGR-CHAR-PIP-03 Rev. 1
Coated particle batch ID:	NUCO350-40T
Coated particle batch description:	TRISO on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	t value (t)	INL EDF-4380 Rev. 4				
Average buffer thickness for each particle (µm)	99.4	6.2	147	1.655	mean 100 ± 15	A = x - ts/√n ≥ 85	98.6	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 115	100.2	pass	
Average IPyC thickness for each particle (µm)	39.8	2.4	158	1.655	mean 40 ± 5	A = x - ts/√n ≥ 35	39.5	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	40.1	pass	
Average SiC thickness for each particle (µm)	33.2	1.0	158	1.655	mean 35 ± 4	A = x - ts/√n ≥ 31	33.1	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 39	33.3	pass	
Average OPyC thickness for each particle (µm)	40.6	2.0	158	1.655	mean 40 ± 5	A = x - ts/√n ≥ 35	40.3	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	40.9	pass	
Particles with missing OPyC			Not measured		defect fraction ≤ 6.0×10^{-4}	≤4 in 15,500			DRF-19

Comments

QC Supervisor — Date: 2-13-06

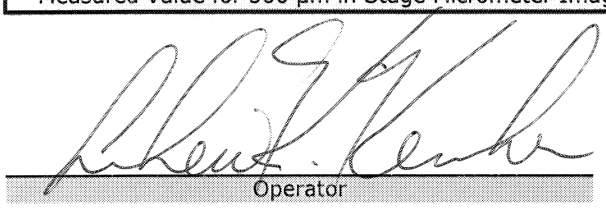
Accept Coated particle batch (Yes or No):	Not applicable

QA Reviewer — Date: 2/22/06

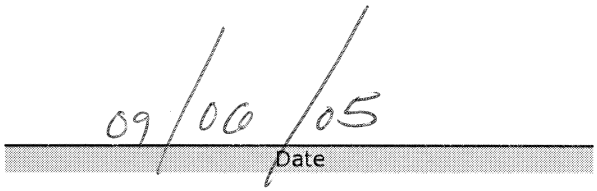
Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-40T-A01
Sample Description:	TRISO on BWXT kernel composite 69300 -- not a riffled sample
Mount Number(s):	M05090201N
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090601\

DMR Calibration Expiration Date:	8/26/2006
Stage Micrometer Calibration Expiration Date:	2/17/2007
Measured Value for 500 µm in Stage Micrometer Image:	499.3 µm



Operator



Date

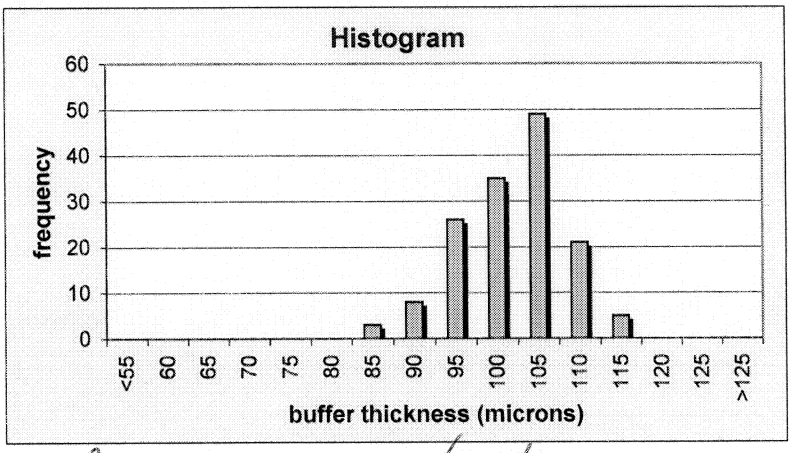
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601\
Sample ID:	NUCO350-40T-A01
Sample Description:	TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601_output\

Number of buffer layers analyzed:	147
Mean of the average buffer thickness of each particle (μm):	99.4
Standard deviation in the average buffer thickness of each particle (μm):	6.2

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	3
90	8
95	26
100	35
105	49
110	21
115	5
120	0
125	0
>125	0



Andrew K. Kercher
Operator

09/12/05
Date

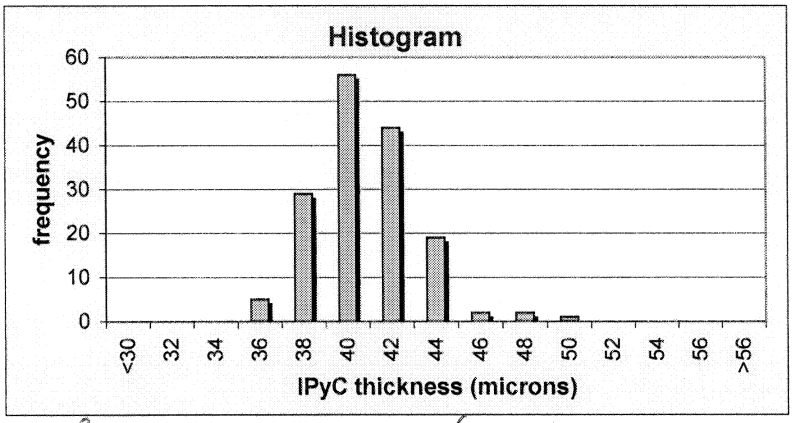
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601\
Sample ID:	NUCO350-40T-A01
Sample Description:	TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601_output\

Number of inner pyrocarbon layers analyzed:	158
Mean of the average IPyC thickness of each particle (μm):	39.8
Standard deviation in the average IPyC thickness of each particle (μm):	2.4

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	0
34	0
36	5
38	29
40	56
42	44
44	19
46	2
48	2
50	1
52	0
54	0
56	0
>56	0



Andrew K. Kercher
Operator

09/12/05
Date

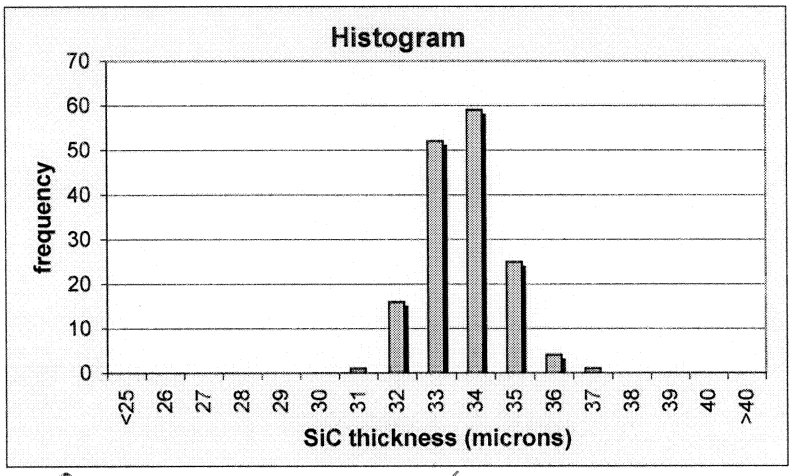
Data Report Form DRF-11C: Measurement of Silicon Carbide Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601\
Sample ID:	NUCO350-40T-A01
Sample Description:	TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601_output\

Number of silicon carbide layers analyzed:	158
Mean of the average SiC thickness of each particle (μm):	33.2
Standard deviation in the average SiC thickness of each particle (μm):	1.0

Distribution of the average SiC layer thickness (top binned)

SiC Thickness (μm)	*Frequency*
<25	0
26	0
27	0
28	0
29	0
30	0
31	1
32	16
33	52
34	59
35	25
36	4
37	1
38	0
39	0
40	0
>40	0



Andrew K. Kercher
Operator

09/12/05
Date

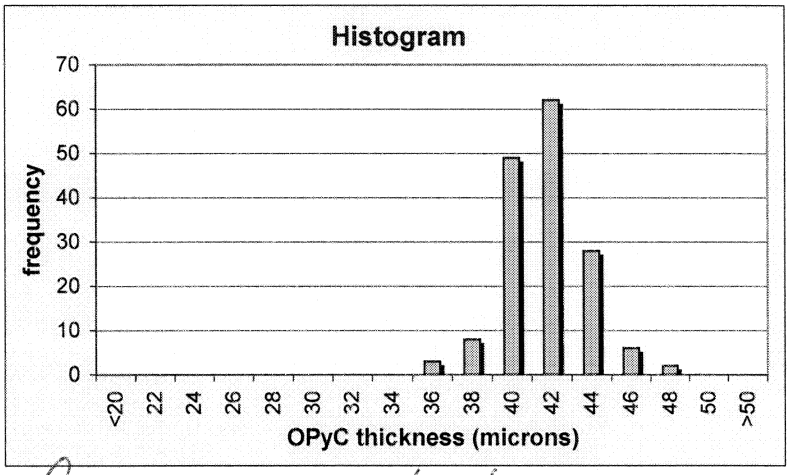
Data Report Form DRF-11D: Measurement of Outer Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder Name:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601\
Sample ID:	NUCO350-40T-A01
Sample Description:	TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090601_output\

Number of outer pyrocarbon layers analyzed:	158
Mean of the average OPyC thickness of each particle (μm):	40.6
Standard deviation in the average OPyC thickness of each particle (μm):	2.0

Distribution of the average OPyC layer thickness (top binned)

OPyC Thickness (μm)	*Frequency*
<20	0
22	0
24	0
26	0
28	0
30	0
32	0
34	0
36	3
38	8
40	49
42	62
44	28
46	6
48	2
50	0
>50	0



Operator

09/12/05
Date

Inspection Report Form IRF-03: Coated Particle Batches

Procedure:	AGR-CHAR-PIP-03 Rev. 1
Coated particle batch ID:	NUCO350-43T
Coated particle batch description:	TRISO on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	t value (t)	INL EDF-4380 Rev. 4				
Average buffer thickness for each particle (µm)	98.3	6.8	199	1.653	mean 100 ± 15	A = x - ts/√n ≥ 85	97.5	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 115	99.1	pass	
Average IPyC thickness for each particle (µm)	39.3	2.6	213	1.652	mean 40 ± 5	A = x - ts/√n ≥ 35	39.0	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	39.6	pass	
Average SiC thickness for each particle (µm)	33.5	1.2	212	1.652	mean 35 ± 4	A = x - ts/√n ≥ 31	33.4	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 39	33.6	pass	
Average OPyC thickness for each particle (µm)	41.2	2.0	211	1.652	mean 40 ± 5	A = x - ts/√n ≥ 35	41.0	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	41.4	pass	
Particles with missing OPyC			Not measured		defect fraction ≤ 6.0×10^{-4}	≤4 in 15,500			DRF-19

Comments

This sample came from middle 3 bins of roller-mike.

QC Supervisor — 2-20-06 Date

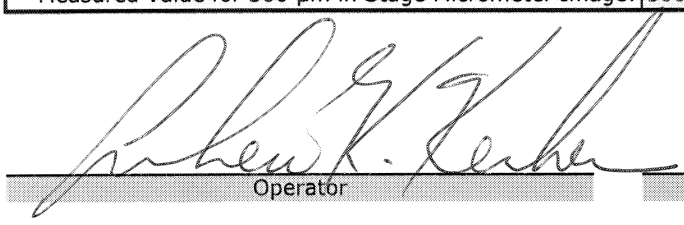
Accept Coated particle batch (Yes or No):	Not applicable

QA Reviewer — 2/22/06 Date

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-43T
Sample Description:	TRISO-coated BWXT composite 69300
Mount Number(s):	M05082301N
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05082501\

DMR Calibration Expiration Date:	8/25/2006
Stage Micrometer Calibration Expiration Date:	2/17/2007
Measured Value for 500 µm in Stage Micrometer Image:	500. µm



Operator

08/25/05

Date

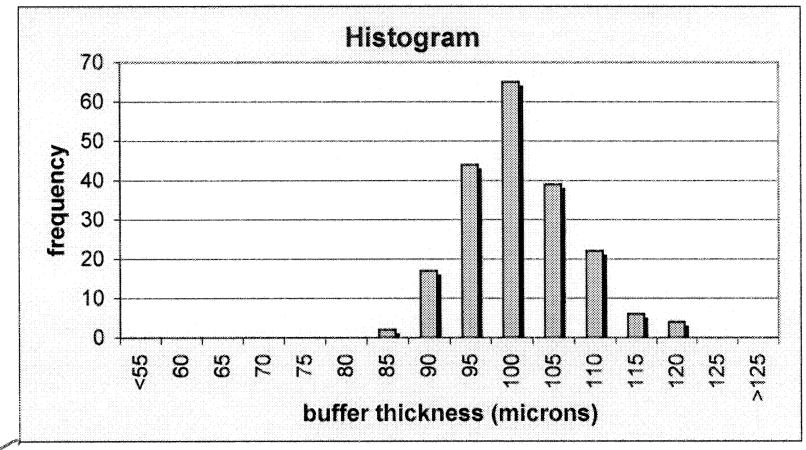
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501\
Sample ID:	NUCO350-43T-M
Sample Description:	TRISO coated BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501_output\

Number of buffer layers analyzed:	199
Mean of the average buffer thickness of each particle (μm):	98.3
Standard deviation in the average buffer thickness of each particle (μm):	6.8

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	2
90	17
95	44
100	65
105	39
110	22
115	6
120	4
125	0
>125	0



Operator

08/26/05
Date

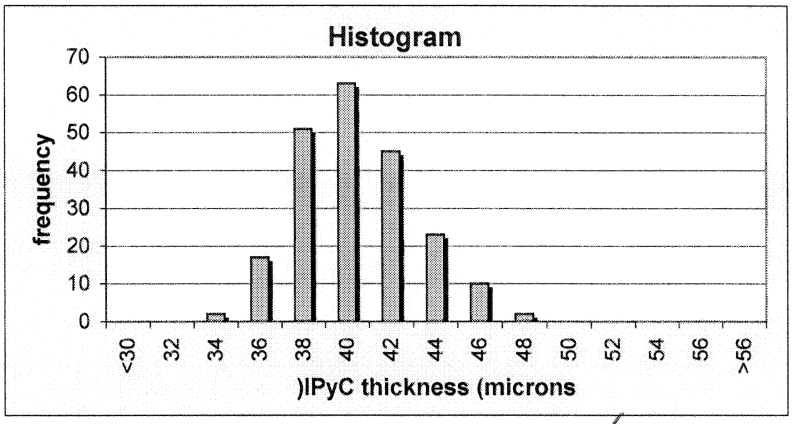
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501\
Sample ID:	NUCO350-43T-M
Sample Description:	TRISO coated BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501_output\

Number of inner pyrocarbon layers analyzed:	213
Mean of the average IPyC thickness of each particle (μm):	39.3
Standard deviation in the average IPyC thickness of each particle (μm):	2.6

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	0
34	2
36	17
38	51
40	63
42	45
44	23
46	10
48	2
50	0
52	0
54	0
56	0
>56	0



Operator

08/26/05
Date

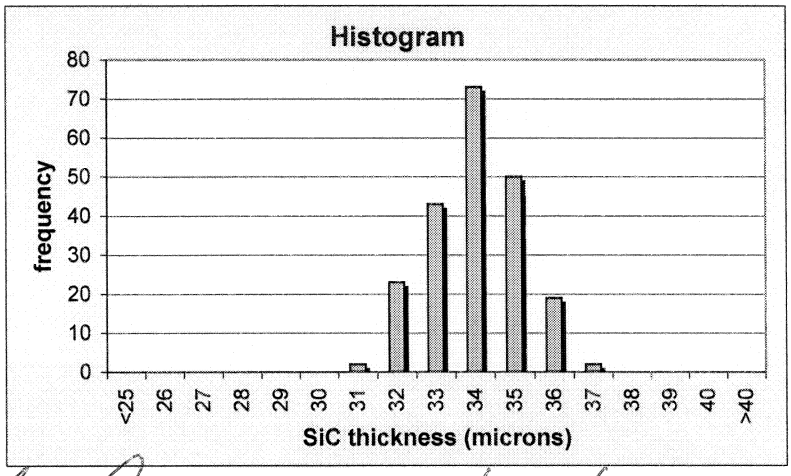
Data Report Form DRF-11C: Measurement of Silicon Carbide Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501\
Sample ID:	NUCO350-43T-M
Sample Description:	TRISO coated BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501_output\

Number of silicon carbide layers analyzed:	212
Mean of the average SiC thickness of each particle (μm):	33.5
Standard deviation in the average SiC thickness of each particle (μm):	1.2

Distribution of the average SiC layer thickness (top binned)

SiC Thickness (μm)	*Frequency*
<25	0
26	0
27	0
28	0
29	0
30	0
31	2
32	23
33	43
34	73
35	50
36	19
37	2
38	0
39	0
40	0
>40	0



Operator

08/26/05
Date

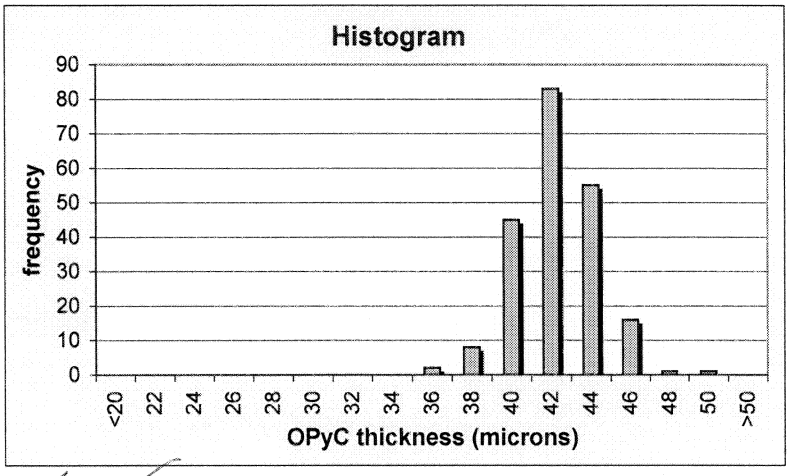
Data Report Form DRF-11D: Measurement of Outer Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder Name:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501\
Sample ID:	NUCO350-43T-M
Sample Description:	TRISO coated BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05082501_output\

Number of outer pyrocarbon layers analyzed:	211
Mean of the average OPyC thickness of each particle (μm):	41.2
Standard deviation in the average OPyC thickness of each particle (μm):	2.0

Distribution of the average OPyC layer thickness (top binned)

OPyC Thickness (μm)	*Frequency*
<20	0
22	0
24	0
26	0
28	0
30	0
32	0
34	0
36	2
38	8
40	45
42	83
44	55
46	16
48	1
50	1
>50	0



Andrew K. Kercher
Operator

08/26/05
Date

Inspection Report Form IRF-03: Coated Particle Batches

Procedure:	AGR-CHAR-PIP-03 Rev. 1
Coated particle batch ID:	NUCO350-48T
Coated particle batch description:	TRISO on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	t value (t)	INL EDF-4380 Rev. 4				
Average buffer thickness for each particle (µm)	101.8	7.4	189	1.653	mean 100 ± 15	A = x - ts/√n ≥ 85	100.9	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 115	102.7	pass	
Average IPyC thickness for each particle (µm)	40.4	2.5	214	1.652	mean 40 ± 5	A = x - ts/√n ≥ 35	40.1	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	40.7	pass	
Average SiC thickness for each particle (µm)	32.8	1.3	215	1.652	mean 35 ± 4	A = x - ts/√n ≥ 31	32.7	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 39	32.9	pass	
Average OPyC thickness for each particle (µm)	44.3	2.3	215	1.652	mean 40 ± 5	A = x - ts/√n ≥ 35	44.0	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 45	44.6	pass	
Particles with missing OPyC			Not measured		defect fraction ≤ 6.0×10^{-4}	≤4 in 15,500			DRF-19

Comments

QC Supervisor — Date: 2-13-06

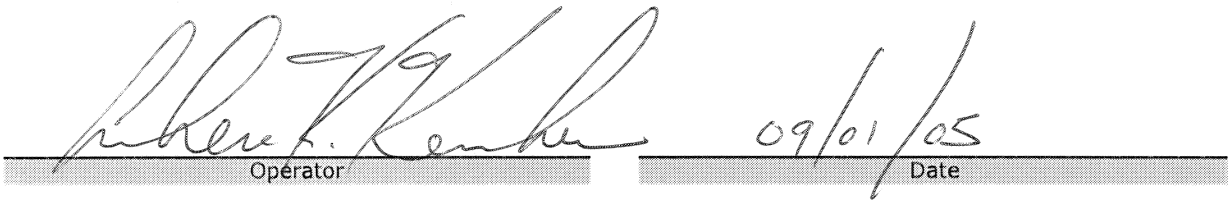
Accept Coated particle batch (Yes or No):	Not applicable

QA Reviewer — Date: 2/22/06

Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-48T
Sample Description:	TRISO-coated BWXT composite 69300
Mount Number(s):	M05083101N
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090101\

DMR Calibration Expiration Date:	8/26/2006
Stage Micrometer Calibration Expiration Date:	2/17/2007
Measured Value for 500 µm in Stage Micrometer Image:	500. µm



Operator Date

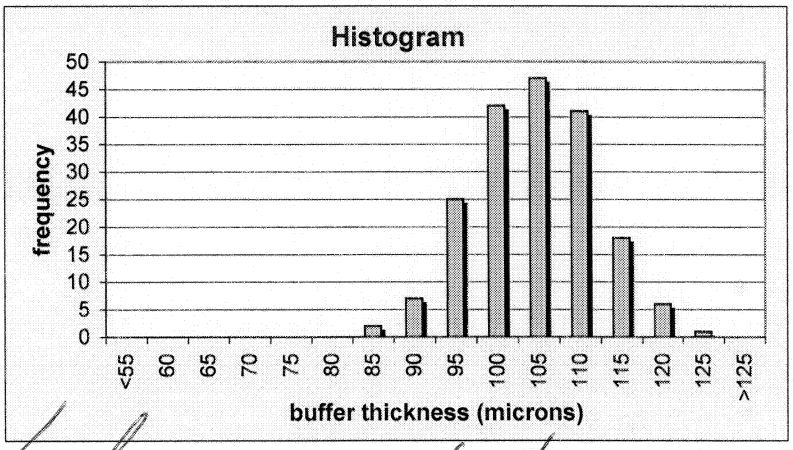
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101\
Sample ID:	NUCO350-48T
Sample Description:	TRISO on BWXT kernel composite 69300 -- not a riffled sample
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101_output

Number of buffer layers analyzed:	189
Mean of the average buffer thickness of each particle (μm):	101.8
Standard deviation in the average buffer thickness of each particle (μm):	7.4

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	0
85	2
90	7
95	25
100	42
105	47
110	41
115	18
120	6
125	1
>125	0



Andrew K. Kercher
Operator

09/06/05
Date

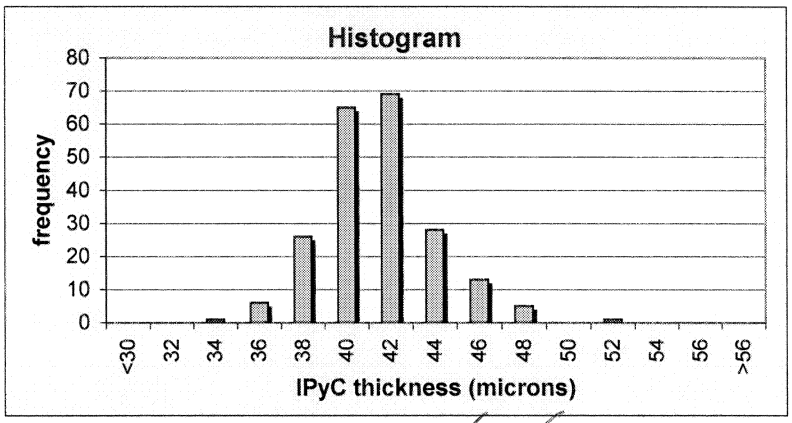
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101\
Sample ID:	NUCO350-48T
Sample Description:	TRISO on BWXT kernel composite 69300 -- not a riffled sample
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101_output

Number of inner pyrocarbon layers analyzed:	214
Mean of the average IPyC thickness of each particle (μm):	40.4
Standard deviation in the average IPyC thickness of each particle (μm):	2.5

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	0
34	1
36	6
38	26
40	65
42	69
44	28
46	13
48	5
50	0
52	1
54	0
56	0
>56	0



Andrew K. Kercher
Operator

09/06/05
Date

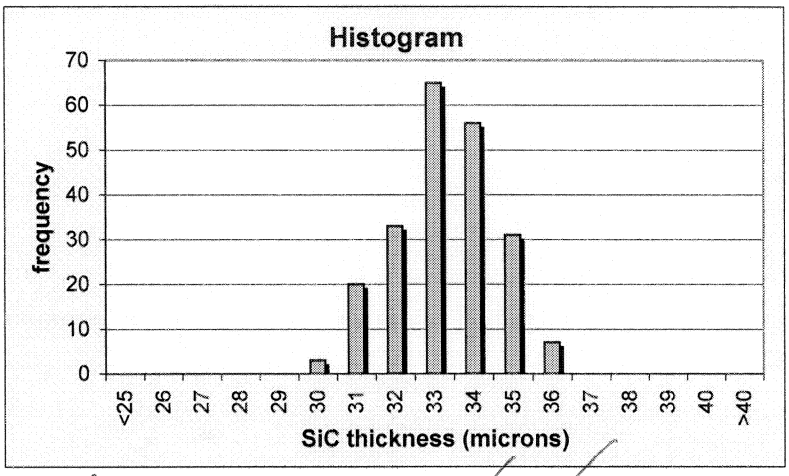
Data Report Form DRF-11C: Measurement of Silicon Carbide Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101\
Sample ID:	NUCO350-48T
Sample Description:	TRISO on BWXT kernel composite 69300 -- not a riffled sample
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101_output

Number of silicon carbide layers analyzed:	215
Mean of the average SiC thickness of each particle (µm):	32.8
Standard deviation in the average SiC thickness of each particle (µm):	1.3

Distribution of the average SiC layer thickness (top binned)

SiC Thickness (µm)	*Frequency*
<25	0
26	0
27	0
28	0
29	0
30	3
31	20
32	33
33	65
34	56
35	31
36	7
37	0
38	0
39	0
40	0
>40	0



Andrew K. Kercher
Operator

09/06/05
Date

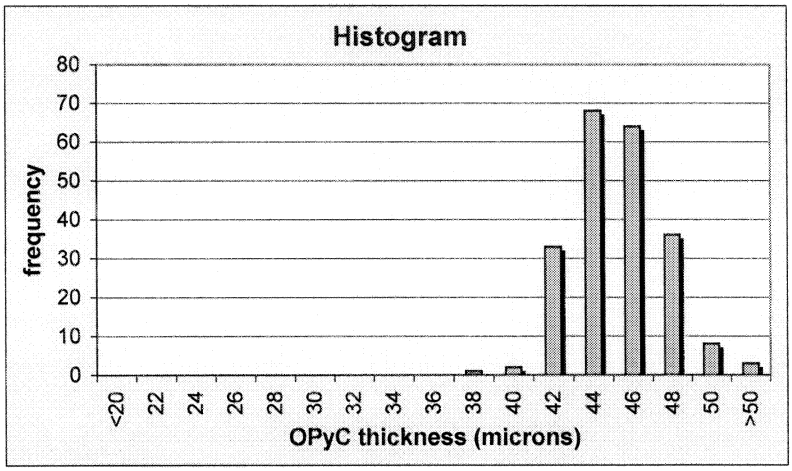
Data Report Form DRF-11D: Measurement of Outer Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder Name:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101\
Sample ID:	NUCO350-48T
Sample Description:	TRISO on BWXT kernel composite 69300 -- not a riffled sample
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090101_output

Number of outer pyrocarbon layers analyzed:	215
Mean of the average OPyC thickness of each particle (μm):	44.3
Standard deviation in the average OPyC thickness of each particle (μm):	2.3

Distribution of the average OPyC layer thickness (top binned)

OPyC Thickness (μm)	*Frequency*
<20	0
22	0
24	0
26	0
28	0
30	0
32	0
34	0
36	0
38	1
40	2
42	33
44	68
46	64
48	36
50	8
>50	3



Operator

09/06/05
Date

9 Characterization of TRISO-coated particle composite

This section contains data on the TRISO-coated particle composite, NUCO350-75T. It was obtained according to product inspection plan AGR-CHAR-PIP-04R2.

The following pages shows the inspection report forms (IRF-04A and IRF-04B) for the NUCO350-75T composite. Following IRF-04 are the individual data report forms for the measurements that were performed. Additional data at the end of this section is provided for information only.

Inspection Report Form IRF-04A: Coated Particle Composites

Procedure:	AGR-CHAR-PIP-04 Rev. 2
Coated particle composite ID:	NUCO350-75T
Coated particle composite description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300

Property	Measured Data: Mean (x)	Std. Dev. (s)	# measured (n)	k or t value	Specification: INL EDF-4380 Rev. 4	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
Average buffer thickness for each particle (µm)	97.1	6.2	181	1.653	mean 100 ± 15	A = x - ts/√n ≥ 85	96.3	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 115	97.9	pass	
				2.550	dispersion ≤0.01 ≤ 55	C = x - ks > 55	81.3	pass	
Average IPyC thickness for each particle (µm)	40.3	2.5	189	1.653	mean 40 ± 4	A = x - ts/√n ≥ 36	40.0	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 44	40.6	pass	
				2.560	dispersion ≤0.01 ≤ 30 ≤0.01 ≥ 56	C = x - ks > 30	33.9	pass	
						D = x + ks < 56	46.7	pass	
Average SiC thickness for each particle (µm)	33.0	1.2	191	1.653	mean 35 ± 3	A = x - ts/√n ≥ 32	32.9	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 38	33.1	pass	
				2.560	dispersion ≤0.01 ≤ 25	C = x - ks > 25	29.9	pass	
Average OPyC thickness for each particle (µm)	41.8	2.6	191	1.653	mean 40 ± 4	A = x - ts/√n ≥ 36	41.5	pass	DRF-08 DRF-11
						B = x + ts/√n ≤ 44	42.1	pass	
				2.560	dispersion ≤0.01 ≤ 20	C = x - ks > 20	35.1	pass	
Buffer envelope density	See IRF-02A								IRF-02A
IPyC sink/float density	See IRF-02B								IRF-02B
SiC sink/float density (Mg/m³)	3.2051	0.0014	21	1.725	mean ≥ 3.19	A = x - ts/√n ≥ 3.19	3.205	pass	DRF-02
				3.262	dispersion ≤0.01 ≤ 3.17	C = x - ks > 3.17	3.201	pass	
OPyC sink/float density	See IRF-04B								IRF-04B
IPyC anisotropy (BAFo equivalent)	1.027	0.004	10	1.833	mean ≤ 1.035	B = x + ts/√n ≤ 1.035	1.030	pass	DRF-18
				3.981	dispersion ≤0.01 ≥1.06	D = x + ks < 1.06	1.045	pass	
OPyC anisotropy (BAFo equivalent)	1.012	0.002	10	1.833	mean ≤ 1.035	B = x + ts/√n ≤ 1.035	1.013	pass	DRF-18
				3.981	dispersion ≤0.01 ≥1.06	D = x + ks < 1.06	1.020	pass	
Particles with SiC gold spot defects			12106		defect fraction ≤ 1.0 x 10^{-3}	≤6 in 12,000 or ≤14 in 22,000	34	fail	DRF-20
Particle aspect ratio			1593		dispersion ≤0.01 ≥1.14	≤1 in 500 or ≤7 in 1420	1	pass	DRF-07 DRF-10
Particles with SiC burn-leach defects			120703		defect fraction ≤ 1.0 x 10^{-4}	≤1 in 50,000 or ≤6 in 120,000	4	pass	DRF-21
Particles with missing OPyC			31281		defect fraction ≤ 3.0 x 10^{-4}	≤4 in 31,000	0	pass	DRF-19
SiC microstructure			3		comparison to visual standard	all imaged pass visual standard comparison	3	pass	DRF-23

Comments

For information only:
Mean particle diameter by shadowgraph was 806.0±14 µm.

John Blum
QC Supervisor

2-20-06
Date

Accept coated particle composite (Yes or No): Not Applicable

M. C. Pan
QA Reviewer

2/22/06
Date

Inspection Report Form IRF-04B: Outer Pyrocarbon Density

Procedure:	AGR-CHAR-PIP-04 Rev. 2
Coated particle composite ID:	NUCO350-75T
Coated particle composite description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Batch 1 ID:	NUCO350-43T
Batch 1 description:	TRISO on BWXT kernel composite 69300
Batch 2 ID:	NUCO350-48T
Batch 2 description:	TRISO on BWXT kernel composite 69300
Batch 3 ID:	NUCO350-40T
Batch 3 description:	TRISO on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	k or t value	INL EDF-4380 Rev. 4				
Batch 1: OPyC sink/float density	1.8458	0.0069	21	1.725	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.843	fail	DRF-03
						B = x + ts/√n ≤ 1.95	1.848	pass	
				3.262	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.823	pass	
						D = x + ks < 2.00	1.868	pass	
Batch 2: OPyC sink/float density	1.8238	0.0054	21	1.725	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.822	fail	DRF-03
						B = x + ts/√n ≤ 1.95	1.826	pass	
				3.262	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.806	pass	
						D = x + ks < 2.00	1.841	pass	
Batch 3: OPyC sink/float density	1.8731	0.0057	24	1.714	mean 1.90 ± 0.05	A = x - ts/√n ≥ 1.85	1.871	pass	DRF-03
						B = x + ts/√n ≤ 1.95	1.875	pass	
				3.181	dispersion ≤0.01 ≤ 1.80 ≤0.01 ≥ 2.00	C = x - ks > 1.80	1.855	pass	
						D = x + ks < 2.00	1.891	pass	

Comments

QC Supervisor — 2-20-06 Date

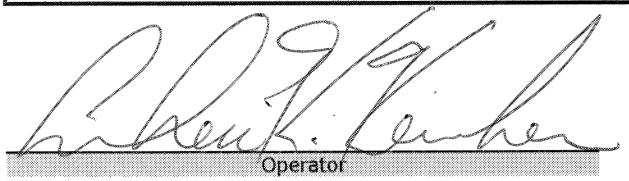
Accept composite for OPyC density (Yes or No): Not Applicable

QA Reviewer — 2/22/06 Date

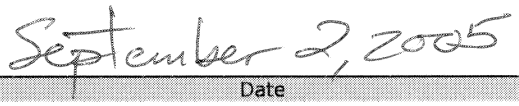
Data Report Form DRF-08: Imaging of Coated Particle Cross-sections Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-08 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Mount Number(s):	M05090202N
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090203

DMR Calibration Expiration Date:	8/26/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 500 µm in Stage Micrometer Image:	500.4 µm



Operator



Date

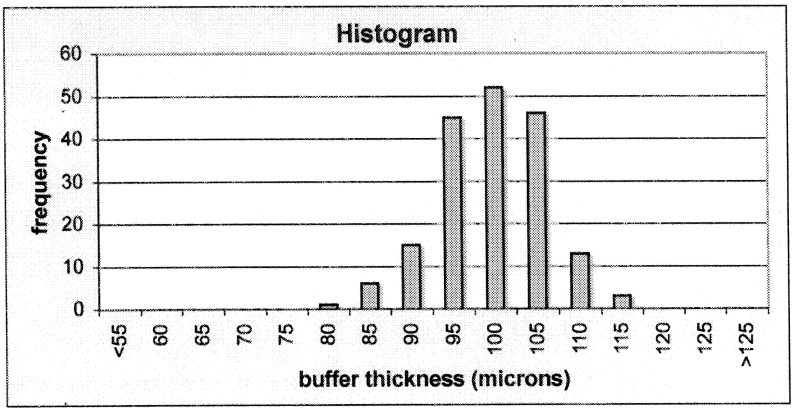
Data Report Form DRF-11A: Measurement of Buffer Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203\
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203_output

Number of buffer layers analyzed:	181
Mean of the average buffer thickness of each particle (μm):	97.1
Standard deviation in the average buffer thickness of each particle (μm):	6.2

Distribution of the average buffer layer thickness (top binned)

Buffer Thickness (μm)	*Frequency*
<55	0
60	0
65	0
70	0
75	0
80	1
85	6
90	15
95	45
100	52
105	46
110	13
115	3
120	0
125	0
>125	0



Andrew K. Kercher
Operator

September 8, 2005
Date

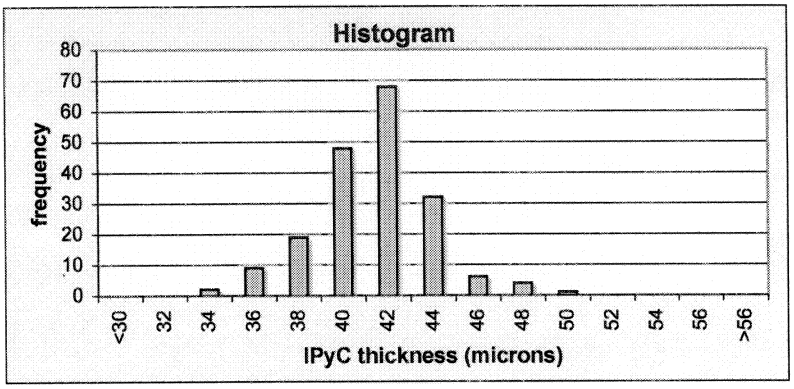
Data Report Form DRF-11B: Measurement of Inner Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203\
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203_output

Number of inner pyrocarbon layers analyzed:	189
Mean of the average IPyC thickness of each particle (μm):	40.3
Standard deviation in the average IPyC thickness of each particle (μm):	2.5

Distribution of the average IPyC layer thickness (top binned)

IPyC Thickness (μm)	*Frequency*
<30	0
32	0
34	2
36	9
38	19
40	48
42	68
44	32
46	6
48	4
50	1
52	0
54	0
56	0
>56	0



Andrew K. Kercher — Operator

September 8, 2005 — Date

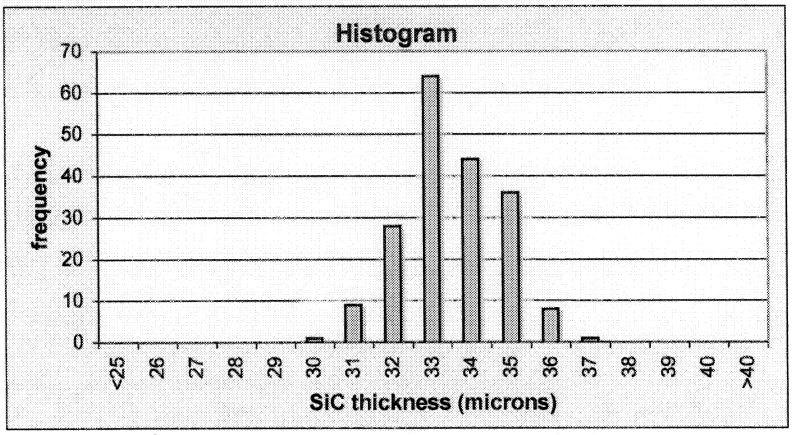
Data Report Form DRF-11C: Measurement of Silicon Carbide Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203\
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203_output

Number of silicon carbide layers analyzed:	191
Mean of the average SiC thickness of each particle (μm):	33.0
Standard deviation in the average SiC thickness of each particle (μm):	1.2

Distribution of the average SiC layer thickness (top binned)

SiC Thickness (μm)	*Frequency*
<25	0
26	0
27	0
28	0
29	0
30	1
31	9
32	28
33	64
34	44
35	36
36	8
37	1
38	0
39	0
40	0
>40	0



Andrew K. Kercher — Operator

September 8, 2005 — Date

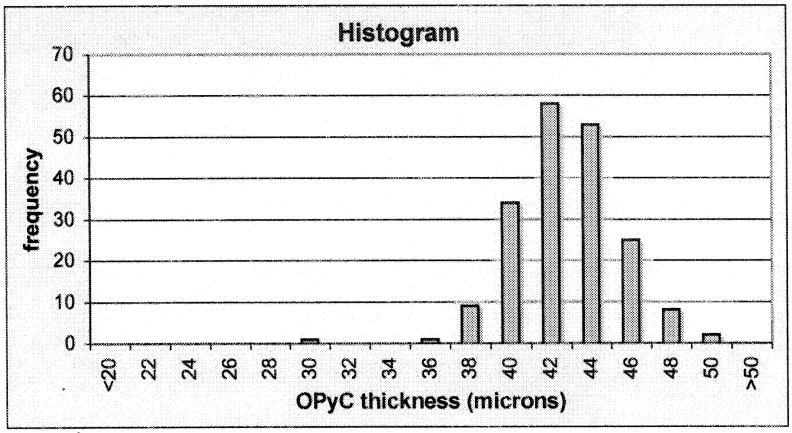
Data Report Form DRF-11D: Measurement of Outer Pyrocarbon Layer Thickness

Procedure:	AGR-CHAR-DAM-11 Rev. 1
Operator:	Andrew K. Kercher
Folder Name:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203\
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Layers\P05090203_output

Number of outer pyrocarbon layers analyzed:	191
Mean of the average OPyC thickness of each particle (μm):	41.8
Standard deviation in the average OPyC thickness of each particle (μm):	2.6

Distribution of the average OPyC layer thickness (top binned)

OPyC Thickness (μm)	*Frequency*
<20	0
22	0
24	0
26	0
28	0
30	1
32	0
34	0
36	1
38	9
40	34
42	58
44	53
46	25
48	8
50	2
>50	0



Andrew K. Kercher — Operator

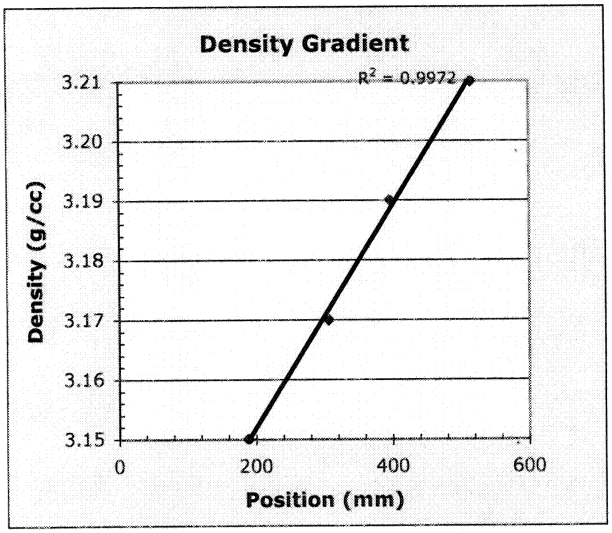
September 8, 2005 — Date

Data Report Form DRF-02: Measurement of SiC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-02 Rev. 2
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05090702_DRF02R1.xls
Sample ID:	NUCO350-75T-D01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.5 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
3.150	175.78	195.37	188.84
3.170	290.04	314.04	306.04
3.190	380.80	403.37	395.85
3.210	499.01	522.95	514.97

Linear Fit			
slope	StDev	intercept	StDev
1.87E-04	3.79E-06	3.11E+00	1.33E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	466.71	3.2016	0.0022
2	471.85	3.2025	0.0022
3	477.60	3.2036	0.0022
4	477.76	3.2036	0.0022
5	480.47	3.2041	0.0023
6	482.69	3.2046	0.0023
7	480.70	3.2042	0.0023
8	483.91	3.2048	0.0023
9	484.50	3.2049	0.0023
10	485.56	3.2051	0.0023
11	486.14	3.2052	0.0023
12	487.03	3.2054	0.0023
13	488.01	3.2055	0.0023
14	488.52	3.2056	0.0023
15	489.75	3.2059	0.0023
16	490.14	3.2059	0.0023
17	490.69	3.2060	0.0023
18	493.95	3.2067	0.0023
19	494.75	3.2068	0.0023
20	494.76	3.2068	0.0023
21	497.45	3.2073	0.0023
22			
23			
24			
25			
Average Density		3.2051	0.0005
Standard Deviation		0.0014	

Dixie Barker
Operator

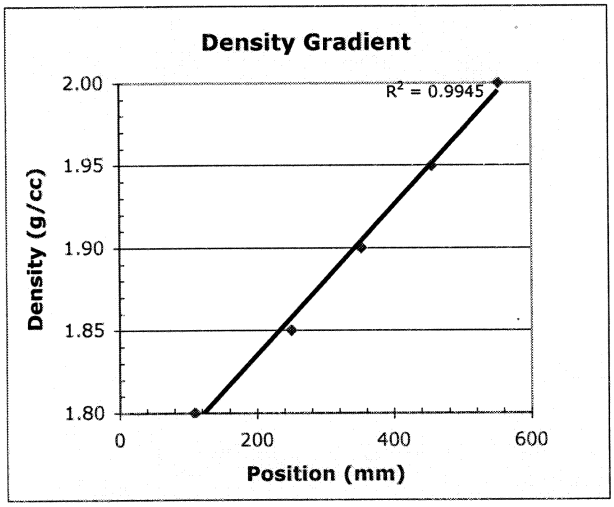
9-7-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D05082501_DRF03R1.xls
Sample ID:	NUCO350-43T-M
Sample Description:	OPyC from TRISO on BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.1 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	105.35	113.70	109.53
1.850	245.91	254.05	249.98
1.900	349.82	355.53	352.68
1.950	451.92	458.71	455.32
2.000	549.41	556.27	552.84

Linear Fit			
slope	StDev	intercept	StDev
4.55E-04	2.70E-06	1.74E+00	1.01E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	201.82	1.8352	0.0012
2	204.55	1.8365	0.0012
3	206.36	1.8373	0.0012
4	207.85	1.8380	0.0012
5	212.98	1.8403	0.0012
6	214.13	1.8408	0.0012
7	214.70	1.8411	0.0012
8	217.12	1.8422	0.0012
9	219.75	1.8434	0.0012
10	220.50	1.8437	0.0012
11	222.49	1.8446	0.0012
12	224.94	1.8458	0.0012
13	228.23	1.8473	0.0012
14	231.25	1.8486	0.0012
15	234.32	1.8500	0.0012
16	238.93	1.8521	0.0012
17	241.43	1.8533	0.0012
18	244.42	1.8546	0.0012
19	246.99	1.8558	0.0012
20	244.97	1.8549	0.0012
21	249.57	1.8570	0.0012
22			
23			
24			
25			
Average Density		1.8458	0.0003
Standard Deviation		0.0069	

Dixie Barker
Operator

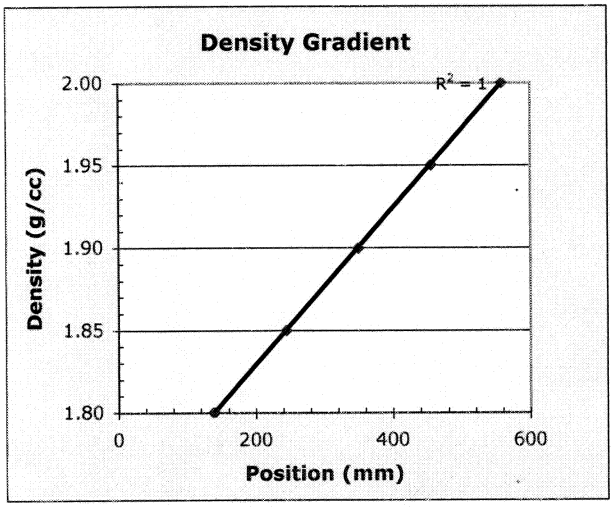
8-25-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D0583001_DRF03R1.xls
Sample ID:	NUCO350-48T
Sample Description:	OPyC from TRISO coated BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	23.0 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	134.47	144.26	139.37
1.850	240.50	248.59	244.55
1.900	346.68	352.44	349.56
1.950	451.67	459.10	455.39
2.000	554.36	561.31	557.84

Linear Fit			
slope	StDev	intercept	StDev
4.77E-04	2.86E-06	1.73E+00	1.01E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	172.87	1.8158	0.0011
2	175.61	1.8171	0.0011
3	178.08	1.8183	0.0011
4	179.39	1.8189	0.0011
5	179.39	1.8189	0.0011
6	180.61	1.8195	0.0011
7	181.74	1.8200	0.0011
8	182.62	1.8204	0.0011
9	184.21	1.8212	0.0011
10	186.20	1.8222	0.0011
11	187.66	1.8228	0.0011
12	189.28	1.8236	0.0011
13	198.98	1.8282	0.0012
14	191.66	1.8248	0.0011
15	192.60	1.8252	0.0011
16	195.55	1.8266	0.0012
17	200.35	1.8289	0.0012
18	202.65	1.8300	0.0012
19	204.01	1.8306	0.0012
20	208.05	1.8326	0.0012
21	213.13	1.8350	0.0012
22			
23			
24			
25			
Average Density		1.8238	0.0002
Standard Deviation		0.0054	

Dixie Barker
Operator

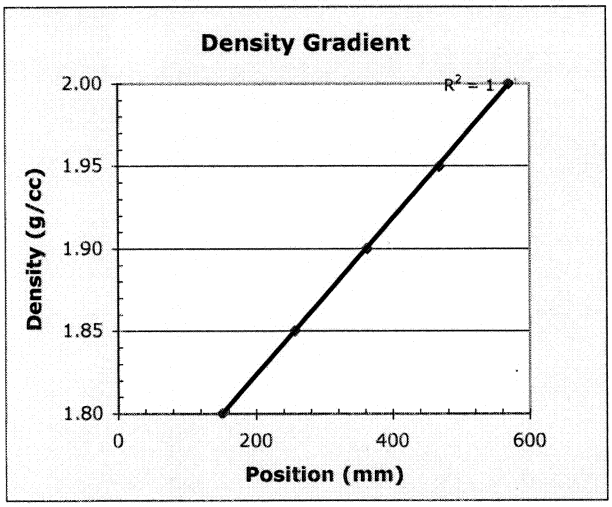
8-30-05
Date

Data Report Form DRF-03: Measurement of PyC Density using a Density Gradient Column

Procedure:	AGR-CHAR-DAM-03 Rev. 1
Operator:	Dixie Barker
Filename:	\\mc-agr\AGR\DensityColumn\D050831021_DRF03R1.xls
Sample ID:	NUCO350-40T
Sample Description:	OPyC from TRISO coated BWXT kernel composite 69300
Float Expiration Date:	07/2007
Gauge Expiration Date:	01/2006
Bath Temperature:	22.9 °C

Calibrated Floats			
Density	Top of Float	Bottom of Float	Center of Mass
1.800	146.31	155.58	150.95
1.850	252.77	260.96	256.87
1.900	359.58	365.33	362.46
1.950	464.53	471.75	468.14
2.000	566.81	573.87	570.34

Linear Fit			
slope	StDev	intercept	StDev
4.76E-04	2.84E-06	1.73E+00	1.03E-03



Sample Density			
Particle Number	Particle Position	Calculated Density	Standard Error
1	282.53	1.8623	0.0013
2	287.18	1.8645	0.0013
3	292.29	1.8669	0.0013
4	293.15	1.8673	0.0013
5	294.08	1.8678	0.0013
6	296.59	1.8690	0.0013
7	293.93	1.8677	0.0013
8	300.12	1.8707	0.0013
9	300.26	1.8707	0.0013
10	302.26	1.8717	0.0013
11	302.26	1.8717	0.0013
12	302.99	1.8720	0.0013
13	306.13	1.8735	0.0014
14	306.77	1.8738	0.0014
15	307.18	1.8740	0.0014
16	309.77	1.8752	0.0014
17	311.16	1.8759	0.0014
18	311.59	1.8761	0.0014
19	313.01	1.8768	0.0014
20	313.91	1.8772	0.0014
21	319.66	1.8800	0.0014
22	323.31	1.8817	0.0014
23	326.71	1.8833	0.0014
24	328.88	1.8843	0.0014
25			
Average Density		1.8731	0.0003
Standard Deviation		0.0057	

Dixie Barker
Operator

8-31-05
Date

Data Report Form DRF-18A: Measurement of Pyrocarbon Anisotropy using the 2-MGEM - IPyC

Procedure:	AGR-CHAR-DAM-18 Rev. 1
Operator:	G. E. Jellison
Mount ID:	M05090703N
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT composite 69300
Folder containing data:	\\mc-agr\AGR\2-MGEM\R05091401

Particle #	Grid Position	Diattenuation			Equivalent BAFo		
		Average	St. Dev.	Ave. Error	Average	St. Dev.	Ave. Error
1	2,2	0.0093	0.0028	0.0017	1.0279	0.0084	0.0051
2	2,3	0.0102	0.0028	0.0015	1.0306	0.0084	0.0045
3	2,4	0.0083	0.0031	0.0018	1.0249	0.0093	0.0054
4	3,2	0.0096	0.0035	0.0018	1.0288	0.0105	0.0054
5	3,3	0.0091	0.0024	0.0016	1.0273	0.0072	0.0048
6	3,4	0.0077	0.0028	0.0019	1.0231	0.0084	0.0057
7	4,2	0.0091	0.0027	0.0017	1.0273	0.0081	0.0051
8	4,3	0.0113	0.0030	0.0018	1.0339	0.0090	0.0054
9	4,4	0.0083	0.0033	0.0019	1.0249	0.0099	0.0057
10	5,3	0.0059	0.0024	0.0019	1.0177	0.0072	0.0057
Average		0.0089	0.0029	0.0018	1.0266	0.0086	0.0053

Mean of average BAFo per particle:	1.0266
Standard deviation of average BAFo per particle:	0.0044

Comments

G. E. Jellison
Operator

9/15/05
Date

Data Report Form DRF-18B: Measurement of Pyrocarbon Anisotropy using the 2-MGEM - OPyC

Procedure:	AGR-CHAR-DAM-18 Rev. 1
Operator:	G. E. Jellison
Mount ID:	M05090703N
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT composite 69300
Folder containing data:	\\mc-agr\AGR\2-MGEM\R05091401

Particle #	Grid Position	Diattenuation			Equivalent BAFo		
		Average	St. Dev.	Ave. Error	Average	St. Dev.	Ave. Error
1	2,2	0.0041	0.0023	0.0015	1.0123	0.0069	0.0045
2	2,3	0.0054	0.0029	0.0016	1.0162	0.0087	0.0048
3	2,4	0.0040	0.0019	0.0019	1.0120	0.0057	0.0057
4	3,2	0.0036	0.0024	0.0018	1.0108	0.0072	0.0054
5	3,3	0.0044	0.0022	0.0017	1.0132	0.0066	0.0051
6	3,4	0.0038	0.0024	0.0020	1.0114	0.0072	0.0060
7	4,2	0.0036	0.0018	0.0019	1.0108	0.0054	0.0057
8	4,3	0.0038	0.0018	0.0020	1.0114	0.0054	0.0060
9	4,4	0.0036	0.0019	0.0020	1.0108	0.0057	0.0060
10	5,3	0.0047	0.0028	0.0022	1.0141	0.0084	0.0066
Average		0.0041	0.0022	0.0019	1.0123	0.0067	0.0056

Mean of average BAFo per particle:	1.0123
Standard deviation of average BAFo per particle:	0.0018

Comments

A. E. Jellison
Operator

9/15/05
Date

Data Report Form DRF-20: Counting of Particles with SiC Gold Spot Defects by Visual Inspection

Procedure:	AGR-CHAR-DAM-20 Rev. 0
Operator:	John Hunn
Sample ID:	NUCO350-75T-C01-Goldspots 12000
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\GoldSpots\G05090201_DRF20R0.xls

Mean average weight/particle (g):	7.25E-04
Uncertainty in average weight/particle (g):	8.29E-07
Weight of sample of particles (g):	8.777
Approximate number of particles in sample:	12106
Uncertainty in number of particles in sample:	14

Number of particles with gold spot defects:	34

Comments on unusual visual characteristics of SiC

Observed gold spots do not conform to GA images of gold spots.
Particles identified as having gold spot defects showed varying shades of yellowish color that differed from the norm. These areas typically covered half the particle.

Some particles with shiny, metallic surfaces were also observed.

John Hunn
Operator

9-02-05
Date

Data Report Form DRF-07: Imaging of Particle Diameter and Aspect Ratio Using an Optical Microscope System

Procedure:	AGR-CHAR-DAM-07 Rev. 0
Operator:	Andrew K. Kercher
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090201\

DMR Calibration Expiration Date:	8/26/06
Stage Micrometer Calibration Expiration Date:	2/17/07
Measured Value for 1200 µm in Stage Micrometer Image:	1200.9 µm

Mean average weight/particle (g):	7.25E-04
Weight of sample of particles (g):	2.037
Approximate number of particles in sample:	2810

Operator

09/02/05
Date

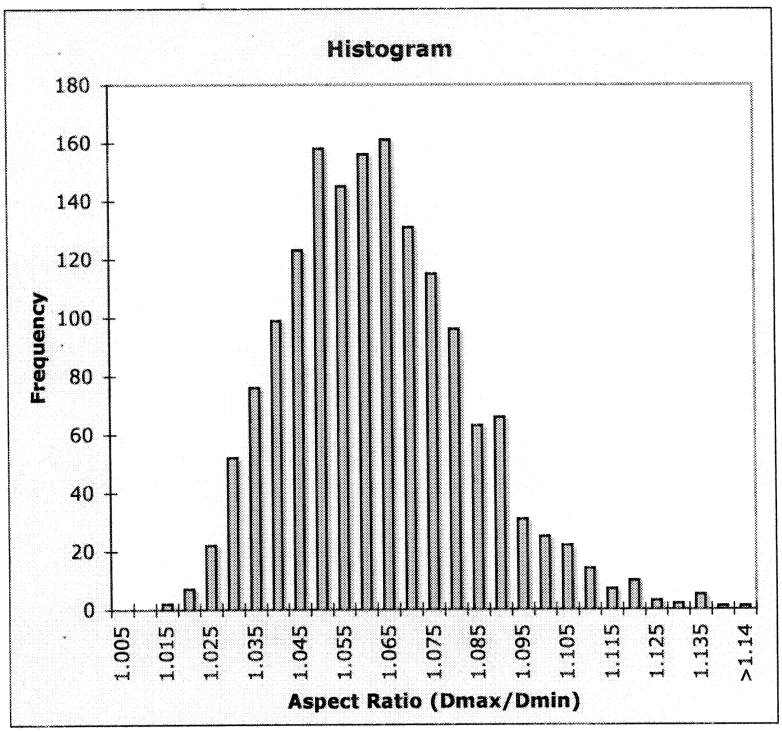
Data Report Form DRF-10B: Measurement of Particle Aspect Ratio (Dmax/Dmin)

Procedure:	AGR-CHAR-DAM-10 Rev. 1
Operator:	Andy Nelson
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090201\
Sample ID:	NUCO350-75T
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05090201_output\

Number of particles analyzed:	1593
Number of particles with aspect ratio > 1.14	1
Average particle aspect ratio:	1.060

Distribution of the aspect ratio (top binned)

Aspect Ratio (D)	*Frequency*
1.005	0
1.010	0
1.015	2
1.020	7
1.025	22
1.030	52
1.035	76
1.040	99
1.045	123
1.050	158
1.055	145
1.060	156
1.065	161
1.070	131
1.075	115
1.080	96
1.085	63
1.090	66
1.095	31
1.100	25
1.105	22
1.110	14
1.115	7
1.120	10
1.125	3
1.130	2
1.135	5
1.140	1
>1.14	1



Operator

9/2/05
Date

Data Report Form DRF-21: Measurement of Number of Particles with SiC Burn-Leach Defects

Procedure:	AGR-CHAR-DAM-21 Rev. 1
Operator:	Fred Montgomery
Sample ID:	NUCO350-75T-E01
Sample Description:	TRISO on BWXT Kernel Composite 69300
Filename:	\\mc-agr\AGR\BurnLeach\QCData\B05090201_DRF21R1.xls

Mean average weight/particle (g):	7.25E-04
Uncertainty in mean average weight/particle (g):	8.29E-07
Weight of sample of particles (g):	36.5192
Approximate number of particles in sample:	50371
Uncertainty in number of particles in sample:	58

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approximate weight uranium/kernel (g):	2.28E-06

	Leach 1	Leach 2	Leach 3	Total
Sample ID	B05090201-1	B05090201-2		
Volume of solution (ml):				
Measured β activity of 0.1ml aliquot (dpm):				
Estimated weight of U in solution (mg):	0	0	0	
Radiochemical laboratory analysis number	050907-033	050907-034		
Weight uranium leached (g):	3.67E-04	1.34E-05		3.80E-04
Uncertainty in weight uranium leached (g):	3.70E-05	1.30E-06		3.70E-05
Calculated number of particles with SiC defects:	2	0		2
Uncertainty in number of particles with SiC defects:	1.72E-01	6.06E-03		1.73E-01

Comments

U data checked fcm 12/02/05

Fred C. Montgomery
Operator

1/31/2006
Date

Data Report Form DRF-21: Measurement of Number of Particles with SiC Burn-Leach Defects

Procedure:	AGR-CHAR-DAM-21 Rev. 1
Operator:	Fred Montgomery
Sample ID:	NUCO350-75T-F01
Sample Description:	TRISO on BWXT Kernel Composite 69300
Filename:	\\mc-agr\AGR\BurnLeach\QCData\B05090202_DRF21R1.xls

Mean average weight/particle (g):	7.25E-04
Uncertainty in mean average weight/particle (g):	8.29E-07
Weight of sample of particles (g):	50.9905
Approximate number of particles in sample:	70332
Uncertainty in number of particles in sample:	80

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approximate weight uranium/kernel (g):	2.28E-06

	Leach 1	Leach 2	Leach 3	Total
Sample ID	B05090202-1	B05090202-2		
Volume of solution (ml):				
Measured β activity of 0.1ml aliquot (dpm):				
Estimated weight of U in solution (mg):	0	0	0	
Radiochemical laboratory analysis number	050913-001	050913-002		
Weight uranium leached (g):	3.46E-04	1.79E-05		3.64E-04
Uncertainty in weight uranium leached (g):	3.50E-05	1.80E-06		3.50E-05
Calculated number of particles with SiC defects:	2	0		2
Uncertainty in number of particles with SiC defects:	1.63E-01	8.39E-03		1.63E-01

Comments

U data checked fcm 12/02/05

Fred C. Montgomery
Operator

1/31/2006
Date

Data Report Form DRF-19: Counting of Particles with Missing OPyC Layer by Visual Inspection

Procedure:	AGR-CHAR-DAM-19 Rev. 0
Operator:	John Hunn
Sample ID:	NUCO350-75T-C01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\MissingOPyC\X05090201.xls

Mean average weight/particle (g):	7.25E-04
Uncertainty in average weight/particle (g):	8.29E-07
Weight of sample of particles (g):	22.679
Approximate number of particles in sample:	31281
Uncertainty in number of particles in sample:	36

Number of particles with missing OPyC layer:	0

Comments on unusual visual characteristics of OPyC

4 particles with unusual appearance were picked out. Coating were cracked off and examined.
OPyC thickness looked to be normal.

John Hunn
Operator

9-2-05
Date

Data Report Form DRF-23: Imaging of SiC Grain Structure

Procedure:	AGR-CHAR-DAM-23 Rev. 0
Operator:	John Hunn
Sample ID:	NUCO350-75T-B01
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel comp 69300
Mount Number(s):	M05090203N
Folder name containing images:	\\mc-agr\AGR\SEM\

Images of SiC grain structure			
	particle 1	particle 2	particle 3
1000x image filename	53726	53728	53730
2500x image filename	53725	53727	53729
grain structure acceptable	yes	yes	yes

Comments

John Hunn — Operator

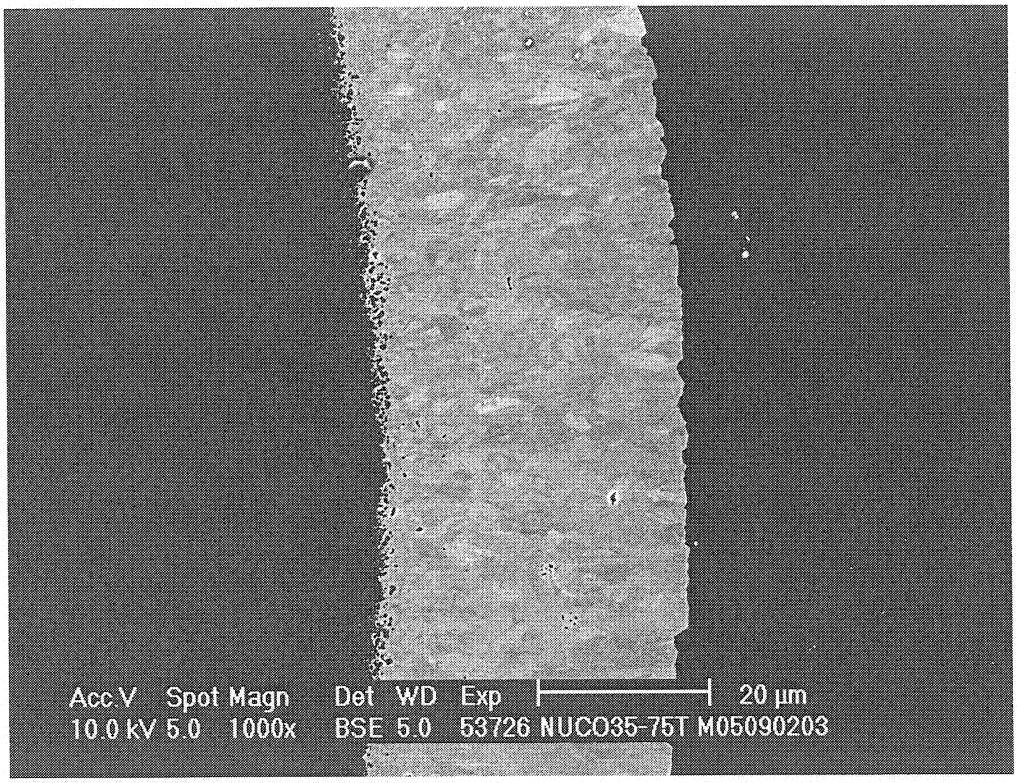
5-9-05 — Date

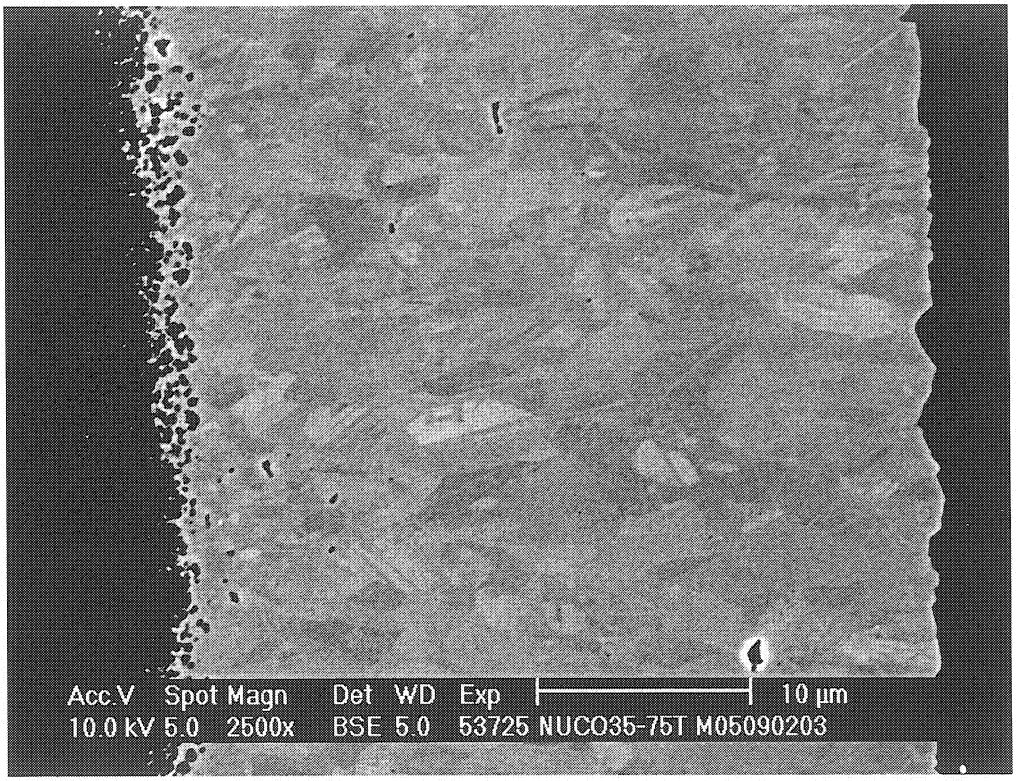
John Hunn — QC Supervisor

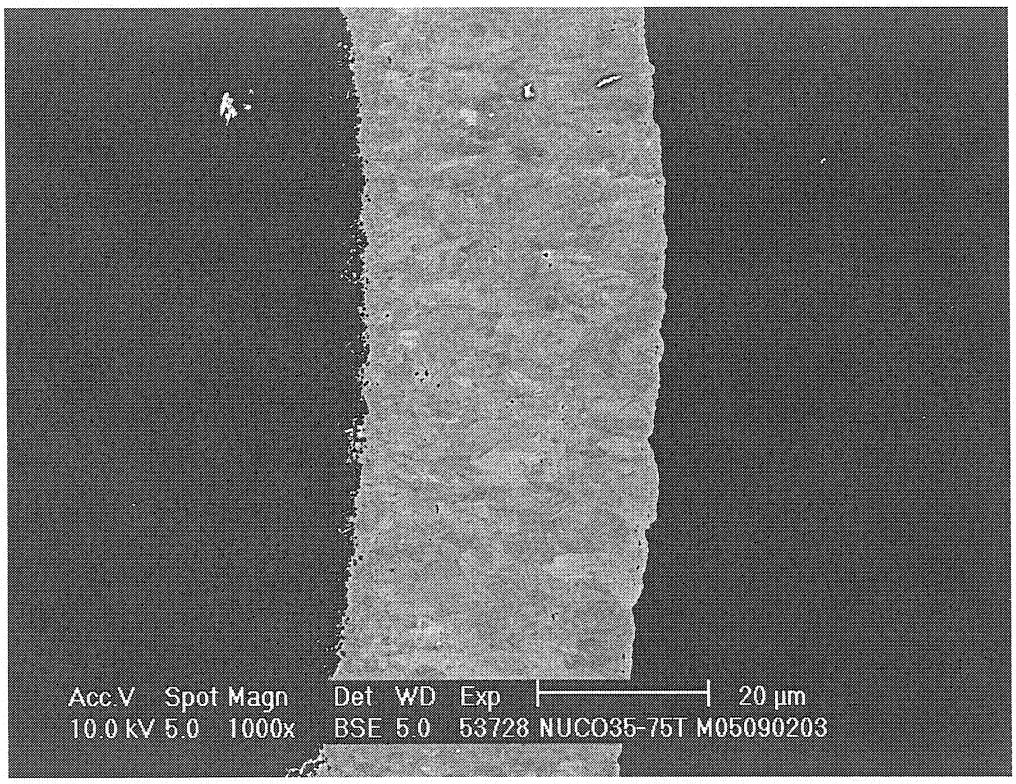
5-9-05 — Date

D. S. Per for M. C. Vance — QA Reviewer

3/2/06 — Date


Acc.V Spot Magn Det WD Exp 20 µm
10.0 kV 5.0 1000x BSE 5.0 53726 NUCO35-75T M05090203


Acc.V Spot Magn Det WD Exp 10 µm
10.0 kV 5.0 2500x BSE 5.0 53725 NUCO35-75T M05090203


Acc.V Spot Magn Det WD Exp 20 µm
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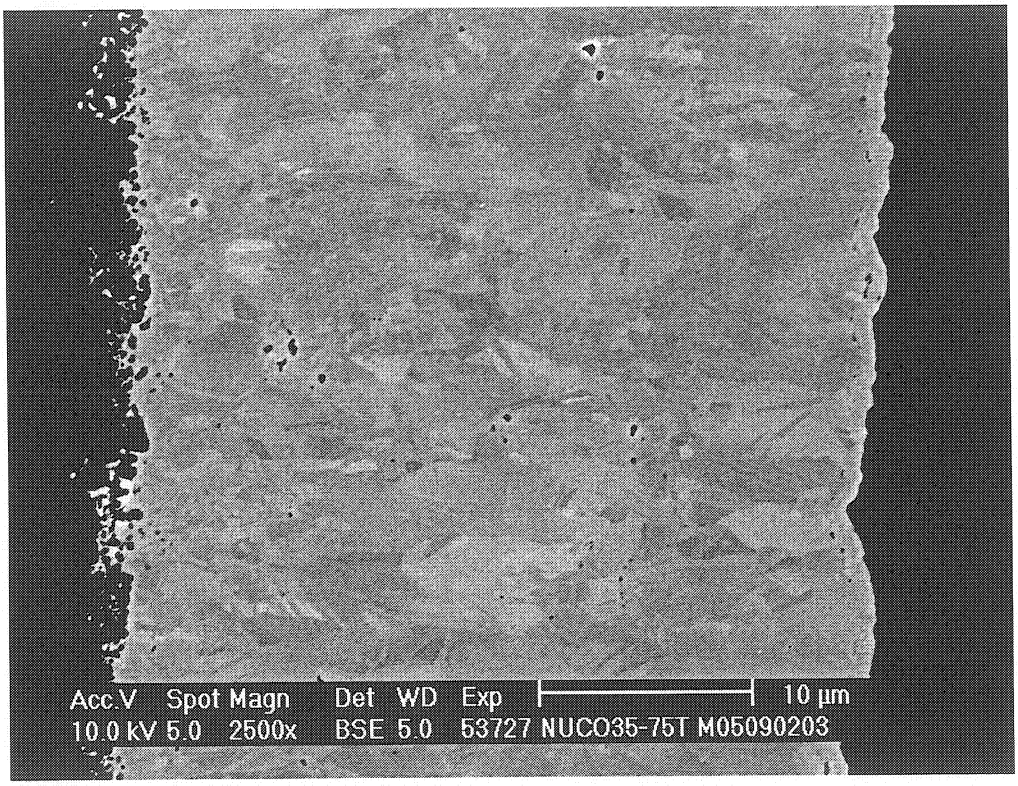
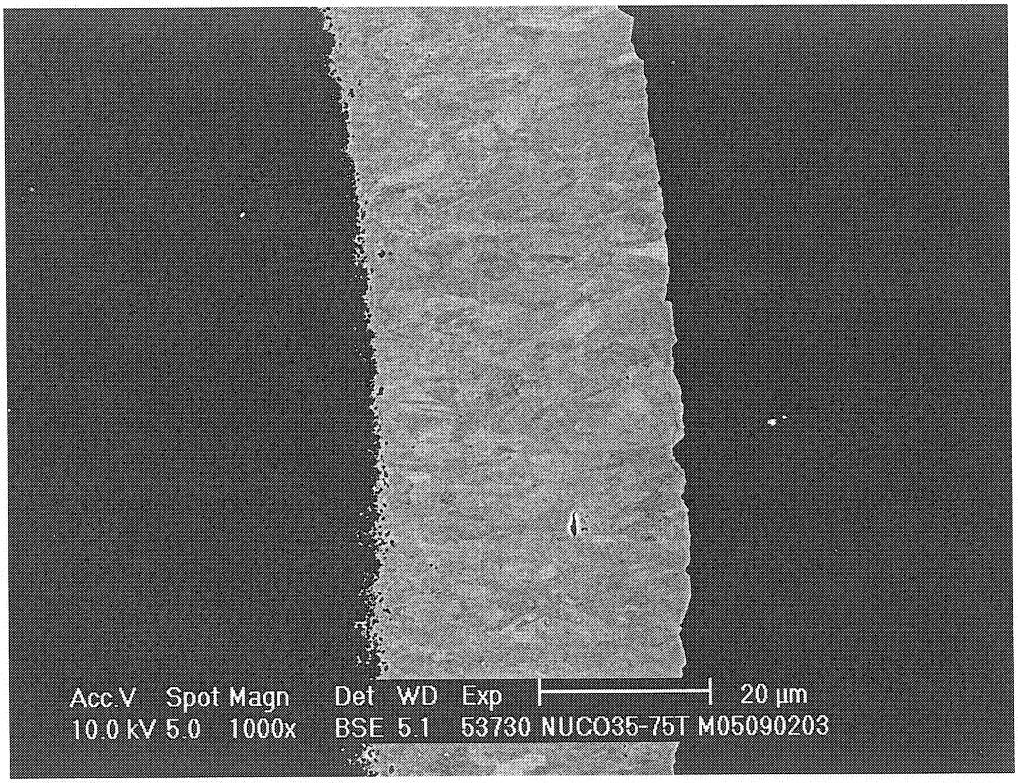
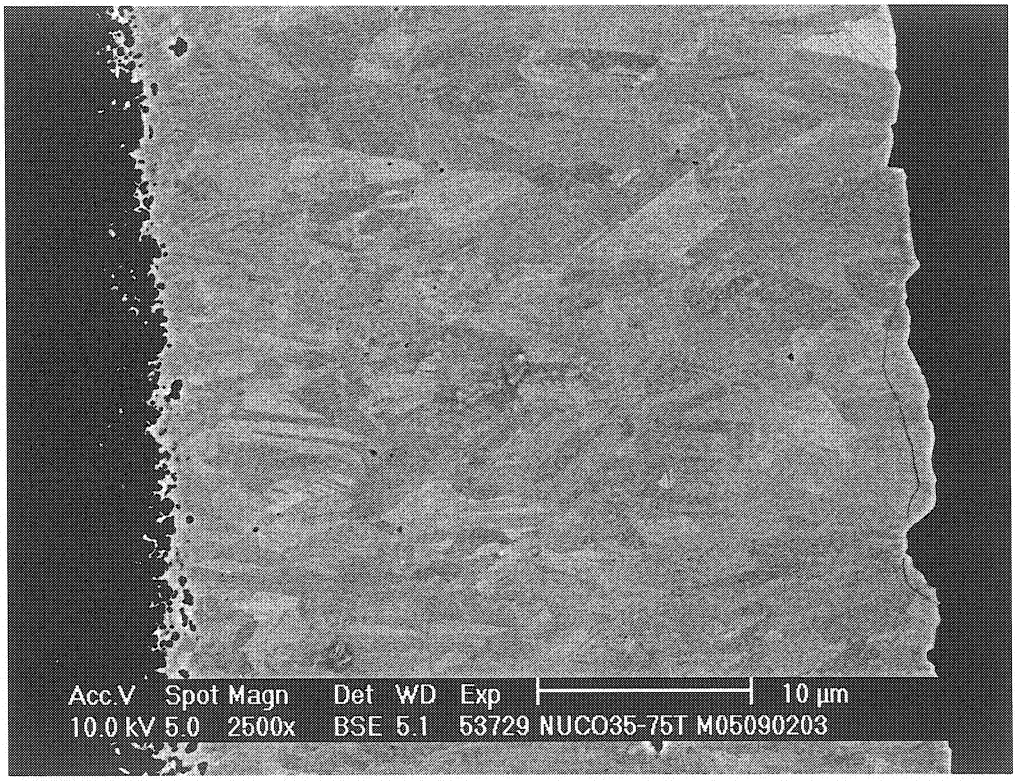

Acc.V Spot Magn Det WD Exp 10 µm
10.0 kV 5.0 2500x BSE 5.0 53727 NUCO35-75T M05090203


Acc.V Spot Magn Det WD Exp 20 µm
10.0 kV 5.0 1000x BSE 5.1 53730 NUCO35-75T M05090203


Acc.V Spot Magn Det WD Exp 10 µm
10.0 kV 5.0 2500x BSE 5.1 53729 NUCO35-75T M05090203

For Information Only

The information in the remainder of this section reports results of measurements not required by the fuel specification and is provided for information only.

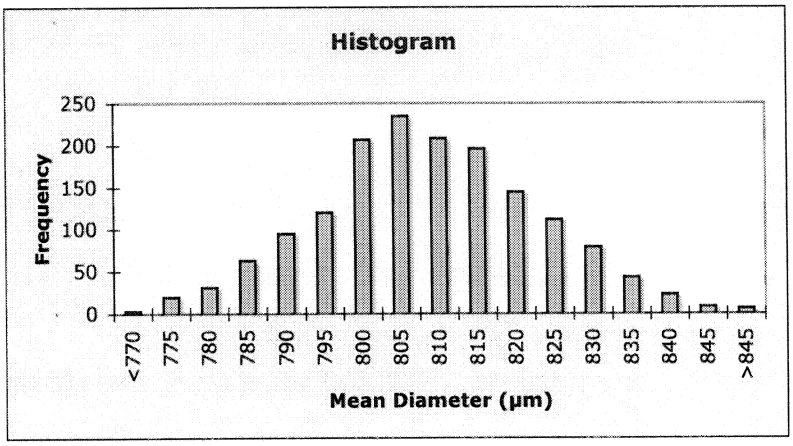
Data Report Form DRF-10A: Measurement of Particle Diameter

Procedure:	AGR-CHAR-DAM-10 Rev. 1
Operator:	Andy Nelson
Folder name containing images:	\\mc-agr\AGR\ImageProcessing\P05090201\
Sample ID:	NUCO350-75T
Sample Description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Folder name containing processed data:	\\mc-agr\AGR\ImageProcessing\Completed_Shadow\P05090201_output\

Number of particles analyzed:	1593
Mean of the average diameter of each particle (μm):	806.0
Standard deviation in the average diameter of each particle (μm):	14

Distribution of the average particle diameter (top binned)

Mean Diameter (μm)	*Frequency*
<770	3
775	20
780	31
785	63
790	95
795	120
800	207
805	235
810	208
815	196
820	144
825	112
830	79
835	43
840	23
845	8
>845	6



Operator

9-2-05

Date

Data Report Form DRF-31: Measurement of Open Porosity using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-31 Rev. 0
Operator:	S. D. Nunn
Coated particle batch ID:	LEU01-47T-I01
Batch Description:	Variant 1 Composite: TRISO on BWXT kernel composite 69302
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S06020201\S06020201_DRF31R0.xls

Mean average weight/particle (g):	7.33E-04
Uncertainty in mean average weight/particle (g):	1.52E-06

Weight of particles (g):	3.5480
Approximate number of particles:	4840
Uncertainty in number of particles:	10
Total envelope volume of sample (cc):	1.304
Average envelope volume/particle (cc):	2.69E-04
Sample envelope density (g/cc):	2.720

Average particle diameter (microns):	8.01E+02
Average surface area/particle (cm2):	2.02E-02
Total sample surface area (cm2):	9.77E+01
Intruded mercury volume from 250-10,000 psia (cc):	1.14E-02
Open porosity (ml/m2):	1.17E+00

Comments

S. D. Nunn
Operator

2/2/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	Dixie Barker
Particle Lot ID:	NUCO350-75T-G01
Particle Lot Description:	Composite (43T+48T+40T) TRISO on BWXT 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W5090201_DRF22.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	1.02E-01	9.97E-02	8.76E-02	9.35E-02	8.19E-02
Number of particles:	141	137	121	129	113
Average weight/particle (g):	7.23E-04	7.28E-04	7.24E-04	7.25E-04	7.25E-04

Mean average weight/particle (g):	7.25E-04
Uncertainty in mean average weight/particle (g):	8.29E-07

Dixie Barker
Operator

9-2-05
Date

10 Characterization of compacts

This section contains data on the compacts, NUCO350-75T-Z. It was obtained according to product inspection plan AGR-CHAR-PIP-05R0 with the exception that the defective OPyC analysis was performed on six compacts used for the uranium contamination measurement because the one compact specified in PIP-05R0 was not available.

The following pages shows the inspection report forms (IRF-05A, IRF-05B, IRF-05C, IRF-05D) for the NUCO350-75T-Z compacts. Following IRF-05 are the individual data report forms for the measurements that were performed.

Inspection Report Form IRF-05A: Fuel Compact Lots

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers of compacts available for irradiation test (pending acceptance):	Not Applicable (NA)

Property	Measured Data Mean (x)	Std. Dev. (s)	Measurements (n)	k or t value	Specification INL EDF-4380	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
Compact diameter (mm)	See DRF-24				12.22 - 12.46	all available for irradiation test meet specification		NA	DRF-24
Compact length (mm)					25.02 - 25.40				
Uranium loading (gU/compact)	0.921	0.006	6	2.015	0.905 ± 0.04	A = x - ts/√n ≥ 0.865	0.916	pass	DRF-25
						B = x + ts/√n ≤ 0.945	0.926	pass	
Iron content outside SiC (µg/compact)	12.0	16.5	4	2.353	mean ≤ 25	B = x + ts/√n ≤ 25	31.4	fail	IRF-05B DRF-26
				7.042	dispersion ≤0.01 ≤ 100	D = x + √3ks < 100	213.3	fail	
Chromium content outside SiC (µg/compact)	2.1	0.3	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	2.5	pass	IRF-05B DRF-26
Manganese content outside SiC (µg/compact)	0.5	0.2	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	0.7	pass	IRF-05B DRF-26
Cobalt content outside SiC (µg/compact)	1.5	0.04	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	1.5	pass	IRF-05B DRF-26
Nickel content outside SiC (µg/compact)	27.5	19.2	4	2.353	mean ≤ 75	B = x + ts/√n ≤ 75	50.1	pass	IRF-05B DRF-26
Cr + Mn + Co + Ni content outside SiC (µg/compact)	31.5	19.1	4	7.042	dispersion ≤0.01 ≤ 300	D = x + √3ks < 300	264.5	pass	IRF-05B DRF-26
Calcium content outside SiC (µg/compact)	59.3	11.5	4	2.353	mean ≤ 25	B = x + ts/√n ≤ 25	72.8	fail	IRF-05B DRF-26
Aluminum content outside SiC (µg/compact)	29.0	2.3	4	2.353	mean ≤ 25	B = x + ts/√n ≤ 25	31.7	fail	IRF-05B DRF-26
Ti + V content outside SiC (µg/compact)	41.5	1.4	4	2.353	mean ≤ 400	B = x + ts/√n ≤ 400	43.1	pass	IRF-05B DRF-26

Property	Measured Data # of compacts	# of particles	Specification INL EDF-4380	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
Uranium contamination fraction (g exposed U/gram U in compact)	24	106690	≤ 1.0×10^{-4}	≤4 effectively exposed kernels in ≥91533 particles	2.5	pass	IRF-05C DRF-26
Defective SiC coating fraction (fraction of total particles)	12	53345	≤ 2.0×10^{-4}	≤4 leached kernels in ≥45766 particles or ≤12 leached kernels in ≥97210 particles	2	pass	IRF-05D DRF-26
Defective IPyC coating fraction (fraction of total particles)	12	53345	≤ 2.0×10^{-4}	≤4 with excessive U dispersion in ≥45766 particles or ≤12 with excessive U dispersion in ≥97210 particles	0	pass	DRF-28
Defective OPyC coating fraction (fraction of total particles)	6	26996	≤ 0.01	≤6 cracked or missing OPyC in ≥1182 particles or ≤30 cracked or missing OPyC in ≥4064 particles	1	pass	DRF-27

Comments

QC Supervisor — Date: 2-13-06

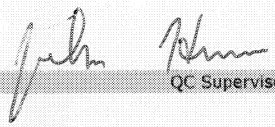
Accept compact lot (Yes or No):	Not Applicable

QA Reviewer — Date: 2/22/06

Inspection Report Form IRF-05B: Summary of Impurites Outside SiC

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact Lot description:	Compacts of TRISO on BWXT kernel composite 69300

Compact ID numbers:	11, 13, 16	02, 05, 07	04, 09, 10	03, 06, 18	Mean	Standard Deviation
Number of compacts:	3	3	3	3		
Iron						
Deconsolidation-leach (DRF-26A) (µg):	107.58	3.95	7.73	10.10		
Burn-leach (DRF-26B) (µg):	2.89	6.33	2.90	2.90		
Total leached (µg):	110.47	10.28	10.63	13.00		
Fe outside SiC (µg/compact):	**36.8**	**3.4**	**3.5**	**4.3**	**12.0**	**16.5**
Chromium						
Deconsolidation-leach (DRF-26A) (µg):	2.60	2.26	2.71	2.95		
Burn-leach (DRF-26B) (µg):	2.65	3.63	3.98	3.96		
Total leached (µg):	5.25	5.89	6.69	6.91		
Cr outside SiC (µg/compact):	**1.8**	**2.0**	**2.2**	**2.3**	**2.1**	**0.3**
Manganese						
Deconsolidation-leach (DRF-26A) (µg):	0.73	0.43	0.70	1.98		
Burn-leach (DRF-26B) (µg):	0.40	0.53	0.73	0.35		
Total leached (µg):	1.13	0.95	1.43	2.33		
Mn outside SiC (µg/compact):	**0.4**	**0.3**	**0.5**	**0.8**	**0.5**	**0.2**
Cobalt						
Deconsolidation-leach (DRF-26A) (µg):	2.45	2.20	2.20	2.20		
Burn-leach (DRF-26B) (µg):	2.20	2.20	2.20	2.20		
Total leached (µg):	4.65	4.40	4.40	4.40		
Co outside SiC (µg/compact):	**1.6**	**1.5**	**1.5**	**1.5**	**1.5**	**0.04**
Nickel						
Deconsolidation-leach (DRF-26A) (µg):	154.70	12.16	75.63	51.83		
Burn-leach (DRF-26B) (µg):	3.86	11.11	15.03	5.66		
Total leached (µg):	158.56	23.27	90.66	57.49		
Ni outside SiC (µg/compact):	**52.9**	**7.8**	**30.2**	**19.2**	**27.5**	**19.2**
Transition Metals						
Cr+Mn+Co+Ni outside SiC (µg/compact):	**56.5**	**11.5**	**34.4**	**23.7**	**31.5**	**19.1**
Calcium						
Deconsolidation-leach (DRF-26A) (µg):	93.90	63.90	75.50	117.60		
Burn-leach (DRF-26B) (µg):	75.90	73.10	109.40	102.40		
Total leached (µg):	169.80	137.00	184.90	220.00		
Ca outside SiC (µg/compact):	**56.6**	**45.7**	**61.6**	**73.3**	**59.3**	**11.5**
Aluminum						
Deconsolidation-leach (DRF-26A) (µg):	64.40	50.40	40.90	69.00		
Burn-leach (DRF-26B) (µg):	23.55	30.88	41.40	27.15		
Total leached (µg):	87.95	81.28	82.30	96.15		
Al outside SiC (µg/compact):	**29.3**	**27.1**	**27.4**	**32.1**	**29.0**	**2.3**
Titanium						
Deconsolidation-leach (DRF-26A) (µg):	10.50	20.80	3.18	15.13		
Burn-leach (DRF-26B) (µg):	31.35	24.85	41.75	25.65		
Total leached (µg):	41.85	45.65	44.93	40.78		
Ti outside SiC (µg/compact):	**14.0**	**15.2**	**15.0**	**13.6**	**14.4**	**0.8**
Vanadium						
Deconsolidation-leach (DRF-26A) (µg):	44.40	42.10	31.60	39.40		
Burn-leach (DRF-26B) (µg):	39.53	42.03	45.63	39.83		
Total leached (µg):	83.93	84.13	77.23	79.23		
V outside SiC (µg/compact):	**28.0**	**28.0**	**25.7**	**26.4**	**27.0**	**1.1**
Titanium and Vanadium						
Ti + V outside SiC (µg/compact):	**41.9**	**43.3**	**40.7**	**40.0**	**41.5**	**1.4**



QC Supervisor

2-2-06

Date

Inspection Report Form IRF-05C: Summary of Uranium Contamination

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact Lot description:	Compacts of TRISO on BWXT kernel composite 69300

Compact ID numbers:	11, 13, 16	02, 05, 07	04, 09, 10	03, 06, 18	19, 20, 26, 28, 30, 34	21, 22, 23, 29, 31, 36	Total
Number of compacts:	3	3	3	3	6	6	24
Effective number of exposed kernels:	0.0	0.0	0.0	0.0	1.7	0.8	2.5

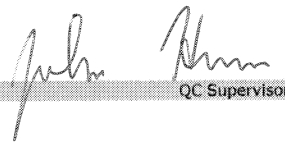
QC Supervisor

2-2-06
Date

Inspection Report Form IRF-05D: Summary of SiC Burn-Leach Defects

Procedure:	AGR-CHAR-PIP-05 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact Lot description:	Compacts of TRISO on BWXT kernel composite 69300

Compact ID numbers:	11, 13, 16	02, 05, 07	04, 09, 10	03, 06, 18			Total
Number of compacts:	3	3	3	3			12
Number of leached kernels:	0	1	1	0			2



QC Supervisor

2-2-06

Date

Data Report Form DRF-24: Compact Diameter and Length

Procedure:	AGR-CHAR-DAM-24 Rev. 1
Operator:	Ivan Dunbar
Coated particle composite ID:	NUCO350-75T
Coated particle description:	Composite (43T+48T+40T) TRISO on BWXT kernel composite 69300
Filename:	\\mc-agr\AGR\CompactDimensions\C05091301_DRF24R0.xls

Vertical height gauge calibration due date:	9/8/06
Pass-thru block calibration due date:	9/8/08
Digital caliper calibration due date:	9/8/06
Gauge blocks calibration due date:	9/8/08

Acceptance criteria for compact length:	≥25.02 and ≤25.40 mm
Acceptance criteria for compact diameter:	≥12.22 and ≤12.46 mm

Compact ID	Length (mm)	Diameter (mm)						Pass Thru? (Y or N)	Accept? (pass or fail)
		Top 1	Top 2	Middle 1	Middle 2	Bottom 1	Bottom 2		
Z01	25.06	12.39	12.40	12.4	12.4	12.42	12.42	Y	pass
Z02	25.41	12.43	12.43	12.43	12.41	12.42	12.42	N	fail
Z03	25.39	12.41	12.41	12.36	12.36	12.36	12.36	Y	pass
Z04	NM								
Z05	25.26	12.41	12.41	12.42	12.42	12.4	12.4	Y	pass
Z06	25.29	12.42	12.42	12.42	12.43	12.43	12.43	Y	pass
Z07	25.33	12.41	12.41	12.42	12.41	12.42	12.42	Y	pass
Z08	25.31	12.43	12.43	12.42	12.43	12.41	12.41	Y	pass
Z09	NM								
Z10	NM								
Z11	NM								
Z12	25.26	12.42	12.42	12.42	12.42	12.41	12.4	Y	pass
Z13	NM								
Z14	25.33	12.40	12.40	12.4	12.39	12.38	12.38	Y	pass
Z15	25.29	12.41	12.40	12.41	12.41	12.41	12.41	Y	pass
Z16	NM								
Z17	25.33	12.39	12.39	12.39	12.4	12.4	12.4	Y	pass
Z18	25.38	12.42	12.42	12.43	12.43	12.43	12.43	Y	pass
Z19	25.32	12.41	12.42	12.43	12.41	12.43	12.43	Y	pass
Z20	25.31	12.41	12.41	12.42	12.42	12.42	12.42	Y	pass
Z21	25.30	12.42	12.43	12.43	12.43	12.42	12.41	Y	pass
Z22	25.28	12.43	12.42	12.42	12.42	12.43	12.43	Y	pass
Z23	25.32	12.43	12.43	12.44	12.43	12.42	12.43	N	fail
Z24	25.37	12.43	12.43	12.43	12.43	12.42	12.42	N	fail
Z25	25.26	12.43	12.43	12.43	12.43	12.42	12.42	Y	pass
Z26	25.33	12.42	12.41	12.41	12.42	12.42	12.42	Y	pass
Z27	25.27	12.41	12.41	12.42	12.43	12.43	12.42	Y	pass
Z28	25.26	12.43	12.43	12.42	12.42	12.42	12.42	Y	pass
Z29	25.31	12.43	12.43	12.44	12.44	12.42	12.43	N	fail
Z30	25.31	12.44	12.44	12.44	12.44	12.43	12.43	N	fail
Z31	25.30	12.43	12.43	12.44	12.43	12.42	12.42	Y	pass
Z32	25.35	12.43	12.43	12.43	12.43	12.43	12.44	Y	pass
Z33	25.35	12.43	12.43	12.43	12.43	12.42	12.42	Y	pass
Z34	25.32	12.44	12.43	12.43	12.43	12.42	12.42	Y	pass
Z35	25.30	12.43	12.43	12.43	12.43	12.42	12.42	Y	pass
Z36	25.34	12.42	12.43	12.43	12.43	12.41	12.42	N	fail

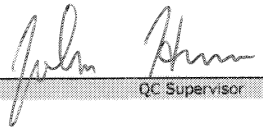
Comments

6 of the compact were already taken for LBL so they were not measured (NM).
See attached images of compact surfaces.

Operator

9-13-05

Date



QC Supervisor

2-13-06

Date

QA Reviewer

Date

Inspection of NUCO350-75T-Z compacts

Some variation in surface appearance of compacts was observed.

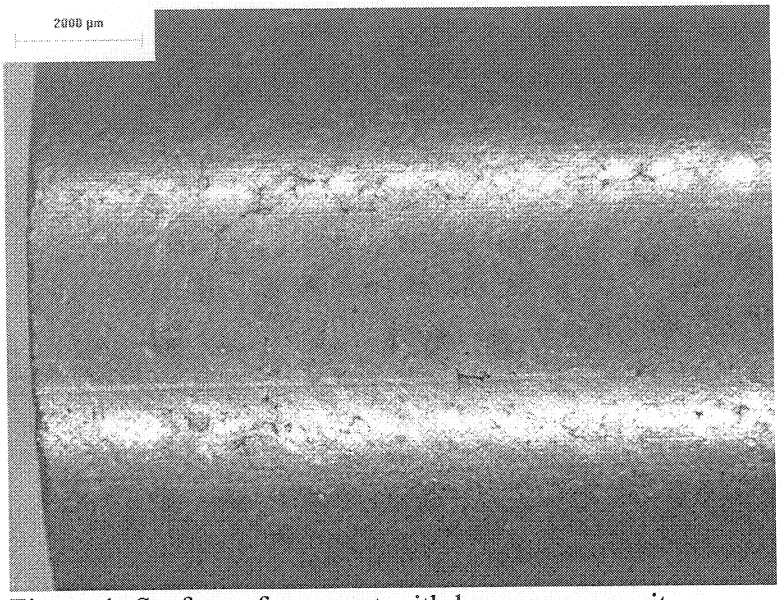


Figure 1: Surface of compact with low open porosity.

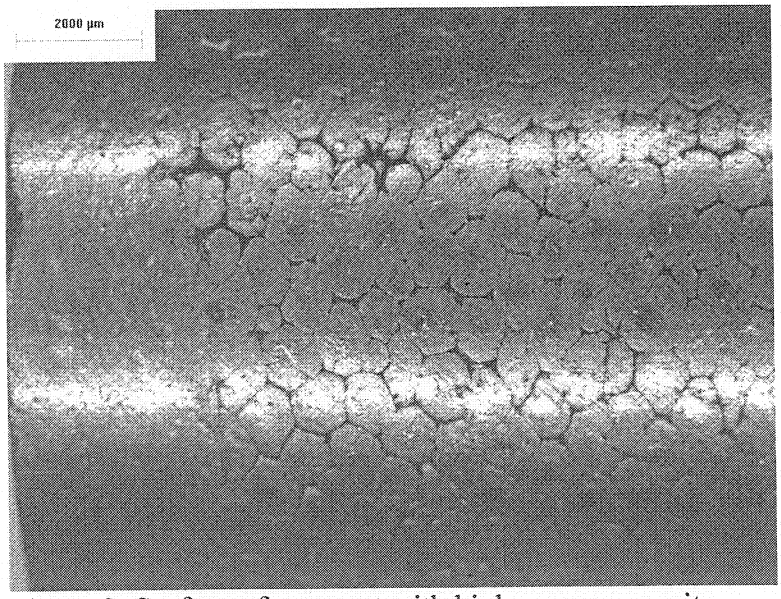


Figure 2: Surface of compact with higher open porosity.

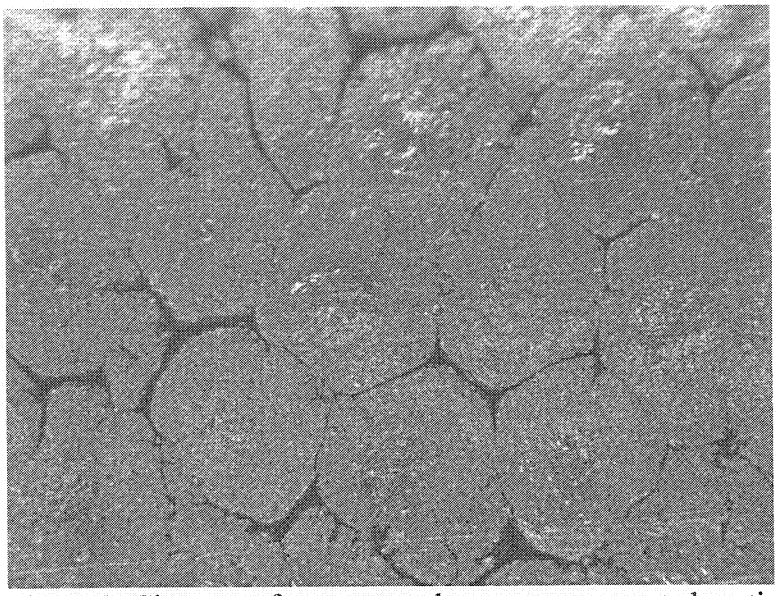


Figure 3: Close up of open space between over-coated particles.

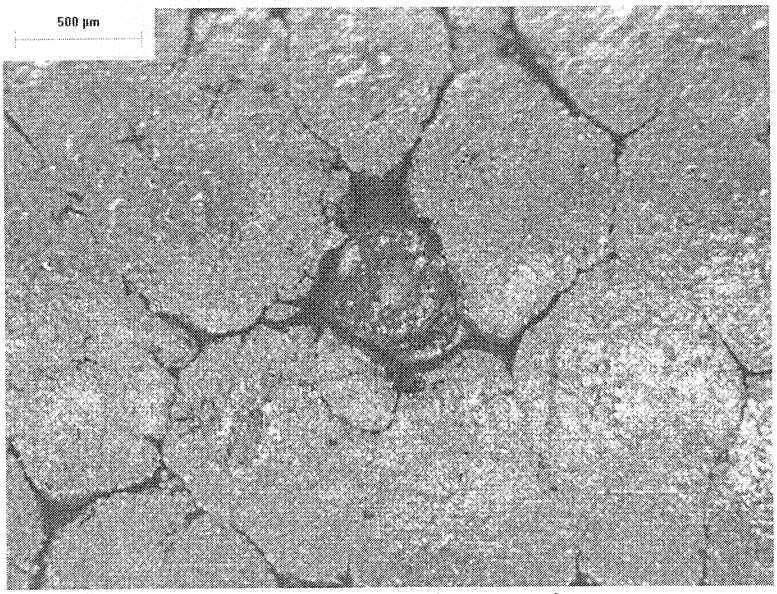


Figure 4: Exposed particle on compact surface.

Data Report Form DRF-25: Fuel Compact Mean Uranium Loading

Procedure:	AGR-CHAR-DAM-25 Rev. 1
Operator:	Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT Kernel Compsite 69300
Filename:	\\mc-agr\AGR\UraniumLoading\NUCO350-75T-Z_DRF25R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Compact ID number:	1	8	12	14	15	17
Sample tube ID number:	U05102401	U05101501	U05101401	U05101701	U05101502	U05102402
Radiochemical laboratory analysis number:	051025-016	051025-002	051025-004	051025-001	051025-003	051025-015
Measured U in compact (g):	0.923	0.922	0.925	0.922	0.910	0.926
Uncertainty in measured U in compact (g):	0.001	0.001	0.001	0.001	0.001	0.001

Mean uranium loading (gU/compact):	0.921
Standard deviation in mean uranium loading (gU/compact):	0.006

Comments

Fred C. Montgomery
Operator

1/31/2006
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	11, 13, 16
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L050912	L050912-2	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051011-006	051011-007	
Weight uranium leached (g):	8.50E-07	1.50E-07	1.00E-06
Uncertainty in weight uranium leached (g):	8.50E-08	3.00E-08	9.01E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	103.00	4.58	107.58
Uncertainty in measured Fe content (µg):	10.00	0.92	10.04
Cr content of leach solution (µg):	1.40	1.20	2.60
Uncertainty in measured Cr content (µg):	0.28	0.24	0.37
Mn content of leach solution (µg):	0.55	< 0.18	0.73
Uncertainty in measured Mn content (µg):	0.11		0.11
Co content of leach solution (µg):	1.35	< 1.10	2.45
Uncertainty in measured Co content (µg):	0.27		0.27
Ni content of leach solution (µg):	138.00	16.70	154.70
Uncertainty in measured Ni content (µg):	14.00	1.70	14.10
Ca content of leach solution (µg):	54.90	39.00	93.90
Uncertainty in measured Ca content (µg):	5.50	3.90	6.74
Al content of leach solution (µg):	41.00	23.40	64.40
Uncertainty in measured Al content (µg):	4.10	4.70	6.24
Ti content of leach solution (µg):	4.25	6.25	10.50
Uncertainty in measured Ti content (µg):	0.85	0.63	1.06
V content of leach solution (µg):	29.80	14.60	44.40
Uncertainty in measured V content (µg):	3.00	1.50	3.35

Comments

impurities check FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	02, 05, 07
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L05091501-1	L05091501-2	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051011-008	051011-009	
Weight uranium leached (g):	8.00E-07	7.50E-08	8.75E-07
Uncertainty in weight uranium leached (g):	8.00E-08	1.50E-08	8.14E-08
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	< 1.45	2.50	3.95
Uncertainty in measured Fe content (µg):		0.50	0.50
Cr content of leach solution (µg):	< 1.13	< 1.13	2.26
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	0.25	< 0.18	0.43
Uncertainty in measured Mn content (µg):	0.05		0.05
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	6.43	5.73	12.16
Uncertainty in measured Ni content (µg):	1.30	1.10	1.70
Ca content of leach solution (µg):	33.70	30.20	63.90
Uncertainty in measured Ca content (µg):	3.40	3.00	4.53
Al content of leach solution (µg):	27.00	23.40	50.40
Uncertainty in measured Al content (µg):	2.70	4.70	5.42
Ti content of leach solution (µg):	13.00	7.80	20.80
Uncertainty in measured Ti content (µg):	1.30	0.78	1.52
V content of leach solution (µg):	33.60	8.50	42.10
Uncertainty in measured V content (µg):	3.40	0.85	3.50

Comments

impurites checked FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	04, 09, 10
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L05090701-1	L05090701-2	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	050913-003	050913-004	
Weight uranium leached (g):	5.50E-07	<3.00E-07	8.50E-07
Uncertainty in weight uranium leached (g):	1.10E-07		1.10E-07
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	6.28	< 1.45	7.73
Uncertainty in measured Fe content (µg):	1.30		1.30
Cr content of leach solution (µg):	1.58	< 1.13	2.71
Uncertainty in measured Cr content (µg):	0.32		0.32
Mn content of leach solution (µg):	0.33	0.38	0.70
Uncertainty in measured Mn content (µg):	0.07	0.08	0.10
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	66.60	9.03	75.63
Uncertainty in measured Ni content (µg):	6.70	1.80	6.94
Ca content of leach solution (µg):	41.10	34.40	75.50
Uncertainty in measured Ca content (µg):	4.10	3.40	5.33
Al content of leach solution (µg):	23.20	<17.70	40.90
Uncertainty in measured Al content (µg):	4.60		4.60
Ti content of leach solution (µg):	1.43	1.75	3.18
Uncertainty in measured Ti content (µg):	0.29	0.35	0.45
V content of leach solution (µg):	16.50	15.10	31.60
Uncertainty in measured V content (µg):	1.70	1.50	2.27

Comments

impurites checked FCM 1-19-06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	03, 06, 18
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L05101201	L05101901	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051025-013	051025-014	
Weight uranium leached (g):	<1.00E-07	<5.00E-08	1.50E-07
Uncertainty in weight uranium leached (g):			
Effective number of exposed kernels:	0.0	0.0	0.0
Uncertainty in effective number of exposed kernels:	0.0	0.0	
Fe content of leach solution (µg):	8.65	< 1.45	10.10
Uncertainty in measured Fe content (µg):	0.87		0.87
Cr content of leach solution (µg):	1.45	1.50	2.95
Uncertainty in measured Cr content (µg):	0.29	0.30	0.42
Mn content of leach solution (µg):	0.23	< 1.75	1.98
Uncertainty in measured Mn content (µg):	0.05		0.05
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	49.90	< 1.93	51.83
Uncertainty in measured Ni content (µg):	5.00		5.00
Ca content of leach solution (µg):	73.30	44.30	117.60
Uncertainty in measured Ca content (µg):	7.30	4.40	8.52
Al content of leach solution (µg):	39.30	29.70	69.00
Uncertainty in measured Al content (µg):	3.90	3.00	4.92
Ti content of leach solution (µg):	6.00	9.13	15.13
Uncertainty in measured Ti content (µg):	1.20	0.91	1.51
V content of leach solution (µg):	28.80	10.60	39.40
Uncertainty in measured V content (µg):	2.90	0.11	2.90

Comments

impurities checked 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	19, 20, 26, 28, 30, 34
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L05102901	L05110301	
Number of compacts:	6		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051115-001	051115-002	
Weight uranium leached (g):	3.58E-04	1.43E-05	3.72E-04
Uncertainty in weight uranium leached (g):	3.60E-05	1.40E-06	3.60E-05
Effective number of exposed kernels:	1.7	0.1	1.7
Uncertainty in effective number of exposed kernels:	0.2	0.0	0.2
Fe content of leach solution (µg):	13.50	7.70	21.20
Uncertainty in measured Fe content (µg):	2.70	1.50	3.09
Cr content of leach solution (µg):	< 3.72	< 3.72	7.44
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.55	< 0.55	1.09
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 3.70	< 3.70	7.40
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	20.90	< 6.44	27.34
Uncertainty in measured Ni content (µg):	4.20		4.20
Ca content of leach solution (µg):	59.10	46.70	105.80
Uncertainty in measured Ca content (µg):	5.90	4.70	7.54
Al content of leach solution (µg):	75.30	61.10	136.40
Uncertainty in measured Al content (µg):	15.00	12.00	19.21
Ti content of leach solution (µg):	<12.50	<12.50	25.00
Uncertainty in measured Ti content (µg):			
V content of leach solution (µg):	56.40	23.50	79.90
Uncertainty in measured V content (µg):	5.60	4.70	7.31

Comments

impurities checked 1/30/06 FCM

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26A: Measurement of U Contamination and Impurities by Deconsolidation Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	21, 22, 23, 29, 31, 36
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Deconsolidation-leach solution ID:	L05110401	L05110801	
Number of compacts:	6		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051115-003	051115-004	
Weight uranium leached (g):	1.62E-04	8.85E-06	1.71E-04
Uncertainty in weight uranium leached (g):	1.60E-05	8.90E-07	1.60E-05
Effective number of exposed kernels:	0.8	0.0	0.8
Uncertainty in effective number of exposed kernels:	0.1	0.0	0.1
Fe content of leach solution (µg):	14.90	7.15	22.05
Uncertainty in measured Fe content (µg):	3.00	1.40	3.31
Cr content of leach solution (µg):	< 3.72	< 3.72	7.44
Uncertainty in measured Cr content (µg):			
Mn content of leach solution (µg):	< 0.55	< 0.55	1.09
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 3.70	< 3.70	7.40
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	44.40	< 6.44	50.84
Uncertainty in measured Ni content (µg):	4.40		4.40
Ca content of leach solution (µg):	45.70	33.30	79.00
Uncertainty in measured Ca content (µg):	4.60	6.70	8.13
Al content of leach solution (µg):	68.30	69.50	137.80
Uncertainty in measured Al content (µg):	14.00	14.00	19.80
Ti content of leach solution (µg):	<12.50	<12.50	25.00
Uncertainty in measured Ti content (µg):			
V content of leach solution (µg):	55.50	25.10	80.60
Uncertainty in measured V content (µg):	5.50	5.00	7.43

Comments

impurities checked 1-30-06 FCM

Fred C Montgomery
Operator

8/02/06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	11, 13, 16
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Burn-leach solution ID:	B0509270201	B0509270202	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051011-014	051011-015	
Weight uranium leached (g):	1.00E-07	<5.00E-08	1.50E-07
Uncertainty in weight uranium leached (g):	2.00E-08		2.00E-08
Number of leached kernels:	0.0	0.0	0.0
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	< 1.45	< 1.44	2.89
Uncertainty in measured Fe content (µg):			
Cr content of leach solution (µg):	1.17	1.48	2.65
Uncertainty in measured Cr content (µg):	0.34	0.30	0.45
Mn content of leach solution (µg):	0.20	0.20	0.40
Uncertainty in measured Mn content (µg):	0.04	0.04	0.06
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	< 1.93	< 1.93	3.86
Uncertainty in measured Ni content (µg):			
Ca content of leach solution (µg):	51.30	24.60	75.90
Uncertainty in measured Ca content (µg):	5.10	2.50	5.68
Al content of leach solution (µg):	15.10	8.45	23.55
Uncertainty in measured Al content (µg):	3.00	1.70	3.45
Ti content of leach solution (µg):	30.10	< 1.25	31.35
Uncertainty in measured Ti content (µg):	3.00		3.00
V content of leach solution (µg):	37.90	< 1.63	39.53
Uncertainty in measured V content (µg):	3.80		3.80

Comments

impurites checked FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	02, 05, 07
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Burn-leach solution ID:	L05092701-1	L05092701-2	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051011-012	051011-013	
Weight uranium leached (g):	2.17E-04	9.50E-06	2.27E-04
Uncertainty in weight uranium leached (g):	2.20E-05	9.50E-07	2.20E-05
Number of leached kernels:	1.0	0.0	1.0
Uncertainty in number of leached kernels:	0.1	0.0	0.1
Fe content of leach solution (µg):	< 1.45	4.88	6.33
Uncertainty in measured Fe content (µg):		0.98	0.98
Cr content of leach solution (µg):	2.48	1.15	3.63
Uncertainty in measured Cr content (µg):	0.50	0.23	0.55
Mn content of leach solution (µg):	0.20	0.33	0.53
Uncertainty in measured Mn content (µg):	0.04	0.07	0.08
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	9.18	< 1.93	11.11
Uncertainty in measured Ni content (µg):	1.80		1.80
Ca content of leach solution (µg):	49.70	23.40	73.10
Uncertainty in measured Ca content (µg):	5.00	2.30	5.50
Al content of leach solution (µg):	23.70	7.18	30.88
Uncertainty in measured Al content (µg):	4.70	1.40	4.90
Ti content of leach solution (µg):	23.60	< 1.25	24.85
Uncertainty in measured Ti content (µg):	2.40		2.40
V content of leach solution (µg):	40.40	< 1.63	42.03
Uncertainty in measured V content (µg):	4.00		4.00

Comments

impurites checked FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	04, 09, 10
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Burn-leach solution ID:	L05092201	L05092601	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051011-010	051011-011	
Weight uranium leached (g):	1.89E-04	2.00E-07	1.89E-04
Uncertainty in weight uranium leached (g):	1.90E-05	4.00E-08	1.90E-05
Number of leached kernels:	0.9	0.0	0.9
Uncertainty in number of leached kernels:	0.1	0.0	0.1
Fe content of leach solution (µg):	< 1.45	< 1.45	2.90
Uncertainty in measured Fe content (µg):			
Cr content of leach solution (µg):	2.40	1.58	3.98
Uncertainty in measured Cr content (µg):	0.48	0.32	0.58
Mn content of leach solution (µg):	0.43	0.30	0.73
Uncertainty in measured Mn content (µg):	0.09	0.06	0.10
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	6.93	8.10	15.03
Uncertainty in measured Ni content (µg):	1.40	1.60	2.13
Ca content of leach solution (µg):	90.60	18.80	109.40
Uncertainty in measured Ca content (µg):	9.10	1.90	9.30
Al content of leach solution (µg):	29.60	11.80	41.40
Uncertainty in measured Al content (µg):	3.00	2.40	3.84
Ti content of leach solution (µg):	40.50	< 1.25	41.75
Uncertainty in measured Ti content (µg):	4.10		4.10
V content of leach solution (µg):	44.00	< 1.63	45.63
Uncertainty in measured V content (µg):	4.40		4.40

Comments

impurites check FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-26B: Measurement of SiC Burn-Leach Defects and Impurities by Burn-Leach

Procedure:	AGR-CHAR-DAM-26 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	03, 06, 18
DRF filename:	\\mc-agr\AGR\LeachBurnLeach\NUCO350-75T_DRF26R0.xls

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06
Mean weight % uranium/kernel:	90.27
Standard deviation in weight % uranium/kernel:	0.03
Approximate weight uranium/kernel (g):	2.16E-04
Uncertainty in approx. weight uranium/kernel (g):	2.28E-06

	First Leach	Second Leach	Total
Burn-leach solution ID:	BL05101901	BL05102401	
Number of compacts:	3		
Volume of leach solution (ml):			
Measured β activity of 0.1ml aliquot (dpm):			
Estimated weight of U in leach solution (mg):			
Radiochemical laboratory analysis number:	051025-019	051025-020	
Weight uranium leached (g):	<5.00E-08	1.29E-05	1.30E-05
Uncertainty in weight uranium leached (g):		1.30E-06	1.30E-06
Number of leached kernels:	0.0	0.1	0.1
Uncertainty in number of leached kernels:	0.0	0.0	0.0
Fe content of leach solution (µg):	< 1.45	< 1.45	2.90
Uncertainty in measured Fe content (µg):			
Cr content of leach solution (µg):	2.13	1.83	3.96
Uncertainty in measured Cr content (µg):	0.43	0.37	0.57
Mn content of leach solution (µg):	< 0.18	< 0.18	0.35
Uncertainty in measured Mn content (µg):			
Co content of leach solution (µg):	< 1.10	< 1.10	2.20
Uncertainty in measured Co content (µg):			
Ni content of leach solution (µg):	3.73	< 1.93	5.66
Uncertainty in measured Ni content (µg):	0.75		0.75
Ca content of leach solution (µg):	74.20	28.20	102.40
Uncertainty in measured Ca content (µg):	7.40	2.80	7.91
Al content of leach solution (µg):	20.30	6.85	27.15
Uncertainty in measured Al content (µg):	4.10	1.40	4.33
Ti content of leach solution (µg):	24.40	< 1.25	25.65
Uncertainty in measured Ti content (µg):	2.40		2.40
V content of leach solution (µg):	38.20	< 1.63	39.83
Uncertainty in measured V content (µg):	3.80		3.80

Comments

impurties checked FCM 1/19/06

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-27: Counting of Particles with a Defective OPyC Layer from Deconsolidated Compacts by Visual Inspection

Procedure:	AGR-CHAR-DAM-27 Rev. 0
Operator:	Fred Montgomery
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT Kernel Composite 69300
Compact ID number:	30, 28, 26, 20, 34, 19
DRF filename:	\\mc-agr\AGR\DefectiveOPyC\NUCO350-75T-Z_DRF27R0.xls

Number of particles with cracked OPyC:	1
Number of particles with partially missing OPyC:	0
Number of particles with completely missing OPyC:	0
Total number of particles with defective OPyC:	1

Comments on unusual visual characteristics of OPyC

The specified compact for defective OPyC analysis was not available so particles from deconsolidation leach were analyzed.
Weight of particles tested: 25.0355 - 6.2461 = 18.7894g
Average weight/particle: 6.96E-4 g (per DAM22)
Number of particles tested: 2.70E4
One broken particle was observed, this contributed to uranium contamination result, it was not counted as defective OPyC.

Fred C. Montgomery
Operator

2/02/06
Date

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 1
Operator:	montgomery
Particle Lot ID:	NUCO350-75T
Particle Lot Description:	from compacts C30, 28, 26, 20, 34, 19
Filename:	\\mc-agr\AGR\ParticleWeight\W05121902_DRF22R1.xls

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Weight of particles (g):	9.87E-02	1.00E-01	1.08E-01	1.11E-01	1.01E-01
Number of particles:	142	143	158	159	143
Average weight/particle (g):	6.95E-04	6.99E-04	6.85E-04	6.97E-04	7.03E-04

Mean average weight/particle (g):	6.96E-04
Uncertainty in mean average weight/particle (g):	2.92E-06

Fred C Montgomery
Operator

12/19/05
Date

Data Report Form DRF-28: Counting of Particles with Excessive Uranium Dispersion Inside SiC

Procedure:	AGR-CHAR-DAM-28 Rev. 0
Operator:	John Hunn
Compact lot ID:	NUCO350-75T-Z
Compact lot description:	Compacts of TRISO on BWXT kernel composite 69300
Compact ID numbers:	11, 13, 16, 02, 05, 07, 04, 09, 10, 03, 06, 18
DRF filename:	\\mc-agr\AGR\DefectiveIPyC\NUCO350-75T-Z_DRF28R0.xls

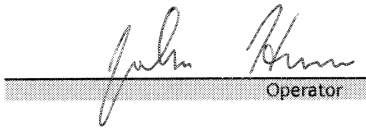
Number of compacts from which particles were recovered:	12

Mean average weight/particle (g):	5.79E-04
Uncertainty in average weight/particle (g):	1.53E-06
Weight of sample of particles (g):	30.887
Approximate number of particles in sample:	53345
Uncertainty in number of particles in sample:	141

Number of particles with excessive U dispersion:	0

Comments

Observed SiC fragments corresponding to one SiC burn-leach defect in 05, 02, 07 compact set and in 09, 04, 10 compact set, as expected from leach-burn-leach results.
Observed one hemisphere-shaped TRISO-coating shell in 03, 06, 18 compact set. No uranium was leached during leach-burn-leach for this compact set. This particle must have broken during handling after leach-burn-leach analysis.
Other observation noted in attached report.

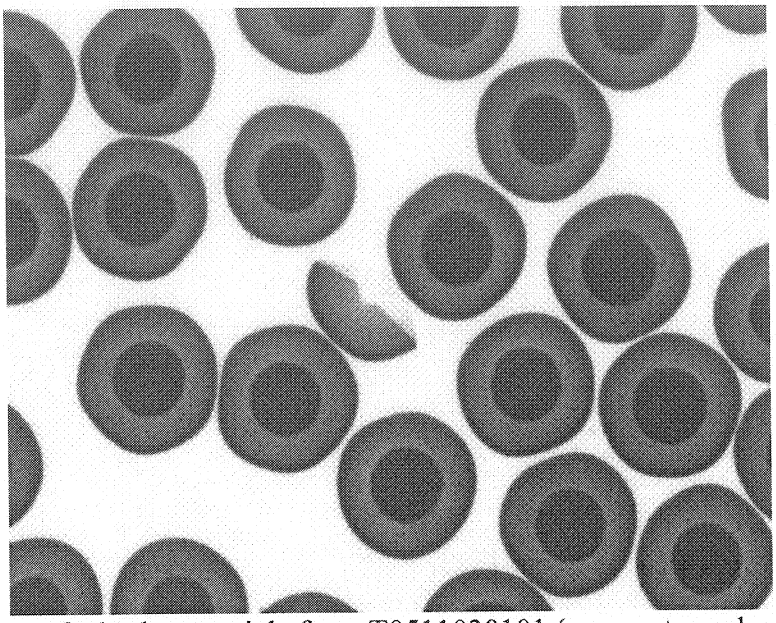


Operator

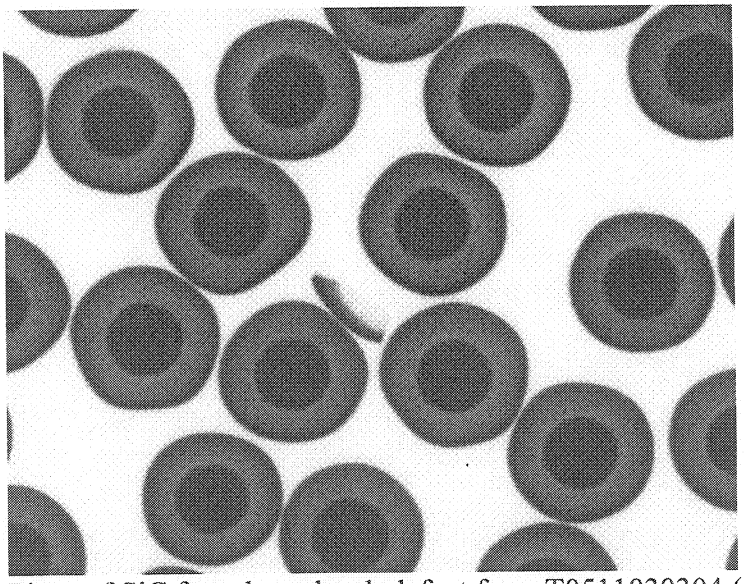
2-3-06

Date

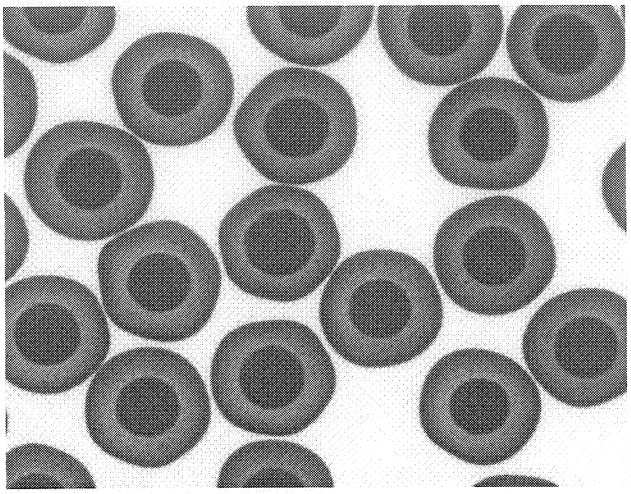
Images from defective IPyC analysis of NUCO350-75T-Z compacts



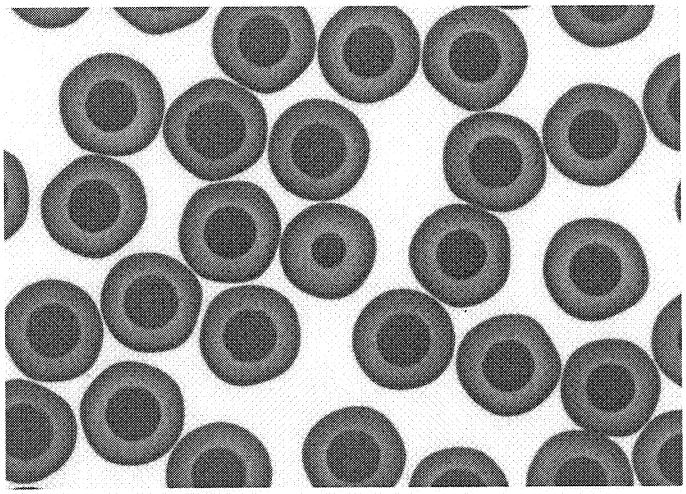
½ of a broken particle from T0511030101 (compact numbers 03, 06, 18). Carbon layers were still present, so this particle must have been broken after the burn step. No exposed kernels were detected in this sample so particle must have been broken after final leach.



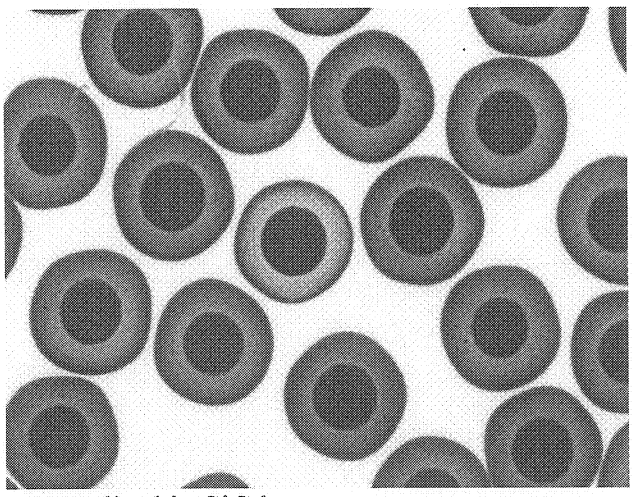
Piece of SiC from burn-leach defect from T0511030304 (compact numbers 05, 02, 07). This broken particle was detected by the leach burn leach analysis.



Oversized kernel.



Undersized kernel.



Unusually thin SiC layer.

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 0
Operator:	Fred Montgomery
Particle Lot ID:	NUC0350-75T
Particle Lot Description:	LBL burned back compacts c05, c02, c07
Filename:	\\mc-agr\AGR\ParticleWeight\B002521-11 DRF22.xls

	1st Measurement	2nd Measurement	3rd Measurement	4th Measurement	5th Measurement
Weight of 100 particles (g):	5.82E-02	5.79E-02	5.80E-02	5.80E-02	5.73E-02
Average weight/particle (g):	5.82E-04	5.79E-04	5.80E-04	5.80E-04	5.73E-04

Mean average weight/particle (g):	5.79E-04
Uncertainty in mean average weight/particle (g):	1.53E-06

Fred C. Montgomery
Operator

10/05/05
Date

11 Superceded data

This section contains data related to the NUCO350-75T-Z compact lot that has been superceded by more recent analysis.

It was determined that the average kernel weight as measured using procedure AGR-CHAR-DAM-22 Rev. 0 was of insufficient accuracy. The average kernel weight was remeasured according to AGR-CHAR-DAM-22 Rev. 1. The average kernel weight was remeasured to improve the accuracy of the reported value. It changed from $(2.39\pm0.03)\cdot10^{-4}$ grams per kernel to $(2.308\pm0.009)\cdot10^{-4}$ grams per kernel. This resulted in significant correction to the calculated average kernel volume and buffer densities and some minor corrections to other reported values. The data in this summary has been updated to show the new average kernel weight and average kernel volume in section 5, and the new buffer densities in section 6. A record of the original measured values is included in this section. Values that were not significantly changed by the change in average kernel weight were left as originally recorded.

The recalculated buffer densities for two of the three buffer-only batches that were coated and analyzed to qualify the buffer coating conditions for full TRISO-coating are reported in section 5 to fail the acceptance criteria. However, the buffer coating conditions in section 2 were previously qualified and used for full TRISO-coating based on the buffer densities calculated using the original value for the average kernel weight. These original buffer densities are shown in the version of IRF-02A included in this section.

Inspection Report Form IRF-02A: Interrupted Coating Batches - Buffer Density

Procedure:	AGR-CHAR-PIP-02 Rev. 2
Batch 1 ID:	NUCO350-64B
Batch 1 description:	Buffer on BWXT kernel composite 69300
Batch 2 ID:	NUCO350-61B
Batch 2 description:	Buffer on BWXT kernel composite 69300
Batch 3 ID:	NUCO350-72B
Batch 3 description:	Buffer on BWXT kernel composite 69300
Composite ID:	NUCO350-73B
Composite description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300

Property	Measured Data				Specification	Acceptance Criteria	Acceptance Test Value	Pass or fail	Data Records
	Mean (x)	Std. Dev. (s)	# measured (n)	t value (t)	INL EDF-4380				
Batch 1: Buffer envelope density	1.12	0.08	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.04	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.20	pass	
Batch 2: Buffer envelope density	1.14	0.08	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.06	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.22	pass	
Batch 3: Buffer envelope density	1.12	0.09	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.03	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.21	pass	
Composite buffer envelope density	1.11	0.08	5	2.132	mean 1.05 ± 0.20	A = x - ts/√n ≥ 0.85	1.03	pass	DRF-16 DRF-22
						B = x + ts/√n ≤ 1.25	1.19	pass	

Comments

Standard deviations are √5 times the uncertainties in buffer density (standard errors) reported on DRF-16.
Coating thickness measured for information only.
Average thickness of buffer was 110 µm based on average envelope volume of 9.42E-5 cc (effective diameter of 564 µm) and average kernel diameter of 345 µm.
Average thickness of buffer was 109 µm based on average outer diameter of 563 µm obtained per DAM-10 and average kernel diameter of 345 µm.

QC Supervisor

8-18-05
Date

Accept for buffer density (Yes or No):	Yes

QA Reviewer

8/19/05
Date

Superceded 2-3-06 JH

Data Report Form DRF-22: Estimation of Average Particle Weight

Procedure:	AGR-CHAR-DAM-22 Rev. 0
Operator:	Dixie Barker
Particle Lot ID:	NUC0350-26-H
Particle Lot Description:	BWXT NUCO Batch 69300
Filename:	\\mc-agr\AGR\ParticleWeight\W05052401_DRF22.xls

	1st Measurement	2nd Measurement	3rd Measurement	4th Measurement	5th Measurement
Weight of 100 particles (g):	2.31E-02	2.38E-02	2.44E-02	2.45E-02	2.38E-02
Average weight/particle (g):	2.31E-04	2.38E-04	2.44E-04	2.45E-04	2.38E-04

Mean average weight/particle (g):	2.39E-04
Uncertainty in mean average weight/particle (g):	2.52E-06

Dixie Barker
Operator

5-24-05
Date

Superceded 2-3-06 JH

Data Report Form DRF-15: Measurement of Average Kernel Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-15 Rev. 2
Operator:	S. D. NUNN
Kernel Lot ID:	NUCO350-26
Kernel Lot Description:	NUCO KERNEL COMPOSITE 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05052601\S05052601_DRF15R2

Mean average weight/kernel (g):	2.39E-04
Uncertainty in mean average weight/kernel (g):	2.52E-06

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05052601L	S0502602L	S05052603L	S05052604L	S05052605L
Weight of kernels (g):	12.8272	12.9542	12.9410	12.9793	12.9624
Approximate number of kernels:	53670	54202	54146	54307	54236
Uncertainty in number of kernels:	566	571	571	573	572
Envelope volume of sample (cc):	1.187	1.200	1.199	1.202	1.199
Average envelope volume/kernel (cc):	2.21E-05	2.21E-05	2.21E-05	2.21E-05	2.21E-05
Sample envelope density (g/cc):	10.805	10.792	10.797	10.799	10.807

Mean average envelope volume/kernel (cc):	2.213E-05
Uncertainty in mean envelope volume/kernel (cc):	5.7E-09
Mean sample envelope density (g/cc):	10.800
Standard deviation in sample envelope density (g/cc):	0.006

S. D. Nunn
Operator

5/26/05
Date

Superceded 2-3-06 JH

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	J.D. Hunn and S.D. Nunn
Buffer-coated kernel batch ID:	NUCO350-64B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080302\S05080302_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	7.00E-07
Mean average weight/bare kernel (g):	2.39E-04
Uncertainty in mean average weight/bare kernel (g):	2.52E-06
Mean average envelope volume/bare kernel (cc):	2.21E-05
Uncertainty in envelope volume/bare kernel (cc):	5.70E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080302L	S05080801L	S05080802L	S05080803L	S05080804L
Weight of buffer-coated kernels (g):	4.1385	4.1703	4.1990	4.2017	4.1848
Approximate number of b-c kernels:	12933	13032	13122	13130	13078
Uncertainty in number of b-c kernels:	28	29	29	29	29
Total envelope volume of sample (cc):	1.224	1.228	1.245	1.248	1.238
Av. envelope volume/b-c kernels (cc):	9.46E-05	9.42E-05	9.49E-05	9.50E-05	9.46E-05
Sample envelope density (g/cc):	3.382	3.396	3.373	3.367	3.382

Mean average envelope volume/b-c kernel (cc):	9.47E-05
Uncertainty in envelope volume/b-c kernel (cc):	1.4E-07

Buffer density:	1.12E+00
Uncertainty in buffer density:	3.61E-02

J.D. Hunn S.D. Nunn — Operator

8-9-05 — Date

Superceded 2-3-06 JH

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-61B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080901\S05080901A_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	9.24E-07
Mean average weight/bare kernel (g):	2.39E-04
Uncertainty in mean average weight/bare kernel (g):	2.52E-06
Mean average envelope volume/bare kernel (cc):	2.21E-05
Uncertainty in envelope volume/bare kernel (cc):	5.70E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080901L	S05080902L	S05080903L	S05080904L	S05080905L
Weight of buffer-coated kernels (g):	4.2536	4.2901	4.2776	4.2169	4.0996
Approximate number of b-c kernels:	13293	13407	13368	13178	12811
Uncertainty in number of b-c kernels:	38	39	39	38	37
Total envelope volume of sample (cc):	1.234	1.250	1.248	1.231	1.197
Av. envelope volume/b-c kernels (cc):	9.29E-05	9.33E-05	9.34E-05	9.34E-05	9.34E-05
Sample envelope density (g/cc):	3.446	3.431	3.428	3.425	3.425

Mean average envelope volume/b-c kernel (cc):	9.33E-05
Uncertainty in envelope volume/b-c kernel (cc):	1.1E-07

Buffer density:	1.14E+00
Uncertainty in buffer density:	3.78E-02

S. D. Nunn
Operator

8/18/05
Date

superceded 2-3-06 JH

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-72B
Batch Description:	Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05080906\S05080906_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.20E-04
Uncertainty in mean average weight/b-c kernel (g):	1.47E-06
Mean average weight/bare kernel (g):	2.39E-04
Uncertainty in mean average weight/bare kernel (g):	2.52E-06
Mean average envelope volume/bare kernel (cc):	2.21E-05
Uncertainty in envelope volume/bare kernel (cc):	5.70E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05080906L	S05080907L	S05080908L	S05080909L	S05080910L
Weight of buffer-coated kernels (g):	4.3142	4.4196	4.2568	4.2748	4.3303
Approximate number of b-c kernels:	13482	13811	13303	13359	13532
Uncertainty in number of b-c kernels:	62	63	61	61	62
Total envelope volume of sample (cc):	1.267	1.302	1.253	1.259	1.274
Av. envelope volume/b-c kernels (cc):	9.39E-05	9.43E-05	9.42E-05	9.43E-05	9.41E-05
Sample envelope density (g/cc):	3.406	3.394	3.397	3.394	3.400

Mean average envelope volume/b-c kernel (cc):	9.42E-05
Uncertainty in envelope volume/b-c kernel (cc):	6.2E-08

Buffer density:	1.12E+00
Uncertainty in buffer density:	4.05E-02

S.D. Nunn
Operator

8/9/05
Date

superceded 2-3-06

Data Report Form DRF-16: Measurement of Buffer Envelope Density using a Mercury Porosimeter

Procedure:	AGR-CHAR-DAM-16 Rev. 2
Operator:	S. D. NUNN
Buffer-coated kernel batch ID:	NUCO350-73B
Batch Description:	Composite (64B+61B+72B) Buffer on BWXT kernel composite 69300
Thermocouple Expiration Date:	5/23/06
Penetrometer Expiration Date:	5/25/06
Completed DRF Filename:	\\mc-agr\AGR\Porosimeter\S05081001\S05081001_DRF16R2.xls

Mean average weight/buffer-coated kernel (g):	3.18E-04
Uncertainty in mean average weight/b-c kernel (g):	7.29E-07
Mean average weight/bare kernel (g):	2.39E-04
Uncertainty in mean average weight/bare kernel (g):	2.52E-06
Mean average envelope volume/bare kernel (cc):	2.21E-05
Uncertainty in envelope volume/bare kernel (cc):	5.70E-09

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Porosimeter data file number:	S05081001L	S05081002L	S05081003L	S05081004L	S05081005L
Weight of buffer-coated kernels (g):	4.3279	4.4597	4.2871	4.3528	4.4245
Approximate number of b-c kernels:	13610	14024	13481	13688	13914
Uncertainty in number of b-c kernels:	31	32	31	31	32
Total envelope volume of sample (cc):	1.268	1.313	1.259	1.279	1.302
Av. envelope volume/b-c kernels (cc):	9.31E-05	9.36E-05	9.34E-05	9.34E-05	9.35E-05
Sample envelope density (g/cc):	3.414	3.397	3.406	3.403	3.399

Mean average envelope volume/b-c kernel (cc):	9.34E-05
Uncertainty in envelope volume/b-c kernel (cc):	8.1E-08

Buffer density:	1.11E+00
Uncertainty in buffer density:	3.68E-02

S. D. Nunn
Operator

8/10/05
Date

Superceded 2-3-06 JH