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SUBJECT: Compendium of Experimental Results of the Circulation of Aqueous Thorium Oxide Slurries in Toroids
TO: E. G. Bohlmann
FROM: G. E. Moore, R. F. Benson, F. E. McDaniel and S. H. Wheeler

SUMMARY

Data are presented for all toroid runs which circulated aqueous thorium oxide slurries between August, 1954, and October, 1956. In addition, a tabulation of the properties of numerous thoria preparations is presented.

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COMPENDIUM OF EXPERIMENTAL RESULTS OF THE CIRCULATION OF AQUEOUS
THORIUM OXIDE SLURRIES IN TOROIDS

Insofar as possible, the attached tables include all the data available for toroid runs circulating aqueous thorium oxide slurries during the period from August, 1954, the time at which tests with aqueous thorium oxide slurries were initiated, through October, 1956. Table I lists chronologically the data obtained from such tests in toroids.^(1,2) Table II summarizes the analytical information of the thorium oxides used in these tests as well as on certain other thorium oxides never used but available in limited quantity.

Results determined from the data in Tables I and II formed the bases for summarizing in more general terms information on aqueous thorium oxide slurries circulated in toroids.⁽³⁾ The reliability of the particle-size measurements has also been discussed.⁽⁴⁾

Table I summarizes some observations of the character of the slurries after circulation, viz., rate of subsidence, thickness, ease of resuspension, etc. Such observations are described qualitatively and not quantitatively; although such descriptions may represent a relative comparison between slurries in any single run, inter-run comparisons may be unreliable. Quantitative observations were not practical on the limited quantity of slurry available.

The manufacturer of the thorium oxides listed in Table II is indicated in several instances (viz., Ames Laboratory, Iowa State College, Lindsay Chemical Company, West Chicago). The oxides prefixed "D-" or "LO-" were prepared by the ORNL Chemical Technology Division. Some of these ORNL oxides were first circulated in 100A pump loop CS, and such product oxides have been designated by suffixing the appropriate loop run number to the code "CS-".

TABLE I

Summary of Runs Circulating Aqueous Thorium Oxide Slurries
in Toroids During Period August, 1954, through October, 1956

(Toroid Runs 15 through 110)

Runs 58 (s, t), 74, 75, 76, 77, 84, 89, 99 (x^1) did not use thorium oxide slurry and are not included here.

TOROID SUMMARY SHEET

Toroid Run No. 15 ^e					16 ^d			
Rotator No. 5					5			
Dates 8-18-54 - 8-25-54					8-26-54 - 8-31-54			
Hr. 107					115			
fps 26					26			
Toroid	A	B	C	D	A	B	C	D
Load - Identification	Ames	Ames	Ames	Ames	Ames	Ames	Ames	Ames
Calcination °C	850	850	850	850	850	850	850	850
Avg Part Dia, μ (Pre)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
g Th/kg H ₂ O	1000	1000	1000	1000	200	200	100	200
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	5	15	15	15	5	15	15	15
Temp - Nominal	250	250	250	250	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 5	- 12	- 3	- 4	-122	- 4	- 4	- 5
mpy	0.2	0.5	0.1	0.2	4.6	0.2	0.2	0.2
PINS								
Defilmed, mpy 347	7.0	2.5	WG	3.3 ^b	1.6 ^j	2.1	0.7	3.0
			1.5				0.7	
Ti-75A	0.0	WG	0.8	2.4	WG ^j	WG ^j	WG ^j	WG ^j
			WG	0.8				
Zr-2				1.3			WG	1.4 ^j
Other								
Post-run: g Th/kg H ₂ O		42			305	205	90	218
mg/g Th, Fe	0.5	1.1	5.8	0.4	30.5	1.2	3.2	1.2
Cr	0.1	0.1	0.8	0.1	5.2	0.5	1.3	0.6
Ni	0.0	0.1	1.6	0.1	5.1	0.1	0.2	0.1
mg/l, Cl			6		10	7	8	7
pH Slurry		6.1			6.6	4.9	5.0	4.6
Supernate					6.7	5.8	5.8	5.2
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	0	0	some	0	some	some	some	some
% Recovery								
Color	white	white	brown	white	black	white	gray	white
Subsidence								
Consistency	thick	thick	thick	thick				
Wet Glass								
Resuspension					magnetic			

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TOROID SUMMARY SHEET

Toroid Run No. 17 ^e					18 ^f			
Tor No. 5					5			
Dates 9-2-54 - 9-13-54					9-16-54 - 9-27-54			
Hr. 257					260			
fps 26					26			
Toroid	A	B	C	D	A	B	C	D
Load - Identification	Ames	Ames	Ames	Ames	Ames	Ames	Ames	Ames
Calcination °C	850	850	850	850	850	850	850	850
Avg Part Dia, μ (Pre)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4
g Th/kg H ₂ O	1000	200	100	1000	200	200	200	200
Additive								
Conc.								
Atm	He	O ₂	O ₂	O ₂	He	O ₂	O ₂	O ₂
psi	30	75	75	75	30	15	75	260
Temp - Nominal	250	250	250	250	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 23	- 5	- 4	- 14	-131	- 3	- 5	- 5
mpy	0.4	0.1	0.1	0.2	2.2	0.1	0.1	0.1
PINS								
Defilmed, mpy 347	13	WG ^j	0.3 ^j	0.8	0.5, 0.8 ^j	0.2, 0.1	0.1, 0.3	0.4, 0.4
	13		WG ^j	WG	0.2			0.2
Ti-75A	WG	WG ^j	WG	WG				
		WG ^j						
Zr-2	WG	WG ^j	WG	WG				
Other Electropolished					0.4	0.1, 0.1	0.2, 0.2	0.3
347SS								
Post-run: g Th/kg H ₂ O	-	180	93	-	352	215	145	168
mg/g Th, Fe	2.1	1.9	2.7	1.0	43.2	1.2	1.7	1.9
Cr	0.6	0.7	1.2	0.3	8.0	0.3	0.6	0.6
Ni	0.1	0.1	0.2	0.1	7.1	0.0	0.1	0.3
mg/l, Cl	-	10	6	-	5	.2	5	5
pH Slurry	-	5.1	5.2	-				
Supernate	-	5.0	5.1	-	7.8	7.8	8.2	7.3
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	0	some	some	0	some	some	some	some
% Recovery	-	-	-	-	-	-	-	-
Color	white	cream	cream	white	black	white	white	white
Subsidence	-	-	-	-	magnetic			
Consistency	thick	-	-	thick				
Glass								
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No.	19 ^g				20 ^h			
Rotator No.	5				5			
Dates	9-29-54 - 10-7-54				10-7-54 - 10-12-54			
Hr.	174				110			
fps	26				26			
Toroid	A	B	C	D	A	B	C	D
Load - Identification	Ames	Ames	Ames	Ames	Ames	Lindsay 7	Ames	Lindsay 7
Calcination °C	850	850	850	850	850	900	850	900
Avg Part Dia, μ (Pre)	6.4	6.4	6.4	6.4	6.4	10.4	6.4	10.4
g Th/kg H ₂ O	500	500	1000	1000	500	500	500	500
Additive								
Conc.								
Atm	He	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	30	75	75	75	75	75	75	75
Temp - Nominal	250	250	250	250	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 49	- 4	- 3	- 10	- 19	- 23	- 10	- 14
mpy	1.2	0.1	0.1	0.2	0.7	0.9	0.4	0.6
PINS								
Defilmed, mpy 347	2.4	0.5	0.7	2.0	0.9,1.3	2.7,1.5	0.4,0.4	1.6,1.0
Ti-75A	WG ^j	WG	WG	0.9				
Zr-2	0	WG ^b	WG	WG				
Other Electropolished	1.7	0.4	0.4	1.9	1.1,0.8	2.0,2.5	WG, WG	1.8,0.8
347 SS								
Post-run: g Th/kg H ₂ O	690	-	167	-	505	565	446	631
mg/g Th, Fe	6.4	0.5	2.0	0.6	2.1	3.1	1.3	1.9
Cr	1.7	0.1	0.6	0.1	0.5	0.4	0.2	0.2
Ni	1.0	0.0	0.1	0.1	1.1	0.6	0.2	0.3
mg/l, Cl			17		7	8	6	9
pH Slurry	6.4	-	5.4	-	6.2	6.1	5.4	6.4
Supernate	6.6	-	5.6	-	6.1	6.4	6.0	6.3
Part. Size > 10 μ								
3-10 μ								
.1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	some	some	0	some	some	some	some
% Recovery								
Color	gray	white	white	white	white	tan	white	tan
Subsidence					slow	slow	slow	slow
Consistency		thick		thick	thick	thick	thick	th
Wet Glass			good	good	fair	slight	slight	go
Resuspension								

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TOROID SUMMARY SHEET

Toroid Run No. 21 ¹					22 ¹			
Repor No. 5					2			
Dates 11-2-54 - 11-8-54					11-2-54 - 11-9-54			
Hr. 136					147			
fps 25					26			
Toroid	A	B	C	D	M	N	O	P
Load - Identification	Ames	Lindsay 7	Ames	Lindsay 7	Ames	Ames	Lindsay 8	Lindsay 8
Calcination °C	850	900	850	900	850	850	900	900
Avg Part Dia, μ (Pre)	6.4	10.4	6.4	10.4	6.4	6.4	10	10
g Th/kg H ₂ O	500	500	500	500	500	500	500	500
Additive								
Conc.								
Atm	O ₂	O ₂	O ₂	O ₂	N ₂	O ₂	O ₂	N ₂
psi	75	75	75	75	30	75	75	30
Temp - Nominal	250	250	250	250	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 53	- 30	- 11	- 33	- 57	- 30	- 13	- 53
mpy	1.7	1.0	0.4	1.0	1.7	0.9	0.4	1.6
PINS								
Defilmed, mpy 347	WG, WG	2.4, 3.8	0.2, 0.0	1.0, 1.7	3.1, 1.0	WG, J WG	WG, 0.5	1.5, WG
	0.3, 0.5	2.1, 1.1	0.1, 0.7	1.4, 1.5	1.5, 3.8	WG, WG	0.5, 0.3	4.3, 1.4
Ti-75A								
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	512	597	515	548	625	57	550	579
mg/g Th, Fe	7.0	4.0	1.5	4.4	7.5	3.9	1.7	7.2
Cr	1.3	0.7	0.3	0.7	1.8	0.6	0.4	1.6
Ni	1.2	0.7	0.2	0.8	1.0	0.6	0.2	1.2
mg/l, Cl								
pH Slurry	5.4	5.6	5.2	5.7	6.7	5.4	7.0	8.7
Supernate	6.5	6.9	6.5	6.8	6.2	5.5	7.0	8.5
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	some	some	some	some	some	some	some
% Recovery	-	-	-	-	-	-	-	-
Color	tan	tan	white	tan	gray	brown	white	gray
Subsidence	-	slow	slow	slow				
Consistency	thick	thick	thick	thick				
Wetness	good	fair	good	fair	good		good	
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No. 23 ^m					24 ^m			
Rotator No. 4					3			
Dates 11-5-54 - 11-24-54					11-8-54 - 12-6-54			
Hr. 142					225			
fps 26					26			
Toroid	E	F	G	H	I	J	K	L
Load - Identification	Lindsay 8	Lindsay 8	Lindsay 8	Lindsay 8	Lindsay 8	Lindsay 8	Lindsay 8	Lindsay 8
Calcination °C	900	900	900	900	900	900	900	900
Avg Part Dia, μ (Pre)	10	10	10	10	10	10	10	10
g Th/kg H ₂ O	500	100	500	1000	500	100	500	1000
Additive								
Conc.								
Atm	N ₂	O ₂	O ₂	O ₂	N ₂	O ₂	O ₂	O ₂
psi	30	90	90	90	30	65	65	65
Temp - Nominal	300	300	300	300	200	200	200	200
Actual								
CORROSION								
Toroid mg/dm ²	- 31	- 22	- 43	- 59	- 89	- 13	- 81	-106
mpy	0.9	0.7	1.3	1.8	1.7	0.3	1.6	2.0
PINS								
Defilmed, mpy 347	3.1, WG	0.7, 0.5	5.4, 5.2	5.0, 6.0	1.8, 1.1	0.2, WG	1.6, 1.7	2.4, 2.3
Ti-75A	7.1	WG	8.2	4.6	0.2	0.3	WG	0.5
Zr-2	6.2	WG	WG	WG	WG	0.2	0.2	0.2
Other								
Post-run: g Th/kg H ₂ O	777	4	499	976	580	105	525	1000
mg/g Th, Fe	4.1	10.8	5.9	4.6	11.9	8.9	10.9	8.0
Cr	0.5	9.0	0.9	0.9	2.6	1.3	1.8	1.6
Ni	0.5	1.2	0.8	0.7	2.0	1.3	1.7	1.3
Ti					0.1	0.5	0.1	0.1
mg/l, Cl	21	5	10	9	9	6	9	10
pH Slurry	6.7	3.8	6.0	7.0	9.7	6.5	7.1	9.5
Supernate	6.8	3.8	6.8	7.6	9.3	7.0	7.3	8.6
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	some	some	some	some	some	some	some
% Recovery	-	-	-	-	-	-	-	-
Color	gray	gray	gray	gray	gray	tan	gray	gray
Subsidence	slow	-	rapid	slow	rapid	rapid	rapid	slow
Consistency								th
Wet Glass	good	slight	fair	good	fair	slight	slight	go...
Resuspension		yellow supn't.						

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TOROID SUMMARY SHEET

Toroid Run No. 25					26			
Tor No. 5					5			
Dates 11-3-54 - 11-29-54					12-3-54 - 12-9-54			
Hr. 138					140			
fps 26					25			
Toroid	A	B	C	D	A	B	C	D
Load - Identification	Ames	Lindsay 8	Lindsay 8	Lindsay 8	Ames	Lindsay 8	Lindsay 8	Lindsay 8
Calcination °C	850	900	900	900	850	900	900	900
Avg Part Dia, μ (Pre)	6.4	10	10	10	6.4	10	10	10
g Th/kg H ₂ O	500	100	500	1000	500	500	1000	2275
Additive								
Conc.								
Atm	02	02	02	02	02	02	02	02
psi	75	75	75	75	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 8	- 20	- 87	-190	- 15	- 72	-124	-293
mpy	0.3	0.6	2.7	6.0	0.5	2.3	3.9	9.1
PINS								
Defilmed, mpy 347	WG, J WG	0.3, 0.6	5.8, 5.5	11.1, 10.3	1.0, 0.9	1.7, 1.7	4.3, 4.7	25, 30
	WG, WG							
Ti-75A		4.0	1.9	5.2 ^b	WG	0.6	2.2 ^b	9.1 ^b
Zr-2		WG	2.5	1.7 ^b	WG	WG	WG	3.1
Other								
Post-run: g Th/kg H ₂ O	392	102	470	1080	547	516	1037	-
mg/g Th, Fe	1.1	13.2	11.8	14.6	2.0	9.8	9.4	12.1
Cr	0.4	1.6	2.3	3.3	0.5	2.0	1.8	2.5
Ni	0.2	2.2	2.1	2.5	0.3	1.6	1.6	2.1
Ti					0.2	0.1	0.2	0.3
mg/l, Cl	13	9	8	15	6	16	10	-
pH Slurry	5.3	5.9	8.2	9.2	6.0	5.8	5.9	-
Supernate	6.0	5.9	8.4	7.1	6.4	6.2	6.4	-
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	some	some	some	some	some	some	-
% Recovery	-	-	-	-	-	-	-	-
Color	white	tan	black	black	white	tan	brown	gray
Subsidence	slow	-	rapid	slow	slow	rapid	slow	-
Consistency	thick	-	-	thick	thick	-	thick	thick
Glass	good	slight	fair	good	good	good	good	-
Resuspension		turbid						
		supn't.						

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TOROID SUMMARY SHEET

Toroid Run No.	27				28			
Rotator No.	4				3			
Dates	12-3-54 - 12-9-54				12-9-54 - 12-22-54			
Hr.	140				140			
fps	26				26			
Toroid	E	F	G	H	I	J	K	L
Load - Identification	Ames	Lindsay	Lindsay	Lindsay	Lindsay	PH-900	Lindsay	PH-900
Calcination °C	850	900	900	900	900	900	900	900
Avg Part Dia, μ (Pre)	6.4	10	10	10	10	3.2	10	3.2
g Th/kg H ₂ O	500	500	1000	2275	500	500	500	500
Additive								
Conc.								
Atm	02	02	02	02	02	02	02	02
psi	110	110	110	110	90	90	90	90
Temp - Nominal	300	300	300	300	250	250	250	250
Actual								
CORROSION								
Toroid mg/dm ²	- 14	- 37	- 52	-	- 94	- 10	- 68	- 28
mpy	0.4	1.2	1.6	-	2.9	0.3	2.4	0.9
PINS								
Defilmed, mpy 347	1.0,1.4	3.5,3.4	4.5,4.9		1.9,2.0	0.3,0.7	1.4,1.7	1.1,0.6
Ti-75A	0.1	3.2	4.7		WG	WG	0.1	WG
Zr-2	WG	WG	0.6		0.5	WG	0.3	0.2
Other								
Post-run: g Th/kg H ₂ O	517	461	1026		447	503	521	508
mg/g Th, Fe	1.8	5.1	4.0		12.7	1.4	10.4	3.7
Cr	0.8	1.1	1.2		2.0	0.4	2.0	0.4
Ni	0.2	0.7	0.6		2.1	0.2	1.8	0.6
Ti	0.1	0.1	0.1		0.1			
mg/l, Cl	5	3	7		< 2	13	14	7
pH Slurry	4.1	5.2	6.9		5.8	4.4	5.9	5.0
Supernate	4.3	5.8	6.6		6.2	5.4	6.4	5.5
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	some	some	dry	some	some	some	some
% Recovery	-	-	-	-	-	-	-	-
Color	white	tan	tan	gray	brown	gray	brown	gray
Subsidence	slow	rapid	slow	-	rapid	slow	-	slow
Consistency	thick	-	thick	-		thick		
Wet Glass	good	slight	good	-	slight	fair	slight	good
Resuspension							turbid	
							supn't.	

TOROID SUMMARY SHEET

Toroid Run No.	29				30°		
Tor No.	2				1		
Dates	12-9-54 - 12-17-54				12-15-54 - 12-21-54		
Hr.	126				137		
fps	26				28		
Toroid	M	N	O	P	Q	R	S
Load - Identification	Lindsay 8	PH-900	Lindsay 8	PH-900	Lindsay 8	Lindsay 8	Lindsay 8
Calcination °C	900	900	900	900	900	900	900
Avg Part Dia, μ (Pre)	10	3.2	10	3.2	10	10	10
g Th/kg H ₂ O	1000	1000	1000	1000	500	500	500
Additive							
Conc.							
Atm	O ₂	O ₂	O ₂	O ₂	O ₂	N ₂	O ₂
psi	90	90	90	90	115	30	115
Temp - Nominal	250	250	250	250	250	250	250
Actual							
CORROSION							
Toroid mg/dm ²	-116	- 12	- 92	- 12	-	-	-
mpy	4.0	0.4	3.2	0.4	-	-	-
PINS							
Defilmed, mpy 347	4.2, 4.2	1.1, 0.9	3.9, 4.5	1.1, 0.9		2.6, 2.5	
Ti-75A	1.9	0.3	2.0	0.4		0.6, 0.5	
Zr-2	1.5	0.2	1.5	0.4			
Other							
Post-run: g Th/kg H ₂ O	1077	1008	1045	1265		600	
mg/g Th, Fe	8.7	0.8	6.9	0.9		0.2	
Cr	1.6	0.4	1.4	0.2		0.1	
Ni	1.6	0.2	1.2	0.1		0.1	
Ti	0.1	0.1	0.1	0.1		2.5	
mg/l, Cl	5	-	9	-		14	
pH Slurry	6.0	6.3	5.7	6.2		8.0	
Supernate	6.7	-	6.4	-		7.6	
Part. Size > 10 μ							
3-10 μ							
1-3 μ							
< 1 μ							
Avg Dia, μ							
% Pour	some	some	some	some	dry	some	dry
% Recovery	-	-	-	-	-	-	-
Color	brown	white	brown	white	white	gray	gray
Subsidence	slow	-	slow	-		slow	
Consistency	thick	thick	thick	thick		thick	
Glass	good	good	good	good		good	
Resuspension							

TOROID SUMMARY SHEET

Toroid Run No. 31					32		
Rotator No. 4					5		
Dates 12-16-54 - 12-22-54					1-25-55 - 2-2-55		
Hr. 128					130		
fps 25					31		
Toroid	E	F	G	H	T		
Load - Identification	Lind. 8	PH-900	Lind. 8	PH-900	Lind. 8		
Calcination °C	900	900	900	900	900		
Avg Part Dia, μ (Pre)	10	3.2	10	3.2	10		
g Th/kg H ₂ O	500	500	500	500	500		
Additive							
Conc.							
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂		
psi	116	116	116	116	115		
Temp - Nominal	300	300	300	300	250		
Actual					250		
CORROSION							
Toroid mg/dm ²	- 76	- 6	-113	-	- 30		
mpy	2.6	0.2	3.8	-	1.0		
PINS							
Defilmed, mpy 347	5.9, 8.0	1.0, 1.0	6.2, 4.9	-	1.5, 1.9		
					1.6, 1.4		
Ti-75A	4.4	0.7	4.6	-			
Zr-2	-	WG	1.8	-			
Other							
Post-run: g Th/kg H ₂ O	581	500	686	-	540		
mg/g Th, Fe	10.3	0.8	15.2		3.3		
Cr	2.2	0.1	2.9		0.7		
Ni	1.9	0.1	2.7		0.5		
Ti	0.1		0.2				
mg/l, Cl	3	7	24		14		
pH Slurry	5.3	4.0	5.4	-	7.7		
Supernate	5.6	4.2	5.8	-	6.7		
Part. Size > 10 μ							
3-10 μ							
1-3 μ							
< 1 μ							
Avg Dia, μ							
% Pour	some	some	some	dry	some		
% Recovery	-	-	-	-	-		
Color	brown	white	brown	white	tan		
Subsidence	rapid	slow	rapid	-	rapid		
Consistency	thick	thick	thick	-			
Wet Glass	fair	good	fair		fair		
Resuspension							
	yellow		yellow				
	supn't		supn't				

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TOROID SUMMARY SHEET

Toroid Run No. 33 ^o				34			
R tor No. 1				2			
Dates 1-19-55 - 1-26-55				1-20-55 - 1-27-55			
Hr. 160				136			
fps 28				26			
Toroid	Q	R	S	M	N	O	P
Load - Identification	Lindsay 8	Lindsay 8	Lindsay 8	D-10	D-10	D-10	Lindsay 8
Calcination °C	900	900	900	650	650	650	900
Avg Part Dia, μ (Pre)	10	10	10	1.5	1.5	1.5	10
g Th/kg H ₂ O	500	500	500	500	1000	500	500
Additive							
Conc.							
Atm	O ₂	N ₂	O ₂	O ₂	O ₂	O ₂	O ₂
psi	115	30	115	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250
Actual	243	243	274	242	-	235	238
CORROSION							
Toroid mg/dm ²	-	-	-	- 20	- 29	- 17	- 66
mpy	-	-	-	0.6	0.9	0.5	2.1
PINS							
Defilmed, mpy 347	7.6, 7.2	18, 21	5.8, 4.3	0.7, 0.8	3.4, 4.0	1.2, 1.2	2.2, 2.3
				1.0			1.9, 2.4
Ti-75A	5.3, 5.3	3.1, 3.9	4.2, 4.4		2.8	WG	
Zr-2					2.1	0.8	
Other							
Post-run: g Th/kg H ₂ O	625	624	354	471	-	476	656
mg/g Th, Fe	0.6	0.7	0.3	2.1	2.3	2.1	8.9
Cr	0.0	0.2	0.0	1.4	0.5	0.9	1.3
Ni	0.1	0.1	0.0	0.4	0.4	1.3	1.6
Ti	7.8	4.2	2.9			0.2	-
mg/l, Cl	-	6	6	10	-	8	5
pH Slurry	6.0	7.8	6.5	6.2	-	6.5	6.0
Supernate	-	7.5	7.0	7.1	-	7.1	7.6
Part. Size > 10 μ							
3-10 μ							
1-3 μ							
< 1 μ							
Avg Dia, μ							
% Pour	some	some	some	some	0	some	some
% Recovery	-	-	-	-	-	-	-
Color	white	white	white	cream	white	cream	brown
Subsidence	slow	slow	rapid	slow	-	slow	slow
Consistency	thick	thick	-		thick		thick
W Glass	good	fair	slight	good	-	good	fair
Resuspension							

TOROID SUMMARY SHEET

Toroid Run No. 35					36			
Rotator No. 3					4			
Dates 1-24-55 - 2-7-55					1-24-55 - 1-31-55			
Hr. 179					162			
fps 26					26			
Toroid	I	J	K	L	E	F	G	H
Load - Identification	Lind.12	Lind.12	Lind.12	Lind. 8	XB-1	(q)	(q)	Lind. 8
Calcination °C	650	650	650	900	650			900
Avg Part Dia, μ (Pre)	12.5	12.5	12.5	10	10.6			10
g Th/kg H ₂ O	500	1000	500	500	500			500
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90			90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	249	250	242	252	241			250
CORROSION								
Toroid mg/dm ²	- 23	- 42	- 22	- 88	-107			
mpy	0.6	1.0	0.5	2.1	2.9			
PINS								
Defilmed, mpy 347	1.7,1.6	6.8,5.6	1.3,1.4	1.7,1.8	0.6, 0.5			
	1.6,1.5			1.4,1.7	0.0			
Ti-75A		6.2	0.9					
Zr-2		2.3	0.5					
Other								
Post-run: g Th/kg H ₂ O	499	-	513	587	588			
mg/g Th, Fe	2.8	3.4	2.6	11.8	14.3			
Cr	1.6	0.6	1.4	2.0	2.6			
Ni	0.4	1.0	0.4	2.0	2.5			
Ti		1.4						
mg/l, Cl	7	-	7	12	16			
pH Slurry	7.0	-	6.3	6.2	5.4			
Supernate	6.7	-	6.8	6.6	5.7			
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	0	some	some	some			dry
% Recovery	-	-	-	-	-			-
Color	cream	cream	cream	brown	brown			white
Subsidence	slow	-	slow	slow	slow			
Consistency	thick	thick	thick	-				
Wet Glass	good	-	good	fair	good			
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No. 37 ⁰				38			
Reactor No. 1				2			
Dates 2-1-55 - 2-8-55				2-2-55 - 2-8-55			
Hr. 160				141			
fps 15				26			
Toroid	Q	R	S	M	N	O	P
Load - Identification	Lind. 8	Lind. 8	Lind. 8	Lind. 13	Lind. 13	Lind. 13	Lind. 8
Calcination °C	900	900	900	650	650	650	900
Avg Part Dia, μ (Pre)	10	10	10	2.9	2.9	2.9	10
g Th/kg H ₂ O	500	500	500	500	1000	500	500
Additive							
Conc.							
Atm	O ₂	N ₂	O ₂	O ₂	O ₂	O ₂	O ₂
psi	115	30	115	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250
Actual	250	239	323	255	250	244	247
CORROSION							
Toroid mg/dm ²	-	-	-	- 47	- 36	- 58	- 85
mpy	-	-	-	1.4	1.1	1.8	2.6
PINS							
Defilmed, mpy 347	7.6, 5.4	14, 15	4.9, 5.0	4.4, 3.6	4.2, 3.8	3.1, 3.1	2.4, 2.6
				3.3			2.2, 2.6
Ti-75A	2.5, 2.1	1.8, 2.6	1.9, 2.3		5.4	0.4	
Zr-2					3.0	1.7	
Other							
Post-run: g Th/kg H ₂ O	460	462	571	527	-	536	632
mg/g Th, Fe	0.2	0.6	0.2	6.5	2.8	7.8	11.4
Cr	0.0	0.1	0.0	1.5	0.5	1.6	2.0
Ni	0.2	0.2	0.1	1.2	0.5	1.4	2.0
Ti	3.9	4.0	3.5		0.2	0.1	
mg/l, Cl	3	5	2	17	-	9	7
pH Slurry	7.1	7.7	6.2	6.4	-	6.5	6.1
Supernate	7.0	6.9	6.6	6.5	-	6.0	6.0
Part. Size > 10 μ							
3-10 μ							
1-3 μ							
< 1 μ							
Avg Dia, μ							
% Pour	some	some	some	some	0	some	some
% Recovery	-	-	-	-	-	-	-
Color	white	white	white	tan	cream	tan	brown
Subsidence	-	rapid	rapid	-	-	-	-
Consistency	-	-	-	-	thick	-	thick
Glass	slight	slight	slight	slight	-	slight	-
Resuspension							
	turbid			turbid		turbid	
	supn't.			supn't.		supn't.	

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TOROID SUMMARY SHEET

Toroid Run No. 39					40			
Rotator No. 4					5			
Dates 2-3-55 - 3-24-55					2-4-55 - 2-10-55			
Hr. 198					136			
fps 26					26			
Toroid	E	F	G	H	T			
Load - Identification	Lind. 11	Lind. 11	Lind. 11	Lind. 8	PH-900			
Calcination °C	650	650	650	900	900			
Avg Part Dia, μ (Pre)	7.6	7.6	7.6	10	3.2			
g Th/kg H ₂ O	500	1000	500	500	1000			
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂			
psi	90	90	90	90	115			
Temp - Nominal	250	250	250	250	250			
Actual	245	250	275	-	243			
CORROSION								
Toroid mg/dm ²	- 14	- 27	- 15	-129	-			
mpy	0.3	0.6	0.3	2.8	-			
PINS								
Defilmed, mpy 347	0.6, 0.4	3.6, 3.0	0.9, 0.5	2.8, 2.4				
	0.6			3.5, 3.0				
Ti-75A		8.7 ^b	1.0					
		1.9	0.4					
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	539	-	694	694				
mg/g Th, Fe	1.7	2.3	1.8	18				
Cr	0.7	0.4	0.9	1.5				
Ni	0.3	0.3	0.3	3.0				
mg/l, Cl	17	-	31	9				
pH Slurry	7.6	-	7.6	6.4				
Supernate	7.2	-	6.9	6.8				
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	84	0	100	65	dry			
% Recovery	101	-	112	72				
Color	cream	white	cream	brown	white			
Subsidence	slow	-	slow	slow				
Consistency	thick	thick	thick	thick				
Wet Glass	good	-	good	fair				
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No.	41				42			
Tor No.	3				2			
Dates	2-10-55 - 2-16-55				2-10-55 - 2-16-55			
Hr.	144				144			
fps	26				26			
Toroid	I	J	K	L	M	N	O	P
Load - Identification	Batch 16	Batch 16	Batch 16	Lind. 8	XB-1	XB-1	XB-1	Lind. 8
Calcination °C	800 ^a	800 ^a	800 ^a	900	650 ^a	650 ^a	650 ^a	900
Avg Part Dia, μ (Pre)	5.8	5.8	5.8	5.8	10.6	10.6	10.6	10
g Th/kg H ₂ O	500	1000	500	500	500	1000	500	500
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	254	254	250	255	250	250	249	258
CORROSION								
Toroid mg/dm ²	- 12	- 15	- 14	- 90	- 27	- 19	- 8	- 95
mpy	0.4	0.5	0.4	2.7	0.8	0.6	0.2	2.9
PINS								
Defilmed, mpy 347	3.4, 3.0	1.9, 1.8	2.4, 2.2	2.5, 2.4	0.3, 0.6	0.5, 0.4	0.3, 0.4	2.6, 2.4
	3.2, 3.4			1.9, 2.9	0.5			2.7, 2.7
Ti-75A		0.4	0.5		j	WG	WG	
Zr-2		0.2	0.1			3.2 ^b	0.9 ^b	
Other								
Post-run: g Th/kg H ₂ O	508	-	479	606	370	532	405	603
mg/g Th, Fe	2.0	1.2	2.0	12.1	3.6	1.4	1.0	12.8
Cr	0.3	0.2	0.3	1.4	0.9	0.4	0.2	1.8
Ni	0.3	0.2	0.3	1.9	0.6	0.3	0.1	2.2
mg/l, Cl	11	-	20	4	11	25	9	15
pH Slurry	3.4	-	3.6	5.9	5.0	5.2	5.2	6.0
Supernate	3.6	-	3.8	6.4	5.2	5.8	5.6	6.1
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some	0	some	some	some	some	some	some
% Recovery	-	-	-	-	-	-	-	-
Color	white	white	white	brown	brown	yellow	yellow	brown
Subsidence	slow	-	slow	slow	rapid	rapid	rapid	slow
Consistency	thick	thick	thick	thick	-	-	-	thick
W Glass	good	-	good	fair	slight	slight	slight	fair
Resuspension								

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TOROID SUMMARY SHEET

Toroid Run No. 43 ^P					44			
Rotator No. 5					3			
Dates 2-21-55 - 2-28-55					2-25-55 - 3-3-55			
Hr. 162					141			
fps 27					26			
Toroid	T				I	J	K	L
Load - Identification	PH-900				D-17	D-17	D-17	Lindsay 8
Calcination °C	900				650	650	650	900
Avg Part Dia, μ (Pre)	3.2				2.1	2.1	2.1	10
g Th/kg H ₂ O	1000				500	1000	500	500
Additive								
Conc.								
Atm	0 ₂				0 ₂	0 ₂	0 ₂	0 ₂
psi	115				90	90	90	90
Temp - Nominal	250				250	250	250	250
Actual	248				253	252	247	250
CORROSION								
Toroid mg/dm ²	- 8				- 20	- 19	- 16	- 88
mpy	0.2				0.6	0.6	0.5	2.7
PINS								
Defilmed, mpy 347	0.5, 0.6				2.6, 2.4	4.7, 4.3	1.2, 1.2	2.4, 3.0
	0.7, 0.7 ²				5.9			2.6, 2.9
	Ti-75A					WG	WG	
	Zr-2					0.8	0.1	
Other								
Post-run: g Th/kg H ₂ O	1072				510	-	550	590
mg/g Th, Fe	1.0				2.9	1.6	2.2	11.9
Cr	0.2				0.6	0.3	0.3	1.8
Ni	0.2				0.4	0.3	0.3	2.0
mg/l, Cl	-				6	-	9	6
pH Slurry	6.3				6.3	-	7.2	6.0
Supernate	-				6.7	-	7.5	6.2
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	some				some	0	some	some
% Recovery	-				-	-	-	-
Color	white				cream	white	white	brown
Subsidence	-				slow	-	slow	slow
Consistency	thick				-	thick	-	thi
Wet Glass	good				fair	-	fair	fair
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No.	45					46 ^P				
R tor No.	2					5				
Dates	2-28-55 - 3-8-55					3-4-55 - 3-10-55				
Hr.	186					142				
fps	26					27				
Toroid	M	N	O	P	T					
Load - Identification	Lindsay ⁸	XB-1	XB-1	XB-1	XB-1					
Calcination °C	900	650 ^a	650 ^a	650 ^a	650 ^a					
Avg Part Dia, μ (Pre)	10	10.6	10.6	10.6	10.6					
g Th/kg H ₂ O	500	1000	500	1000	1000					
Additive										
Conc.										
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂					
psi	90	90	90	90	115					
Temp - Nominal	250	250	250	250	250					
Actual	251	252	233	232	249					
CORROSION										
Toroid mg/dm ²	-126	- 8	- 8	- 14	- 5					
mpy	2.9	0.2	0.2	0.3	0.1					
PINS										
Defilmed, mpy 347	3.5, 3.9	0.5 ^j	0.6	0.4	1.6, 1.4 ^j					
	3.8									
Ti-75A			WG	WG, WG	WG					
Zr-2		0.5	WG	1.4	0.3					
Other		1.7	WG							
Post-run: g Th/kg H ₂ O	629	823	391	266	1350					
mg/g Th, Fe	16.9	0.6	1.0	0.6	0.6					
Cr	1.2	0.1	0.2	0.6	0.2					
Ni	2.8	0.1	0.1	0.3	0.1					
mg/l, Cl	6	17	11	13	-					
pH Slurry	7.7	4.7	5.2	5.4	6.1					
Supernate	6.7	5.1	6.0	6.0	6.6					
Part. Size > 10 μ										
3-10 μ										
1-3 μ										
< 1 μ										
Avg Dia, μ										
% Pour	100	72	83	15	58					
% Recovery	109	100	111	76	96					
Color	brown	yellow	yellow	yellow	cream					
Subsidence	slow	rapid	rapid	rapid	slow					
Consistency	thick	-	-	-	thick					
Glass	fair	slight	slight	slight	good					
Resuspension										

TOROID SUMMARY SHEET

Toroid Run No. 47					48			
Rotator No. 3					2			
Dates 3-10-55 - 3-16-55					3-11-55 - 3-21-55			
Hr. 146					215			
fps 26					26			
Toroid	I	J	K	L	M	N	O	P
Load - Identification	Lind. 11	Lind. 11	Lind. 11	Lind. 8	D-17	D-17	D-17	D-17
Calcination °C	650	650	650	900	650	650	650	650
Avg Part Dia, μ (Pre)	7.6	7.6	7.6	10	2.1	2.1	2.1	2.1
g Th/kg H ₂ O	500	1000	500	500	500	500	1000	1000
Additive					He purge	Added CO ₂	He purge	Added CO ₂
Conc.								
Atm	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	252	260	257	248	245	250	253	252
CORROSION								
Toroid mg/dm ²	- 21	- 22	- 15	- 94	- 25	- 20	- 56	- 46
mpy	0.6	0.7	0.5	2.8	0.5	0.4	1.1	0.9
PINS								
Defilmed, mpy 347	2.1, 2.0 1.9	3.0, 2.7	1.4, 1.3	2.6, 3.2 2.5, 3.0	1.1	1.7	2.6, 2.0	2.4, 2.8
Ti-75A		1.7	0.8		WG	0.3	1.7	1.4
Zr-2		1.2	0.3		0.6	0.9	2.0	1.6
Other								
Post-run: g Th/kg H ₂ O	530	-	488	610	530	560	-	1078
mg/g Th, Fe	3.0	1.8	2.1	13.0	2.7	2.6	3.6	3.0
Cr	0.7	0.3	0.6	2.5	1.4	0.6	0.7	0.7
Ni	0.2	0.3	0.3	2.4	0.6	0.4	0.6	0.5
C					0.8	1.3	0.6	2.5
mg/l, Cl	17	-	17	10	-	-	-	-
pH Slurry	7.2	-	7.4	8.4	7.1	5.9	-	5.3
Supernate	7.1	-	7.5	8.0	-	-	-	-
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	92	0	83	105	88	90	-	84
% Recovery	105	-	94	117	99	97	-	98
Color	cream	white	cream	brown	yellow	cream	cream	cream
Subsidence	slow	-	slow	slow	slow	slow	-	slow
Consistency	thick	thick	thick	thick	thick	thick	thick	thi
Wet Glass	fair	-	good	fair	good	fair	fair	goo
Resuspension								

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TOROID SUMMARY SHEET

Toroid Run No. 49 ^D					50			
Tor No. 5					3			
Dates 3-11-55 - 3-21-55					3-22-55 - 3-31-55			
Hr. 159					150			
fps 27					25			
Toroid	T				I	J	K	L
Load - Identification	D-17				Lind. 7	Lind. 7	Lind. 8	D-17
Calcination °C	650				900	1800	900	650
Avg Part Dia, μ (Pre)	2.1				10.4	2.2	10	2.1
g Th/kg H ₂ O	1000				1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂				0 ₂	0 ₂	0 ₂	0 ₂
psi	115				90	90	90	90
Temp - Nominal	250				250	250	250	250
Actual	249				256	245	239	254
CORROSION								
Toroid mg/dm ²	- 20				- 44	- 41	-149	- 40
mpy	0.6				1.3	1.2	4.3	1.2
PINS								
Defilmed, mpy 347	2.1, 2.1				4.1, 3.6	4.7, 5.3	4.9, 5.6	2.3, 2.2
	2.0, 1.5				3.3	5.2, 3.6	5.6, 5.6	2.2, 3.3
Ti-75A								
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	1043				1111	840	1175	1275
mg/g Th, Fe	1.8				3.0	2.8	11.6	3.1
Cr	0.4				0.6	0.4	2.1	1.1
Ni	0.3				0.5	0.5	2.0	0.5
mg/l, Cl	11				15	127	10	-
pH Slurry	6.7				5.4	6.5	9.6	6.6
Supernate	7.4				6.7	6.1	8.4	-
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	71				84	91	90	64
% Recovery	88				102	148	109	100
Color	cream				tan	tan	black	cream
Subsidence	slow				slow	rapid	slow	slow
Consistency	thick				thick	-	thick	thick
W Glass	good				good	slight	good	good
Resuspension								

TOROID SUMMARY SHEET

Toroid Run No.	51			
Rotator No.	2			
Dates	3-22-55 - 3-29-55			
Hr.	162			
fps	26			
Toroid	M	N	O	P
Load - Identification	D-17	D-17	Ames	Ames
Calcination °C and Hr	650	1000-5	850	1000-5
Avg Part Dia, μ (Pre)	2.1	2.3	6.4	7.0
g Th/kg H ₂ O	1000	1000	1000	1000
Additive				
Conc.				
Atm	02	02	02	02
psi	90	90	90	90
Temp - Nominal	250	250	250	250
Actual	250	269	243	243
CORROSION				
Toroid mg/dm ²	- 44	- 58	- 28	-158
mpy	1.2	1.5	0.8	4.3
PINS				
Defilmed, mpy 347	2.8, 2.9	3.6, 3.5	3.2, 3.8	10, 11
	2.0	3.8	3.7, 3.9	9.8, 12
Ti-75A				
Zr-2				
Other				
Post-run: g Th/kg H ₂ O	1060	1065	1065	1176
mg/g Th, Fe	2.9	3.8	2.0	10.9
Cr	0.6	0.7	0.4	2.3
Ni	0.5	0.8	0.1	2.0
C	1.8	0.2	7.1	1.7
mg/l, Cl	15	14	-	13
pH Slurry	5.9	5.2	6.1	7.9
Supernate	6.7	6.1	-	6.8
Part. Size > 10 μ				
3-10 μ				
1-3 μ				
< 1 μ				
Avg Dia, μ				
% Pour	71	85	56	73
% Recovery	94	99	80	92
Color	cream	brown	white	gray
Subsidence	slow	slow	slow	slow
Consistency	thick	thick	thick	thick
Wet Glass	good	good	good	good
Resuspension				

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TOROID SUMMARY SHEET

Toroid Run No. 52 ^S					52 ^S (cont'd.)			
Reactor No. 20 Toroid								
Dates 3-29-55 - 4-4-55								
Hr. 137								
fps 27								
Toroid	AA	BB	CC	DD	EE	FF	GG	HHH
Load - Identification	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8
Calcination °C	900	900	900	900	900	900	900	900
Avg Part Dia, μ (Pre)	10	10	10	10	10	10	10	10
g Th/kg H ₂ O	500	1000	500	500	500	500	500	500
Additive	-	-	Th(SO ₄) ₂	Th(SO ₄) ₂	Th(SO ₄) ₂	CaSO ₄	MgSO ₄	Na ₂ SO ₄
Conc., gSO ₄ /kg Th			10.0	1.0	0.10	1.0 ⁴	1.0 ⁴	1.0 ⁴
Atm	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	252	252	252	252	252	252	252	252
CORROSION								
Toroid mg/dm ²	- 19	- 26	- 19	- 12	- 15	- 11	- 9	- 18
mpy	0.6	0.8	0.6	0.4	0.5	0.4	0.3	0.6
PINS								
Defilmed, mpy 347	1.0,1.1	2.1,2.0	5.3, 5.0	1.3,1.1	1.3,1.4	1.4,1.2	0.8,0.7	0.8,1.0
Ti-75A	WG	1.0	0.3	0.2	0.3	WG	0.3	0.5
Zr-2	0.0	0.7	0.3	0.3	0.7	0.4	0.4	WG
Other								
Post-run: g Th/kg H ₂ O	166	630	256	266	260	510	528	475
mg/g Th, Fe	2.4	1.5	2.6	1.3	2.0	1.3	1.2	1.9
Cr	1.0	0.9	0.3	1.0	0.4	0.7	0.4	1.3
Ni	0.2	0.1	1.0	0.1	0.2	0.1	0.1	0.1
SO ₄	0.8	0.8	7.4	2.1	< 0.5	1.3	1.3	0.8
mg/l, Cl			14					
SO ₄	< 10	< 10	1097	33	< 10	154	-	392
pH Slurry	6.0	6.2	2.6	5.1	6.4	5.9	7.2	5.7
Supernate	6.4	5.9	2.6	5.5	6.2	6.4	7.0	5.8
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	28	46	45	47	43	94	94	89
% Recovery	62	74	70	80	91	99	99	98
Color	cream	cream	tan	cream	cream	cream	cream	cream
Subsidence	rapid	rapid	rapid	rapid	rapid	rapid	rapid	-
Consistency	thin	thin	thin	thin	thin	thick	thick	thick
Wet Class	slight	slight	slight	slight	slight	slight	slight	slight
Resuspension								Difficult
Supn't.						yellow		turbid

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TOROID SUMMARY SHEET

Toroid Run No. 52 ^S					52 (cont'd.)			
Rotator No.								
Dates								
Hr.								
fps								
Toroid	II	JJ	KK	LL	MM	NN	OO	PP
Load - Identification	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8	Lind. 8
Calcination °C	900	900	900	900	900	900	900	900
Avg Part Dia, μ (Pre)	10	10	10	10	10	10	10	10
g Th/kg H ₂ O	1000	500	500	1000	500	500	500	500
Additive	Th(SO ₄) ₂	Th(SO ₄) ₂	-	-	Th(SO ₄) ₂	Th(SO ₄) ₂	Th(SO ₄) ₂	CaSO ₄
Conc., g SO ₄ /kg Th	1.0	1.0			10.0	1.0	0.1	1.0
Atm	O ₂	N ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
psi	90	30	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	252	252	252	252	252	252	252	252
CORROSION								
Toroid mg/dm ²	- 11	- 14	- 16	- 25	- 32	- 12	- 17	- 11
mpy	0.4	0.5	0.5	0.8	1.0	0.4	0.6	0.3
PINS								
Defilmed, mpy 347	1.9,2.5	2.0,1.8	1.4,1.3	2.4,2.0	9.3,10.5	1.4,0.9	1.4,1.2	1.4,1.3
Ti-75A	1.2	0.7	1.0	0.8	0.6	0.9	0.2	0.4
Zr-2	0.9	0.7	WG	WG	WG	0.4	0.1	1.9
Other								
Post-run: g Th/kg H ₂ O	1100	514	526	757	236	504	532	502
mg/g Th, Fe	0.6	1.9	2.1	1.4	4.4	1.5	2.2	1.4
Cr	0.4	0.2	0.6	0.9	0.6	0.5	1.0	0.4
Ni	0.1	0.1	0.2	0.1	1.4	0.1	0.1	0.1
SO ₄	1.1	1.6	0.5	0.5	8.7	1.4	0.7	1.6
mg/l, Cl								
SO ₄	26	19	< 10	36	991	12	14	-
pH Slurry	5.6	7.3	6.5	6.2	2.4	5.7	5.9	6.5
Supernate	7.3	7.0	7.2	7.0	2.2	6.1	6.6	7.0
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	95	94	95	56	41	93	97	95
% Recovery	102	98	100	83	66	99	103	100
Color	cream	gray	cream	cream	brown	cream	tan	cream
Subsidence	slow	rapid	rapid	rapid	rapid	rapid	rapid	rapid
Consistency	thick	thin	thin	thin	thin	thin	thin	th
Wet Glass	fair	slight	slight	slight	slight	slight	slight	sl
Resuspension			easy					

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TOROID SUMMARY SHEET

Toroid Run No.		52 (cont'd.)			
R tor No.					
Dates					
Hr.					
fps					
Toroid	QQ	RR	SS	TT	
Load - Identification	Lind. 8	Lind. 8	Lind. 8	Lind. 8	
Calcination °C	900	900	900	900	
Avg Part Dia, μ (Pre)	10	10	10	10	
g Th/kg H ₂ O	500	500	1000	500	
Additive	MgSO ₄	Na ₂ SO ₄	Th(SO ₄) ₂	Th(SO ₄) ₂	
Conc., g SO ₄ /kg Th	1.0	1.0	1.0	1.0	
Atm	O ₂	O ₂	O ₂	N ₂	
psi	90	90	90	30	
Temp - Nominal	250	250	250	250	
Actual	252	252	252	252	
CORROSION					
Toroid mg/dm ²	- 11	- 14	- 20	- 12	
mpy	0.3	0.4	0.6	0.4	
PINS					
Defilmed, mpy 347	1.5, 1.5	2.6, 2.1	2.3, 2.1	1.9, 2.1	
Ti-75A	0.5	1.1	0.9	0.0	
Zr-2	WG	WG	0.4	WG	
Other					
Post-run: g Th/kg H ₂ O	513	502	1027	528	
mg/g Th, Fe	1.4	1.7	1.0	1.9	
Cr	0.6	0.8	0.8	0.2	
Ni	0.0	0.1	0.1	0.1	
SO ₄	1.6	0.8	1.3	1.5	
mg/l, Cl					
SO ₄	-	461	22	24	
pH Slurry	6.0	6.6	5.5	7.5	
Supernate	7.0	7.0	6.6	6.5	
Part. Size > 10 μ					
3-10 μ					
1-3 μ					
< 1 μ					
Avg Dia, μ					
% Pour	96	94	90	96	
% Recovery	101	100	98	101	
Color	cream	cream	cream	gray	
Subsidence	rapid	-	rapid	rapid	
Cistency	thin	thin	thick	thick	
W Glass	slight	slight	fair	slight	
Resuspension		easy			
Supn't.	yellow	turbid			

TOROID SUMMARY SHEET

Toroid Run No. 53					54 ^P			
Rotator No. M					T			
Dates 4-6-55 - 4-12-55					4-15-55 - 4-28-55			
Hr. 142					305			
fps 26					27			
Toroid	M	N	O	P	T			
Load - Identification	Lind. 7	Lind. 7	Lind. 7	D-17	Lind. 8			
Calcination °C	1800	1800	1800	650	900			
Avg Part Dia, μ (Pre)	2.2	1.9	~ 16	2.1	10			
g Th/kg H ₂ O	1000	1000	1000	1000	1000			
Additive	as rec'd	Fines	Bottoms	-				
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂			
psi	90	90	90	90	115			
Temp - Nominal	250	250	250	250	250			
Actual	248	268	243	246	249			
CORROSION								
Toroid mg/dm ²	-196	-169	- 55	- 52	- 36			
mpy	6.0	5.2	1.7	1.6	0.5			
PINS								
Defilmed, mpy 347	81	15	3.4, 4.5	3.4, 3.5	1.6, 1.8			
					1.9, 1.9 ^y			
Ti-75A	WG	0.9	4.3	0.7				
Zr-2	12	0.3	9.5	1.1				
Other								
Post-run: g Th/kg H ₂ O	877	1137	734	1027	926			
mg/g Th, Fe	13.5	10.8	3.5	3.4	2.4			
Cr	3.6	1.5	1.0	0.8	0.6			
Ni	2.8	1.8	0.8	0.6	0.4			
mg/l, Cl	173	963	17	11	15			
pH Slurry	8.4	3.6	7.8	6.4	7.5			
Supernate	9.4	3.6	5.9	7.0	6.8			
Part. Size > 10 μ	11	3	50	-	-			
3-10 μ	46	19	22	-	-			
1-3 μ	32	45	22	-	-			
< 1 μ	11	33	6	-	-			
Avg Dia, μ	3.4	1.8	10	-	-			
% Pour	75	93	75	81	81			
% Recovery	103	105	90	98	92			
Color	black	gray	tan	cream	tan			
Subsidence	rapid	slow	rapid	slow	slow			
Consistency	-	thin	-	thin	thin			
Wet Glass	slight	slight	slight	good	fair			
Resuspension	-	-	-	-	-			
	magnetic	magnetic						

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TOROID SUMMARY SHEET

Toroid Run No.	55 ^B				55 (cont'd.)			
F ₁ Tor No.	20 Toroid							
Dates	4-26-55 - 5-2-55							
Hr.	145							
fps	26							
Toroid	AA	BB	CC	DD	EE	FF	GG	HHH
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	650	650	650	650	650	650	650	650
Avg Part Dia, μ (Pre)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
g Th/kg H ₂ O	500	1000	500	500	500	500	500	500
Additive	-	-	Th(SO ₄) ₂	Th(SO ₄) ₂	Th(SO ₄) ₂	CaSO ₄	MgSO ₄	NaSO ₄
Conc., g SO ₄ /kg Th	-	-	10.0 ²	1.0 ²	0.1 ²	1.0	1.0	1.0
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	253	253	253	253	253	253	253	253
CORROSION								
Toroid mg/dm ²	- 13	- 7	- 12	- 21	- 4	- 10	- 12	- 12
mpy	0.4	0.2	0.4	0.6	0.1	0.3	0.4	0.3
PINS								
Defilmed, mpy 347	0.8,0.9	1.3,1.8	0.5,0.1	1.3,1.1	1.0,1.4	1.2,1.3	1.1,0.4	1.3,1.2
Ti-75A	WG	WG	WG	0.2	WG	WG	WG	0.0
Zr-2	WG	WG	WG	WG	WG	0.0	0.0	WG
Other								
Post-run: g Th/kg H ₂ O	503	1000	520	503	498	493	493	540
mg/g Th, Fe	1.9	1.1	0.6	1.6	1.3	1.8	1.5	4.3
Cr	0.6	0.3	0.2	0.5	0.3	1.0	0.6	1.0
Ni	0.3	0.2	0.0	0.2	0.2	0.1	0.1	0.2
SO ₄	<0.3	0.4	11.6	1.7	1.8	0.2	1.5	0.8
mg/l, Cl								
SO ₄	< 1	< 1	32	< 1	< 1	10	37	326
pH Slurry	6.5	6.6	3.8	5.8	6.2	-	6.8	7.0
Supernate	6.6	6.4	4.0	6.7	6.3	6.6	7.1	7.5
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	94	80	96	93	92	92	90	92
% Recovery	100	97	100	99	98	97	96	97
Color	cream	cream	white	cream	white	cream	cream	cream
Subsidence	rapid	rapid	rapid	rapid	rapid	rapid	rapid	-
Consistency	thick	thick	thick	thick	thick	thick	thick	thick
W ₁ class	fair	good	fair	fair	fair	fair	fair	fair
Resuspension								
Supn't.								turbid

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TOROID SUMMARY SHEET

55 (cont'd.)					55 (cont'd.)			
Toroid Run No.								
Rotator No.								
Dates								
Hr.								
fps								
Toroid	II	JJ	KK	LL	MM	NN	OO	PP
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	650	650	650	650	650	650	650	650
Avg Part Dia, μ (Pre)	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
g Th/kg H ₂ O	1000	500	500	1000	500	500	500	500
Additive	Th(SO ₄)	Th(SO ₄)	-	-	Th(SO ₄)	Th(SO ₄)	Th(SO ₄)	CaSO ₄
Conc., g SO ₄ /kg Th	1.0 ²	1.0 ²	-	-	10.0 ²	1.0 ²	0.1 ²	1.0
Atm	0	N	0	0	0	0	0	0
psi	96	36	96	96	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	253	253	253	253	253	253	253	253
CORROSION								
Toroid mg/dm ²	- 15	- 16	- 5	- 12	- 10	- 15	- 12	- 34
mpy	0.4	0.5	0.1	0.4	0.3	0.5	0.4	1.0
PINS								
Defilmed, mpy 347	0.9,2.1	1.7,1.6	1.8,1.5	3.1,2.0	1.6,1.9	1.4,1.4	1.4,1.1	1.3,1.6
Ti-75A	WG	WG	WG	0.9	0.3	WG	WG	0.5
Zr-2	0.0	0.3	WG	0.1	WG	0.1	0.3	WG
Other								
Post-run: g Th/kg H ₂ O	1056	518	518	1040	525	525	550	514
mg/g Th, Fe	0.9	1.0	1.6	1.4	0.5	1.3	1.6	1.4
Cr	0.2	0.1	0.4	0.3	0.3	0.3	0.4	0.6
Ni	0.1	0.1	0.2	0.2	0.0	0.2	0.1	0.1
SO ₄	1.2	1.3	0.5	0.3	11.4	1.6	0.3	1.2
mg/l, Cl	-	22	11	-	23	8	12	-
SO ₄	-	< 10	< 10	< 1	42	< 10	< 10	< 10
pH Slurry	6.5	6.7	6.5	6.4	3.9	6.2	6.8	6.4
Supernate	-	6.6	6.8	6.4	4.3	6.8	6.8	6.8
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	85	93	90	82	95	94	97	90
% Recovery	98	99	97	96	102	101	103	97
Color	white	white	cream	cream	white	cream	cream	cream
Subsidence	rapid	rapid	rapid	rapid	rapid	rapid	rapid	rapid
Consistency	thick	thick	thick	thick	thick	thick	thick	th
Wet Glass	good	fair	fair	good	fair	fair	fair	f
Resuspension								

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TOROID SUMMARY SHEET

Toroid Run No.	55 (cont'd.)							
Tor No.								
Dates								
Hr.								
fps								
Toroid	QQ	RR	SS	TT				
Load - Identification	D-17	D-17	D-17	D-17				
Calcination °C	650	650	650	650				
Avg Part Dia, μ (Pre)	2.1	2.1	2.1	2.1				
g Th/kg H ₂ O	500	500	1000	500				
Additive	MgSO ₄	Na ₂ SO ₄	Th(SO ₄) ₂	Th(SO ₄) ₂				
Conc., g SO ₄ /kg Th	1.0	1.0	1.0	1.0				
Atm	0	0	0	N ₂				
psi	90	90	90	30				
Temp - Nominal	250	250	250	250				
Actual	253	253	253	253				
CORROSION								
Toroid mg/dm ²	- 14	- 18	- 17	- 1				
mpy	0.4	0.6	0.5	0.0				
PINS								
Defilmed, mpy 347	1.4, 0.8	2.8, 2.7	3.3, 2.7	1.2, 1.6				
Ti-75A	1.2	0.9	0.6	0.0				
Zr-2	0.4	0.7	0.7	0.7				
Other								
Post-run: g Th/kg H ₂ O	553	230	1117	514				
mg/g Th, Fe	1.8	2.4	1.2	1.2				
Cr	0.7	1.0	0.3	0.1				
Ni	0.2	0.2	0.2	0.1				
SO ₄	0.9	1.1	0.8	1.8				
mg/l, Cl	-	-	15	9				
SO ₄	67	324	< 10	< 10				
pH Slurry	6.8	7.0	6.1	7.4				
Supernate	6.7	7.6	6.6	6.8				
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	89	54	82	91				
% Recovery	96	58	98	97				
Color	cream	cream	cream	white				
Subsidence	rapid	-	rapid	rapid				
Consistency	thick	thick	thick	thick				
W Glass	fair	fair	good	fair				
Resuspension								
Supn't.		turbid						

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TOROID SUMMARY SHEET

Toroid Run No. 56					57			
Rotator No. 2					3			
Dates 5-4-55 - 5-11-55					5-4-55 - 5-12-55			
Hr. 116					185			
fps 26					26			
Toroid	M	N	O	P	I	J	K	L
Load - Identification	D-17	D-17	CS-4	Lind. 8	Ames	Ames	Ames	Ames
Calcination °C	650	650	650	900	850	850	900	900
Avg Part Dia, μ (Pre)	2.1	2.1	< 1	10	6.4	6.4	10	10
g Th/kg H ₂ O	1000	1000	1000	500	1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	245	274	255	249	248	252	249	249
CORROSION								
Toroid mg/dm ²	- 19	- 23		-129	- 14	- 16	-250	-235
mpy	0.7	0.9		4.8	0.3	0.4	5.9	5.6
PINS								
Defilmed, mpy 347	2.0,2.1	2.0,1.6		9.7, 10.3 ^b	2.2,2.3	1.6,1.5	13.5, 13.7 ^b	12.5, 16.2 ^b
	2.1	1.2		8.9,11.2	2.5	1.2,1.2	12.2,12.4	12.4,13.4
Ti-75A								
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	-	804	-	763	-	1054	1235	1185
mg/g Th, Fe	1.3	1.2		18.0	1.0	1.1	19.9	15.8
Cr	0.7	0.8		4.3	0.1	0.1	4.7	3.8
Ni	0.2	0.2		3.0	0.1	0.1	3.2	2.7
mg/l, Cl		23		5	-	-	6	-
pH Slurry		6.4		9.1	-	5.7	9.5	8.9
Supernate		6.6		5.6	-	6.4	8.2	8.2
Part. Size > 10 μ								
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ								
% Pour	0	46	dry	126	0	51	70	78
% Recovery	47	63		142	35	78	108	105
Color	cream	white	-	black	white	white	black	black
Subsidence	-	slow	-	slow	-	slow	slow	slow
Consistency	thick	thick	-	thick	thick	thick	thick	th
Wet Glass	-	good	-	fair	-	good	good	gs
Resuspension				magnetic				

TOROID SUMMARY SHEET

Toroid Run No. 59 ^u					60 ^o			
Reactor No. 3					1			
Dates 5-27-55 - 6-12-55					10-21-55 - 10-25-55			
Hr. 208					94			
fps 26					15			
Toroid	I	J	K	L	Q	R	S	V
Load - Identification	D-17	D-17	CS-4	CS-4	Lind. 8	Lind. 8	Lind. 8	Lind. 8
Calcination °C	650	1000	650	1000	900	900	900	900
Avg Part Dia, μ (Pre)	2.1	2.3	< 1	< 1	10	10	10	10
g Th/kg H ₂ O	1000	1000	1000	1000	500	500	500	500
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	N ₂	0 ₂	0 ₂
psi	90	90	90	90	115	30	115	100
Temp - Nominal	250	250	250	250	300	300	300	300
Actual	247	257	255	248	300	288	318	298
CORROSION								
Toroid mg/dm ²	- 33	-272	- 14	- 27	-	-	-	51
mpy	0.7	5.7	0.3	0.6	-	-	-	2.4
PINS								
Defilmed, mpy 347	12	32. ^b 29	1.8, 1.9	2.9. ^b 3.3	5.4, 3.4	6.2, 3.3	3.2, 3.5	2.0, 2.9
Ti-75A	1.7 ^b	9.7 ^b	1.5	4.9	7.7	4.8	3.2	3.2
Zr-2	1.5	1.5	0.4	0.4	1.2	1.3	1.4	0.5
Other								
Post-run: g Th/kg H ₂ O	-	1196	847	1070	456	422	509	498
mg/g Th, Fe	2.3	18.4	2.7	3.6	0.2	0.2	0.1	2.1
Cr	0.3	5.1	0.6	0.8	0.2	0.0	0.0	0.2
Ni	0.3	3.2	0.4	0.6	0.0	0.0	0.0	0.1
Ti					2.9	3.2	2.0	
mg/l, Cl								
pH Slurry	6.1	9.2	7.2	8.9	6.7	7.2	6.9	6.8
Supernate	7.1	8.3	7.5	7.8	6.8	7.2	7.2	6.8
Part. Size > 10 μ	3	5	2	1				
3-10 μ	3	43	4	2				
1-3 μ	35	44	23	17				
< 1 μ	59	8	71	80				
Avg Dia, μ	0.8	3.0	0.6	0.5				
% Pour	12	86	72	91	83	80	90	84
% Recovery	81	108	90	99	94	88	102	96
Color	white	black	white	gray	white	white	white	yellow
Subsidence	-	-	-	-	rapid	rapid	rapid	rapid
Consistency	thick	thick	thick	thick	-	-	-	thick
W glass	good	good	good	fair	slight	slight	slight	slight
Resuspension					easy	easy	easy	easy

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TOROID SUMMARY SHEET

Toroid Run No. 61					62			
Rotator No. 2					2			
Dates 6-6-55 - 6-16-55					6-30-55 - 7-12-55			
Hr. 244					282			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	Dist.	D-17	CS-4	CS-4	Dist.	D-17	D-17	CS-5
	Water				Water		(Fines ^a)	
Calcination °C	-	650	650	650	-	650	650	650
Avg Part Dia, μ (Pre)	-	2.1	< 1	< 1	-	2.1	1.1	< 1
g Th/kg H ₂ O	-	1000	1000	1000	-	1000	1000	1000
Additive				Na ₂ P ₂ O ₇				
Conc., M				0.0057				
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	249	255	253	262	250	-	251	256
CORROSION								
Toroid mg/dm ²	-	- 18	- 8	- 73	-	- 13	- 20	- 20
mpy	-	0.3	0.1	1.3	-	0.2	0.3	0.3
PINS								
Defilmed, mpy 347	0.7	2.9 ^b	3.5, 3.3	7.1, 7.0	0.4	0.5	14, 12	2.6, 2.3
Ti-75A	0.5	1.1	2.4	3.7	0.3	0.2	0.7	0.7
Zr-2	WG	1.1	1.0	0.2	WG	0.1	1.5	0.7
Other								
Post-run: g Th/kg H ₂ O	-	-	901	932	-	-	895	-
mg/g Th, Fe	-	1.2	2.4	6.7	-	1.0	2.4	1.8
Cr	-	0.3	0.6	1.7	-	0.2	0.4	0.2
Ni	-	0.1	0.3	1.1	-	0.1	0.1	0.1
PO ₄				1.1				
mg/l, Cl								
pH Slurry	6.4	-	7.0	8.3	-	-	6.1	-
Supernate	7.0	-	7.4	8.5	6.3	-	-	-
Part. Size > 10 μ	-	5	2	1	-	1	4	1
3-10 μ	-	4	3	3	-	6	6	13
1-3 μ	-	24	14	19	-	25	25	18
< 1 μ	-	67	81	77	-	68	65	68
Avg Dia, μ	-	0.8	0.5	0.6	-	0.8	0.7	0.7
% Pour	-	0	69	92	-	0	43	0
% Recovery	-	47	91	98	-	32	84	44
Color	cream	white	cream	gray	tan	white	white	white
Subsidence	-	-	slow	slow	-	-	-	-
Consistency	-	thick	thick	thin	-	thick	thick	th
Wet Glass	-	-	good	slight	-	-	good	-
Resuspension				easy				
Supn't.	turbid				yellow			

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TOROID SUMMARY SHEET

Toroid Run No. 63					64			
Rotator No. 3					2			
D 6-30-55 - 7-13-55					7-22-55 - 8-2-55			
Hr. 241					259			
fps 21					26			
Toroid	I	J	K	L	M	N	O	P
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	650	800	1000	1600C ²	650	(Fines ¹) 650	1600C ²	1600C ²
Avg Part Dia, μ (Pre)	2.1	2.1	2.3	2.4	2.1	1.1	2.4	0.7
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	264	271	264	249	245	-	252	251
CORROSION								
Toroid mg/dm ²	18	44	567	61	36	48	12	12
mpy	0.3	0.8	10.2	1.1	0.6	0.8	0.2	0.2
PINS								
Defilmed, mpy 347	8.8 ^b	8.0, 7.8 ^b	36, 37 ^b	4.5, 8.6 ^b	6.0	9.1 ^b	0.6, 0.5	0.8, 0.3
Ti-75A	3.4	7.4	13 ^b	1.5	4.8	2.9	0.3	0.0
Zr-2	1.4	1.9	2.0	0.0	1.9	2.0	WG	0.0
Other								
Post-run: g Th/kg H ₂ O	-	897	1390	384	1135	1165	307	575
mg/g Th, Fe	1.2	3.2	37.4	4.6	2.6	2.3	1.0	0.9
Cr	0.4	0.8	5.7	0.8	0.3	1.6	0.1	0.2
Ni	0.3	0.4	4.8	0.6	0.3	0.3	0.1	0.1
Al							194	127
mg/l, Cl	-	-	-	-	-	-	-	-
pH Slurry	-	9.2	9.2	8.3	6.0	5.6	8.6	8.3
Supernate	-	-	-	-	-	-	8.4	8.3
Part. Size > 10 μ	4	1	2	2	5	5	1	2
3-10 μ	4	3	56	3	4	5	3	4
1-3 μ	18	15	32	55	25	27	21	28
< 1 μ	74	81	10	40	66	63	75	66
Avg Dia, μ	0.7	0.6	3.2	1.1	0.7	0.8	0.6	0.8
% Pour	0	47	31	44	23	54	31	66
% Recovery	42	97	103	65	73	106	75	88
Color	white	white	black	white	cream	cream	white	white
Subsidence	-	slow	slow	-	slow	slow	-	-
Consistency	thick	thick	thick	thin	thick	thick	thin	thin
W. loss	-	good	good	fair	good	good	fair	fair
Re-suspension				moderate				
Supernatant				turbid			turbid	turbid
			magnetic					

TOROID SUMMARY SHEET

Toroid Run No. 65					66			
Rotator No. 3					3			
Dates 7-22-55 - 8-2-55					8-8-55 - 8-18-55			
Hr. 246					216			
fps 26					26			
Toroid	I	J	K	L	I	J	K	L
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
		*	**	Fract. B				Fract. C
Calcination °C	650	1600C ²	650	1600C ²	650	1000	1200	1600C ²
Avg Part Dia, μ (Pre)	2.1	1.7	4.0	1.6	2.1	2.3	2.6	0.7
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	247	246	-	260	250	249	-	-
CORROSION								
Toroid mg/dm ²	34	23	62	17	35	20	60	15
mpy	0.6	0.4	1.1	0.3	0.7	0.4	1.2	0.3
PINS								
Defilmed, mpy 347	4.1 ^b	0.8,0.6	1.5,2.0	0.9,0.9	6.9	3.3,2.7	4.4, ^b 3.8	0.5,0.3
Ti-75A	4.1	0.3	0.2	0.2	2.9	1.1	2.2 ^b	WG
Zr-2	2.4	0.4	0.8	WG	2.4	0.6	0.4	0.1
Other								
Post-run: g Th/kg H ₂ O	-	1050	1003	830	-	-	-	543
mg/g Th, Fe	2.1	1.4	2.7	1.3	2.4	1.3	4.6	1.2
Cr	0.8	0.3	0.9	0.2	0.6	0.3	0.5	0.2
Ni	0.3	0.4	2.3	0.1	0.3	0.2	0.5	0.0
Al		56		56				
mg/l, Cl			10					4
Cr		273		207				132
pH Slurry	-	6.4	6.4	6.6	-	-	-	8.6
Supernate	-	6.3	7.3	7.5	-	-	-	8.5
Part. Size > 10 μ	2	1.3	1	2	2	4	8	14
3-10 μ	3	1	1	2	2	14	13	39
1-3 μ	22	2	23	80	23	32	33	37
< 1 μ	73	72	75	16	73	50	46	10
Avg Dia, μ	0.6	25	0.7	1.3	0.6	1.0	1.1	3.2
% Pour	0	87	84	79	0	0	0	32
% Recovery	76	100	100	87	92	44	17	61
Color	cream	cream	cream	cream	cream	tan	brown	white
Subsidence	-	slow	slow	slow	-	-	-	-
Consistency	thick	thick	thick	thick	thick	thick	thick	thi
Wet Glass	-	fair	good	fair	-	-	-	-
Resuspension	-	easy	-	easy	-	-	-	difficult
*Fractions A and B								
**Heavies and Mediums								

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TOROID SUMMARY SHEET

Toroid Run No.	67				68			
Reactor No.	2				3			
Dates	8-8-55 - 8-22-55				8-19-55 - 8-29-55			
Hr.	174				195			
fps	26				26			
Toroid	M	N	O	P	I	J	K	L
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	650	1200	650	1200	1600C ²	1200	1400	1600
Avg Part Dia, μ (Pre)	2.1	2.6	2.1	2.6	0.7	2.6	2.5	2.4
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive			Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇				
Conc., M			0.087	0.087				
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	248	264	262	260	248	249	-	-
CORROSION								
Toroid mg/dm ²	- 28	-112	-120	-156	- 31	- 54	- 76	- 13
mpy	0.7	2.8	3.0	3.9	0.7	1.2	1.7	0.3
PINS								
Defilmed, mpy 347	8.4	3.1	10.3, 11.2	11.11	0.4	5.4, 4.6	5.4, 4.1	1.8, 2.1
Ti-75A	5.5	5.2	16	119	0.4	2.0	3.2	2.5
Zr-2	1.7	0.9	WG	0.9	0.2	1.1	1.2	1.4
Other								
Post-run: g Th/kg H ₂ O	-	1165	1050	1120	420	-	1620	2020
mg/g Th, Fe	2.1	7.9	8.2	10.8	2.8	4.3	7.0	1.3
Cr	0.5	1.0	1.9	2.0	0.0	0.2	0.1	0.0
Ni	0.3	1.3	1.2	1.8	0.0	0.7	0.1	0.0
mg/l, Cl	-	7	< 5	< 5	< 2	-	-	< 5
Cr	-	28	1335		51	-	34	-
pH Slurry	-	5.5	9.7	12.0	8.8	-	5.8	6.7
Supernate	-	6.3	9.8	12.0	8.8	-	6.4	6.6
Part. Size > 10 μ	2	-	1	2	6	2	2	-
3-10 μ	15	-	6	10	6	1	9	-
1-3 μ	34	-	23	29	16	17	36	-
< 1 μ	49	-	70	59	72	80	53	-
Avg Dia, μ	1.0	-	0.6	0.8	0.7	0.8	0.9	-
% Pour	0	87	94	81	16	0	107	142
% Recovery	97	114	105	105	> 76	34	140	158
Color	cream	brown	tan	brown	white	gray	gray	white
Subsidence	-	slow	rapid	rapid	slow	-	slow	rapid
Consistency	thick	thick	thin	thick	thin	thick	thick	thick
W Glass	-	good	good	good	fair	-	good	fair
Resuspension	-	easy	easy	easy	moderate	-	easy	easy
Supernatant	-	yellow	yellow	-	yellow	-	yellow	yellow

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TOROID SUMMARY SHEET

Toroid Run No. 69					70			
Rotator No. 2					2			
Dates 8-25-55 - 9-8-55					9-9-55 - 9-20-55			
Hr. 200					206			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	Fernald	Fernald	Fernald	D-17	Distilled Water	Fernald	Fernald	Fernald
Calcination °C	800	800	800	800	-	800	800	800
Avg Part Dia, μ (Pre)	2.5	2.5	2.5	2.1	-	2.5	2.5	2.5
g Th/kg H ₂ O	1000	1000	1000	1000	-	500	1000	1000
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	H ₂
psi	90	90	90	90	80	80	80	25
Temp - Nominal	250	250	250	250	200	200	200	200
Actual	243	256	265	271	192	192	-	197
CORROSION								
Toroid mg/dm ²	19	21	24	47	-	- 9	- 11	- 10
mpy	0.4	0.5	0.5	1.0	-	0.2	0.2	0.2
PINS								
Defilmed, mpy 347	3.5	2.9	3.7, 3.1	6.0, 6.1	-	-	0.0	0.3
Ti-75A	5.1	5.0	5.3	7.7				
Zr-2	1.0	1.6	1.5	1.7				
Other 54S Al					(f')(g')	(f')(g')	(f')(g')	(f')(g')
Post-run: g Th/kg H ₂ O	220	-	-	1070	-	680	-	-
mg/g Th, Fe	1.3	1.4	1.6	3.2	-	1.2	0.7	0.6
Cr	0.2	0.1	0.3	1.0	-	0.1	0.1	0.1
Ni	0.2	0.2	0.3	0.5	-	0.2	0.1	0.1
Al						46	23	34
mg/l, Cl	-	-	-	9				
pH Slurry	-	-	-	8.3	7.6	-	-	-
Supernate	-	-	-	7.1	-	-	-	-
Part. Size > 10 μ , wt%	2	5	6	3	-	2	6	3
3-10 μ	2	2	7	3	-	2	6	7
1-3 μ	3	2	5	14	-	7	11	10
< 1 μ	93	84	82	80	-	89	77	80
Avg Dia, μ	~0.1	~0.1	~0.1	0.6	-	~0.1	~0.2	~0.2
% Pour	2	0	0	71	(1')	45	0	0
% Recovery	35	85	55	99	-	105	57	61
Color	white	cream	cream	cream	gray	gray	gray	gray
Subsidence	-	-	-	slow	-	-	-	-
Consistency	thick	thick	thick	thick	-	thick	thick	th
Wet Glass	-	-	-	good				
Resuspension	-	-	-	easy				

TOROID SUMMARY SHEET

Toroid Run No. 71					72			
R tor No. 2					2			
Dates 9-22-55 - 9-24-55					10-3-55 - 10-9-55			
Hr. 56					149			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	Dist.	Dist.	Fernald	Fernald	D-17	Fernald	D-17	D-17
	Water	Water						
Calcination °C	-	-	800	800	800	800	800	800
Avg Part Dia, μ (Pre)	-	-	2.5	2.5	2.1	2.5	2.1	2.1
g Th/kg H ₂ O	-	-	1000	1000	1000	1000	1000	1000
Additive		NiSO ₄		NiSO ₄			ThF ₄ (h')	ThF ₄ (h')
Conc.		0.00018M		0.0005M			100 ⁴ ppm F	100 ⁴ ppm F
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	86	86	86	86	96	96	96	96
Temp - Nominal	200	200	200	200	300	300	300	300
Actual	194	194	197	197	296	296	293	290
CORROSION								
Toroid mg/dm ²	-	-	- 4	- 6	- 58	- 7	- 70	- 46
mpy	-	-	0.3	0.5	1.7	0.2	2.0	1.3
PINS								
Defilmed, mpy 347	0.0	WG	WG, 0.1	WG	20 ^b	0.2	23 ^b	8.6 ^b
Ti-75A					8.0	0.0	13	6.0
Zr-2					0.2	WG	2.4, 3.8 ^d	1.9, 1.2 ^d
Other 54 S Al	645, 714	WG, 6.3	(g')	(g')				
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	-	-	-	-	1098	993	1070	1070
Cr	-	-	0.3	0.2	3.9	0.4	4.6	3.0
Ni	-	-	0.0	0.0	1.0	0.1	1.1	0.9
Al	-	-	0.0	0.3	0.6	0.1	0.4	0.3
			23	29				
mg/l, Cl	-	< 2	-	-	-	-	-	-
Ni	-	1	-	-	-	-	-	-
pH Slurry	-	6.7	-	-	9.0	7.9	9.0	8.4
Supernate	-	7.0	-	-	8.2	-	-	-
Part. Size > 10 μ								
	2	-	1	7	-	-	1	1
3-10 μ	5	-	5	10	-	-	2	3
1-3 μ	45	-	36	13	-	-	11	35
< 1 μ	48	-	58	70	-	-	86	61
Avg Dia, μ	1.0	-	0.9	0.5	-	-	~0.3	0.8
% Pour	(1')	(1')	0	0	59	0	80	84
% Recovery	-	-	> 75	107	100	90	103	103
Color	brown	brown	white	white	gray	cream	gray	gray
Subsidence	-	-	-	-	slow	slow	slow	slow
Consistency	thick	-	thick	thick	thick	thick	thick	thick
Glass	-	-	-	-	good	good	good	good
Resuspension								

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TOROID SUMMARY SHEET

Toroid Run No. 73					78			
Rotator No. 2					4			
Dates 10-3-55 - 10-9-55					11-22-55 - 12-13-55			
Hr. 208					27 430			
fps 23					10 5			
Toroid	M	N	O	P	E	F	G	H
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	800	800	1600	1200	650	1600	1200	800
Avg Part Dia, μ (Pre)	2.1	2.1	2.4	2.6	2.1	2.1	2.6	2.1
g Th/kg H ₂ O	1500	1000	1500	1500	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	96	96	96	96
Temp - Nominal	300	300	300	300	250	250	250	250
Actual	296	296	293	290	241	264	250	250
CORROSION								
Toroid mg/dm ²	- 92	- 62	-633	-693	- 21	-	- 6	- 23
mpy	1.9	1.3	13	14	0.2	-	0.1	0.2
PINS								
Defilmed, mpy 347	42 ^b	(b)(c')	88 ^b 70	63 ^b 65	0.3, 0.2	-	0.3, 0.2	0.4, 0.5
Ti-75A	13	11	32 ^b	32 ^b	0.2	-	0.3	0.7
Zr-2	3.4	2.1	8.2 ^b	5.4	-	-	WG	WG
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	4.4	4.7	28.3	30.5	1.3	-	0.4	1.5
Cr	0.9	1.0	4.6	5.6	0.1	-	0.1	0.4
Ni	0.8	0.8	4.7	5.3	0.2	-	0.1	0.2
mg/l, Cl								
	-	-	-	-	16	-	23	11
pH Slurry								
	-	8.6	-	-	6.6	-	6.8	10.7
Supernate	-	6.9	-	-	7.4	-	7.6	8.7
Part. Size > 10 μ								
	1	7	3	1	0	-	13	8
3-10 μ	2	66	10	5	10	-	29	17
1-3 μ	15	24	70	25	50	-	31	47
< 1 μ	82	3	17	69	40	-	27	28
Avg Dia, μ	0.5	3.9	1.8	0.7	1.2	-	2.2	1.5
% Pour								
	0	51	0	0	74	dry	94	89
% Recovery								
	47	92	33	87	95	95	102	103
Color								
	gray	gray	black	black	white	white	white	white
Subsidence								
	-	slow	-	-	-	-	-	-
Consistency								
	thick	thick	thick	thick	thin	-	thin	th
Wet Glass								
	-	good	-	-	easy	-	easy	ea
Resuspension								
			magnetic	magnetic				

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TOROID SUMMARY SHEET

Toroid Run No. 79 ^p					80			
Rotator No. 5					4			
D 3 12-15-55 - 12-28-55					12-15-55 - 12-30-55			
Hr. 282					342			
fps 26					15			
Toroid	V ^p				E	F	G	H
Load - Identification	D-17				D-17	D-17	D-17	D-17
Calcination °C	1600				650	1600	1200	800
Avg Part Dia, μ (Pre)	2.4				2.1	2.4	2.6	2.1
g Th/kg H ₂ O	1000				1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂				0 ₂	0 ₂	0 ₂	0 ₂
psi	110				90	90	90	90
Temp - Nominal	250				250	250	250	250
Actual	248				242	248	264	250
CORROSION								
Toroid mg/dm ²	- 45				- 30	- 44	- 63	- 40
mpy	0.7				0.4	0.6	0.8	0.5
PINS								
Defilmed, mpy 347	3.7, 3.3 2.9 ⁱ , 3.1 ^j				2.4, 2.8	1.9 ^b , 2.2	1.8, 1.5	2.3, 2.2
Ti-75A					0.9	0.8	2.2	2.9
Zr-2					-	0.5	0.1	0.9
Other								
Post-run: g Th/kg H ₂ O	990				1090	1170	1040	1050
mg/g Th, Fe	4.3				1.9	3.0	4.1	2.4
Cr	1.1				0.8	0.6	0.8	1.1
Ni	0.6				0.3	0.5	1.0	0.4
mg/l, Cl	11				-	11	8	13
Cr					-	37	42	-
pH Slurry	7.7				5.8	5.7	5.2	7.2
Supernate	7.6				-	6.1	5.6	6.4
Part. Size > 10 μ	0				1	6	6	2
3-10 μ	2				11	29	20	10
1-3 μ	15				30	48	32	36
< 1 μ	83				58	17	42	52
Avg Dia, μ	~0.4				0.8	2.1	1.3	1.0
% Pour	82				60	80	84	84
% Recovery	97				90	99	99	92
Color	gray				cream	gray	gray	cream
Subsidence	-				slow	-	-	-
Consistency	thin				thick	thin	thick	thick
W Glass	-				good	slight	good	good
Resuspension	easy				easy	easy	easy	easy
Supernatant						yellow	yellow	

TOROID SUMMARY SHEET

Toroid Run No. 81 ^K					82 ^P				
Rotator No. 2					5				
Dates 12-19-55 - 12-25-55					12-28-55 - 1-7-56				
Hr. 208					244				
fps 26					27				
Toroid	M	N ^K	O	P	T				
Load - Identification	Fernald	D-17	D-17	D-17	D-17				
Calcination °C	800	800	800	800	1600C ²				
Avg Part Dia, μ (Pre)	2.5	2.1	2.1	2.1	2.4				
g Th/kg H ₂ O	1000	1000	1000	1000	1000				
Additive		ThF ₄ (h')		ThF ₄ (h')					
Conc.		1000 ppm F		100 ppm F					
Atm	0	0	0	0	0				
psi	96	96	96	96	116				
Temp - Nominal	300	300	300	300	250				
Actual	266	295	300	300	249				
CORROSION									
Toroid mg/dm ²	- 12	- 33	-144	- 95	- 52				
mpy	0.3	0.7	3.0	2.0	0.9				
PINS									
Defilmed, mpy 347	1.3 ^j	6.4 ^b	7.1, 5.3	7.7, 7.5	WG, WG ^p				
					WG, WG ^p				
Ti-75A	2.1	8.4 ^b	5.5	6.2					
Zr-2	WG	4.1	2.0	1.9					
Other									
Post-run: g Th/kg H ₂ O	1180	1205	1320	1105	705				
mg/g Th, Fe	0.7	2.1	8.3	6.1	33.7				
Cr	0.2	0.6	1.9	1.4	2.5				
Ni	0.1	0.5	1.6	1.3	4.5				
F	-	1.1	0.4	0.7					
mg/l, Cl					17				
pH Slurry	-	6.8	8.6	7.5	6.1				
Supernate	-	-	7.4	7.4	8.2				
Part. Size > 10 μ	2	9	2	4	1				
3-10 μ	22	13	3	29	1				
1-3 μ	54	11	40	59	15				
< 1 μ	22	67	55	8	83				
Avg Dia, μ	1.8	~0.2	0.9	2.6	0.7				
% Pour	0	77	95	87	73				
% Recovery	101	107	121	103	80				
Color	cream	cream	gray	gray	gray				
Subsidence	-	-	-	-	-				
Consistency	thick	thick	thick	thick	thin				
Wet Glass	-	good	good	good	-				
Resuspension			easy						

TOROID SUMMARY SHEET

Toroid Run No. 83 ¹⁰					85 ¹¹			
R tor No. 4					1			
Dates 1-10-56 - 2-17-56					1-26-56 - 2-6-56			
Hr. 213					262			
fps 26					26			
Toroid	E	F	G	H	M	N	O	P
Load - Identification	D-17	D-17	D-17	D-17	TO-10	PO-10	LO-1	CS-21
Calcination °C	650	1600	1200	800	900-24	900-24	800	800
Avg Part Dia, μ (Pre)	2.1	2.4	2.6	2.1	0.7	0.6	2.3	0.6
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	250	245	268	255	247	250	251	252
CORROSION								
Toroid mg/dm ²	- 42	-	-800	-195	- 30	- 27	- 53	- 30
mpy	0.9	-	16	4.0	0.5	0.4	0.9	0.5
PINS								
Defilmed, mpy 347	3.3, 3.2	-	36, ^b 40	24, ^p 27	3.5, 3.2 ^b	9.6, ^b 8.4	4.2, 4.0	2.2, 3.3
Ti-75A	2.0	-	11	8.5	5.1 ^b	2.4	4.8	5.7
Zr-2	-	-	3.0	2.1	-	-	1.6	1.3
Other								
Post-run: g Th/kg H ₂ O	1108	-	1800	1106	1052	-	-	1205
mg/g Th, Fe	2.7	-	41.4	12.8	2.0	1.9	3.5	1.9
Cr	0.6	-	9.1	3.3	0.4	0.5	0.7	0.5
Ni	0.5	-	7.3	2.2	0.4	0.3	0.6	0.3
mg/l, Cl	-	-	-	24	-	-	-	-
pH Slurry	6.0	-	8.8	7.9	7.4	-	-	7.7
Supernate	-	-	-	7.4	-	-	-	-
Part. Size > 10 μ	1	-	5	4	1	1	4	3
3-10 μ	3	-	67	18	6	9	8	7
1-3 μ	19	-	19	62	23	25	31	25
< 1 μ	77	-	9	16	70	65	57	65
Avg Dia, μ	0.6	-	4.1	2.1	0.7	0.6	0.8	0.6
% Pour	53	dry	66	79	68	0	0	64
% Recovery	103	83	124	104	103	98	92	105
Color	cream	-	black	gray	tan	cream	-	cream
Subsidence	slow	-	slow	slow	-	-	-	-
Consistency	thick	-	thick	thick	thick	thick	thick	thick
W Glass	good	-	good	good	good	-	-	good
Resuspension				easy				
			magnetic					

TOROID SUMMARY SHEET

Toroid Run No. 86 ⁰¹					87			
Rotator No. 1					1			
Dates 2-7-56 - 2-16-56					2-17-56 - 2-28-56			
Hr. 206					260			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	IO-1	CS-21	HC1-7,11	CS-21	D-17	D-17	D-17	D-17
					Fract. B		Fract. A	Fract. C
Calcination °C	800	800	1200	1200-5	1600	1600	1600	1600
Avg Part Dia, μ (Pre)	2.3	0.6	3.2	0.7	1.6	2.4	5.4	0.7
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	243	250	255	260	242	250	252	-
CORROSION								
Toroid mg/dm ²	- 41	- 31	-116	- 33	- 36	-102	-144	- 18
mpy	0.9	0.7	2.5	0.7	0.6	1.7	-2.4	0.3
PINS								
Defilmed, mpy 347	4.2, ^b 3.3	4.9, ^b 5.0	9.3, 9.2	3.2, 2.2	1.4, ^b 1.2	5.0, ^b 4.3	8.2, ^b 5.5	0.7, 0.6
Ti-75A	3.7	3.9	8.3	3.1	0.0	3.6	7.5 ^b	0.3
Zr-2	-	-	14	0.9	-	-	3.5 ^b	WG
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	1040	1067	1120	1166	670	925	903	1005
Cr	2.7	2.1	7.2	2.0	2.4	6.9	9.4	1.2
Ni	0.6	0.4	1.1	0.4	0.6	1.4	2.3	0.2
	0.5	0.4	1.4	0.4	0.4	1.2	2.2	0.2
mg/l, Cl								
Cr	-	-	-	-	< 2	< 2	< 2	< 2
	-	-	121	-	79	41	21	83
pH Slurry								
Supernate	6.8	6.8	5.2	6.6	5.4	6.1	6.9	6.3
	6.5	6.8	5.2	6.2	5.2	6.0	6.6	6.0
Part. Size > 10 μ								
3-10 μ	0	3	2	4	0	4	21	1
1-3 μ	9	3	2	2	1	28	44	2
< 1 μ	24	18	19	17	79	50	28	8
Avg Dia, μ	67	76	77	77	20	18	7	89
	0.6	0.6	0.6	0.6	1.4	2.2	4.5	0.8
% Pour								
% Recovery	59	73	76	68	55	82	82	83
Color	101	99	106	105	92	99	100	100
	tan	tan	tan	tan	gray	gray	brown	white
Subsidence	slow	slow	-	-	rapid	rapid	rapid	-
Consistency	thick	thick	thick	thick	thin	thin	thin	th
Wet Glass	good	good	good	good	slight	fair	fair	go
Resuspension	easy	easy	easy	easy	moderate	moderate	moderate	easy
Supernatant			yellow		yellow	yellow		

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TOROID SUMMARY SHEET

Toroid Run No. 88					90			
Rotator No. 4					4			
I 2-17-56 - 4-10-56					4-12-56 - 4-23-56			
Hr. 316					263			
fps 26					26			
Toroid	E	F	G	H	E	F	G	H
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
	Fract. E		Fract. A	Fract. C				
Calcination °C	650	650	650	650	1400-4	1400-2	1400-96	1400-24
Avg Part Dia, μ (Pre)	1.3	2.1	3.7	0.4	2.2	2.7	2.6	2.8
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc...								
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	96	96	96	96
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	240	240	260	230	243	-	276	248
CORROSION								
Toroid mg/dm ²	-113	-	- 72	- 53	-164	- 88	-180	-135
mpy	1.6	-	1.0	0.7	2.7	1.5	3.0	2.2
PINS								
Defilmed, mpy 347	7.1, ^b 7.4	-	2.3, ^b 3.2	2.8, 3.0	3.8, ^b 4.2	4.2, 3.5	5.6, ^b 5.5	4.5, 4.2
Ti-75A	5.7 ^b	-	3.9	3.2	2.3 ^b	3.0	6.7	1.8
Zr-2	-	-	2.2	2.8	-	2.9 ^b	1.8	2.0
Other								
Post-run: g Th/kg H ₂ O	967	-	1127	-	740	1050	1024	1175
mg/g Th, Fe	7.5	-	4.3	3.4	10.5	5.6	11.5	8.1
Cr	2.0	-	1.1	0.7	1.8	1.1	2.6	1.8
Ni	0.6	-	0.4	0.2	1.7	0.9	2.0	1.4
mg/l, Cl	-	-	-	-	-	-	3	3
Cr	-	-	-	-	25	37	20	21
pH Slurry	6.8	-	7.1	-	6.0	5.3	5.8	5.1
Supernate	7.1	-	-	-	6.8	6.7	6.1	5.7
Part. Size > 10 μ	2	-	4	6	11	2	5	8
3-10 μ	2	-	3	6	23	19	35	37
1-3 μ	64	-	39	3	41	38	39	29
< 1 μ	34	-	54	85	25	41	21	26
Avg Dia, μ	1.3	-	1.0	~0.1	2.1	1.2	2.4	2.5
% Pour	62	dry	68	0	50	70	90	108
% Recovery	64	98	120	55	99	99	102	122
Color	tan	-	cream	cream	brown	brown	brown	tan
Subsidence	rapid	-	slow	-	rapid	slow	rapid	slow
Consistency	thick	-	thick	thick	thin	thick	thin	thick
W glass	good	-	good	-	fair	good	fair	good
R suspension	easy	-	-	-	easy	easy	easy	easy
Supernatant					yellow	yellow	yellow	yellow

TOROID SUMMARY SHEET

Toroid Run No. 91					92 ⁹¹			
Rotator No. 2					4			
Dates 4-13-56 - 4-23-56					4-24-56 - 5-7-56			
Hr. 232					294			
fps 26					26			
Toroid	M	N	O	P	E	F ⁹¹	G	H
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
	Fract. C		Fract. B	Fract. A				
Calcination °C	1200-7	1200-7	1200-7	1200-7	800-8	800-8	800-8	800-8
Avg Part Dia, μ (Pre)	0.5	2.8	1.2	4.9	2.4	2.4	2.4	2.4
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive					NaOH	NaOH	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇
Conc. M					0.01 (pH 1)	0.01 (pH 1)	0.1 (pH 1)	0.1 (pH 1)
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	H ₂	0 ₂	H ₂
psi	90	90	90	90	90	30	90	30
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	245	263	-	263	240	246	275	251
CORROSION								
Toroid mg/dm ²	11	155	80	347	179	696	179	37
mpy	0.2	2.9	1.5	6.5	2.6	10	2.6	0.5
PINS								
Defilmed, mpy 347	1.2, 1.2	3.1, 2.9 ^b	4.6, 4.4	10, 13 ^b	3.0	35, 35 ^b	14, 24 ^b	5.2, 5.4
Ti-75A	3.8	2.6	1.0	0.2 ^b	3.1	8.1	91 ^b	1860 ^{g*}
Zr-2	-	-	0.2	2.8	0.7	1.6	WG	0.4
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	914	983	1430	1220	993	-	-	-
Cr	0.8	11.0	5.7	27.1	11.3	40.4	12.4	2.6
Ni	0.2	1.5	1.1	4.8	1.4	7.1	2.5	0.9
Ti	0.1	1.7	1.0	0.4	1.9	5.5	2.1	0.4
PO ₄							5	16
mg/l, Cl		2		27	25		15	14
pH Slurry								
Supernate	6.5	5.9	5.2	8.6	6.2	-	10.3	-
	-	6.1	-	8.3	6.4	-	-	-
Part. Size > 10 μ								
3-10 μ	3	3	3	10	2	7	1	15
1-3 μ	7	16	8	33	4	41	6	7
< 1 μ	4	36	64	46	51	38	19	23
Avg Dia, μ	86	45	25	11	43	14	74	55
	0.4	1.2	1.4	2.7	1.2	2.9	0.6	0.9
% Pour								
% Recovery	37	59	77	94	71	0	0	0
Color	126	80	98	99	88	97	101	99
Subsidence	white	brown	brown	black	tan	black	brown	gray
Consistency	-	-	-	-	-	-	rapid	-
Wet Glass	thick	thick	thick	thick	thin	thick	thick	th
Resuspension	good	fair	good	fair	slight	good	good	-
Supernatant	easy	easy	easy	easy	easy	-	-	-
	-	yellow	yellow	magnetic	turbid	magnetic		

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TOROID SUMMARY SHEET

Toroid Run No. 93					94			
Rotator No. 3					4			
5-3-56 - 5-23-56					5-7-56 - 5-24-56			
Hr. 475					402			
fps 26					26			
Toroid	I	J	K	L	E	F	G	H
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	800	1600	1600	800	800-8	800-8	800-8	800-8
Avg Part Dia, μ (Pre)	2.1	2.4	2.4	2.1	2.4	2.4	2.4	2.4
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive					natural	natural	*	*
Conc.					pH 7	pH 7	**	**
Atm	O ₂	O ₂	O ₂	O ₂	O ₂	H ₂	O ₂	H ₂
psi	90	90	90	90	90	30	90	30
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	248	256	262	250	246	250	277	242
CORROSION								
Toroid mg/dm ²	- 55	-186	- 87	- 55	-194	-	-286	- 83
mpy	0.5	1.7	0.8	0.5	2.1	-	2.9	0.9
PINS								
Defilmed, mpy 347	u'	u'	3.7, ^b 3.9	3.5, ^b 2.1	1.9	-	11, ^b 20	6.3, ^b 6.0
Ti-75A	-	-	1.8	0.7	3.6	-	7320	1360
Zr-2	-	-	0.4	0.0	0.5	-	0.7	0.7
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	1010	1177	1308	1053	1062	-	-	-
Cr	3.8	11.8	5.1	4.5	13.6	-	17.4	5.6
Ni	0.6	2.7	2.4	0.0	1.9	-	5.8	1.6
Cr ⁶⁺	0.6	2.2	1.5	0.8	2.0	-	3.4	0.8
Cr	0.5	1.7	1.5	0.5				
PO ₄							59	86
mg/l, Cl								
Cr	31	< 1	75	52				
pH Slurry	6.3	7.3	2.4	6.0	5.5	-	-	-
Supernate	6.8	7.7	2.5	6.4	-	-	-	-
Part. Size > 10 μ								
	0	0	1	0	1	-	5	2
3-10 μ	3	18	35	2	4	-	12	6
1-3 μ	22	57	48	23	48	-	35	29
< 1 μ	75	25	16	75	47	-	48	63
Avg Dia, μ	0.7	1.7	2.5	0.7	1.1	-	1.0	0.8
% Pour								
	74	92	96	90	71	dry	0	0
% Recovery								
	90	125	114	102	91	57	87	110
Color								
	tan	gray	black	tan	brown	-	brown	gray
Subsidence								
	slow	-	rapid	-	-	-	-	-
Consistency								
	thick	thin	thin	thick	-	-	thick	thick
W glass								
	fair	fair	slight	fair	good	-	-	-
R spension								
	easy	easy	easy	easy	easy			
Supernatant								
	yellow	-	yellow	yellow				
*NaH ₂ PO ₄ , Na ₂ HPO ₄								
**0.1m)								
0.1m) pH 7								

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TOROID SUMMARY SHEET

Toroid Run No. 95					96 ⁽¹⁾			
Rotator No. 4					3			
Dates 6-14-56 - 6-25-56					6-19-56 - 6-21-56			
Hr. 261					50			
fps 26					26			
Toroid	E	F	G	H	I	J	K	L
Load - Identification	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17
	Fract. A		Fract. C	Fract. B				
Calcination °C	1400-2	1400-2	1400-2	1400-2	800-9	1200-9	800-9	1200-9
Avg Part Dia, μ (Pre)	4.5	2.7	0.6	1.5	2.1	2.3	2.1	2.3
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0	0	0	0	0	0	0	0
psi	96	96	96	96	55	55	55	55
Temp - Nominal	250	250	250	250	r'	r'	r'	r'
Actual	247	256	276	255	95	100	95	-
CORROSION								
Toroid mg/dm ²	192	180	54	30	s'	s'	- 3	- 10
mpy	3.2	3.0	0.9	0.5	s'	s'	0.3	0.9
PINS								
Defilmed, mpy 347	4.5, 5.1 ^b	4.0, 3.8	4.1, 3.6	1.7, 1.8	1.7, 1.8	2.3, 1.8	1.7, 1.2	0.6, 1.9
Ti-75A	5.1 ^b	1.9	1.5	1.2	1.2	0.0, 1.6	0.0, WG	0.1, 1.4
Zr-2	-	1.5	WG	0.4	-	-	-	-
Other								
Post-run: g Th/kg H ₂ O	1040	-	1224	930	s'	s'	-	8.2
mg/g Th, Fe	13.1	12.0	4.0	1.9	s'	s'	0.3	0.7
Cr	3.0	2.7	0.7	0.3	s'	s'	0.1	0.2
Ni	2.1	2.3	0.6	0.4	s'	s'	0.0	0.1
mg/l, Cl	8	-	-	< 2	s'	s'	s'	s'
pH Slurry	6.4	-	4.8	4.8	s'	s'	-	8.2
Supernate	6.8	-	-	4.8	s'	s'	-	7.4
Part. Size > 10 μ	1	2	2	1	s'	s'	1	5
3-10 μ	21	8	2	7	s'	s'	3	9
1-3 μ	43	33	12	73	s'	s'	31	31
< 1 μ	35	57	84	19	s'	s'	65	55
Avg Dia, μ	1.9	0.8	0.7	1.4	s'	s'	0.7	0.9
% Pour	75	0	75	70	s'	s'	0	84
% Recovery	105	127	100	101	s'	s'	85	105
Color	brown	brown	gray	gray	white	white	white	white
Subsidence	slow	-	slow	rapid	s'	s'	-	slow
Consistency	thin	thick	thick	thin	-	-	thick	thin
Wet Glass	fair	-	good	fair	s'	s'	-	go
Resuspension	easy	-	easy	easy	s'	s'	-	easy
Supernatant	yellow	-	yellow	yellow				

TOROID SUMMARY SHEET

Toroid Run No. 96(2)					96(3)			
Rotor No. 3					3			
Dates 6-21-56 - 6-26-56					6-27-56 - 7-5-56			
Hr. 121					195			
fps 26					26			
Toroid	I	J	K	L	I	J	K	L
Load - Identification	96(1)-I	96(1)-J	D-17	D-17	D-17	D-17	96(2)-K	96(2)-L
Calcination °C	800-9	1200-9	800-9	1200-9	800-9	1200-9	800-9	1200-9
Avg Part Dia, μ (Pre)	-	-	2.1	2.3	2.1	2.3	-	-
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	55	55	55	55	55	55	55	55
Temp - Nominal	r'	r'	r'	r'	r'	r'	r'	r'
Actual	91	100	93	-	102	105	100	-
CORROSION								
Toroid mg/dm ²	- 8	- 16	s'	s'	s'	s'	- 20	- 22
mpy	0.2 ^{v'}	0.4 ^{v'}	s'	s'	s'	s'	0.4 ^{v'}	0.3 ^{v'}
PINS								
Defilmed, mpy 347	1.2,0.9	1.4,1.6	2.0,2.1	1.4,0.8	1.7,1.5	0.2, WG	1.3,1.1	0.6,0.5
Ti-75A	0.9	0.0, WG	2.0,2.5	1.7,1.0	0.9	0.5,0.3	0.2,0.5	1.2,1.2
Zr-2	-	-	-	-	-	-	-	-
Other								
Post-run: g Th/kg H ₂ O	-	1050	s'	s'	s'	s'	-	1020
mg/g Th, Fe	0.5	1.1	s'	s'	s'	s'	2.0	1.4
Cr	0.1	0.3	s'	s'	s'	s'	0.2	0.4
Ni	0.1	0.2	s'	s'	s'	s'	0.2	0.2
mg/l, Cl	-	-	s'	s'	s'	s'	-	22
pH Slurry	-	7.9	s'	s'	s'	s'	-	7.8
Supernate	-	6.8	s'	s'	s'	s'	-	6.5
Part. Size > 10 μ	1	2	s'	s'	s'	s'	2	1
3-10 μ	2	6	s'	s'	s'	s'	4	6
1-3 μ	24	33	s'	s'	s'	s'	17	33
< 1 μ	73	59	s'	s'	s'	s'	77	60
Avg Dia, μ	0.5	0.8	s'	s'	s'	s'	0.6	0.7
% Pour	0	78	s'	s'	s'	s'	0	79
% Recovery	81	118	s'	s'	s'	s'	81	100
Color	white	white	white	white	white	white	white	white
Subsidence	-	slow	s'	s'	s'	s'	-	slow
Consistency	thick	thick	thick	-	-	-	thick	thick
W. Glass	-	good	s'	s'	s'	s'	-	good
Resuspension	-	easy	s'	s'	s'	s'	-	-

TOROID SUMMARY SHEET

Toroid Run No. 96(4)					96(5)			
Rotator No. 3					3			
Dates 7-16-56 - 7-25-56					7-26-56 - 8-1-56			
Hr. 208					147			
fps 26					26			
Toroid	I	J	K	L	I	J	K	L
Load - Identification	96(3)-I	96(3)-J	D-17	D-17	D-17	D-17	96(4)-K	96(4)-L
Calcination °C	800-9	1200-9	800-9	1200-9	800-9	1200-9	800-9	1200-9
Avg Part Dia, μ (Pre)	-	-	2.1	2.3	2.1	2.3	-	-
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	251	264	244	-	252	248	267	-
CORROSION								
Toroid mg/dm ²	- 24	- 74	s'	s'	s'	s'	- 90	-196
mpy	0.3 ^v	0.8 ^v	s'	s'	s'	s'	1.1 ^v	2.4 ^v
PINS								
Defilmed, mpy 347	4.2,4.0	2.1,2.8	28, ^b 27	2.4,2.2	4.9,2.4	2.9,2.4	3.5,3.3	2.8,0.3
Ti-75A	7.2	0.9,1.5	11, ^b 10	1.9,1.9	7.4	2.0,2.6	6.6,4.3	1.6,1.5
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	1347	1030	s'	s'	s'	s'	1410	992
mg/g Th, Fe	2.8	5.1	s'	s'	s'	s'	7.7	14.1
Cr	0.6	1.1	s'	s'	s'	s'	1.7	2.2
Ni	0.4	0.7	s'	s'	s'	s'	1.0	2.2
mg/l, Cl	-	-	s'	s'	s'	s'	< 2	< 2
Cr	-	-	s'	s'	s'	s'	7	50
pH Slurry	-	6.1	s'	s'	s'	s'	6.8	6.5
Supernate	-	-	s'	s'	s'	s'	6.3	5.5
Part. Size > 10 μ	3	3	s'	s'	s'	s'	6	2
3-10 μ	9	6	s'	s'	s'	s'	4	11
1-3 μ	18	39	s'	s'	s'	s'	20	33
< 1 μ	70	52	s'	s'	s'	s'	70	54
Avg Dia, μ	0.6	0.9	s'	s'	s'	s'	0.6	0.9
% Pour	69	82	s'	s'	s'	s'	62	83
% Recovery	119	101	s'	s'	s'	s'	134	103
Color	cream	gray	gray	tan	-	-	tan	gray
Subsidence	slow	-	s'	s'	s'	s'	slow	-
Consistency	thick	thick	-	-	-	thick	thick	tl
Wet Glass	good	good	s'	s'	s'	s'	good	g
Resuspension	-	-	s'	s'	s'	s'	-	easy
Supernatant		yellow						yellow

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TOROID SUMMARY SHEET

Toroid Run No. 96(6)					97			
Rotator No. 3					4			
D...s 8-2-56 - 8-4-56					6-27-56 - 7-6-56			
Hr. 50					214			
fps 26					26			
Toroid	I	J	K	L	E	F	G	H
Load - Identification	96(5)-I	96(5)-J	D-17	D-17	D-17	D-17	D-17	D-17
Calcination °C	800-9	1200-9	800-9	1200-9	1400-96	1400-96	1400-96	1400-96
Avg Part Dia, μ (Pre)	-	-	2.1	2.3	5.1	2.6	0.5	1.5
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	254	223	256	-	257	258	285	260
CORROSION								
Toroid mg/dm ²	- 5	-177 _v	- 35	- 53	-187	-138	- 5	- 74
mpy	0.1	3.9	3.0	4.6	3.8	2.8	0.1	1.5
PINS								
Defilmed, mpy 347	0.7,0.8	WG,WG	12, 11	6.0,4.6	5.5,6.6	6.1,7.5	1.1,0.8	8.3,10.5
Ti-75A	3.7	1.2,3.4	8.0,7.4	4.1,6.5	6.4	2.0	0.3	8.2 ^b
Zr-2					-	2.1	0.2	5.1 ^b
Other								
Post-run: g Th/kg H ₂ O	992	-	1024	1013	615	915	-	1030
mg/g Th, Fe	0.5	11.6	2.1	3.6	13.2	9.4	0.4	5.3
Cr	0.1	2.9	0.7	0.7	2.3	2.0	0.1	1.2
Ni	0.1	1.9	0.5	0.6	2.1	1.6	0.0	0.9
mg/l, Cl	-	-	-	7	-	-	-	-
Cr					16	31	-	49
pH Slurry	7.2	-	7.0	6.0	6.4	5.8	-	5.5
Supernate	-	-	-	6.1	7.7	6.6	-	6.4
Part. Size > 10 μ	6	2	9	2	9	2	1	1
3-10 μ	4	13	5	13	40	25	2	2
1-3 μ	18	36	18	40	27	47	4	16
< 1 μ	72	49	68	45	24	26	93	81
Avg Dia, μ	0.6	1.0	0.6	1.1	3.0	2.0	0.7	0.8
% Pour	51	0	65	88	54	76	0	81
% Recovery	104	53	97	101	95	100	-	101
Color	cream	-	cream	tan	brown	brown	white	tan
Subsidence	-	-	-	-	rapid	moderate	-	slow
Consistency	thick	thick	thick	thick	thin	thin	thick	thick
W Glass	good	-	good	good	slow	fair	-	good
Resuspension	easy	-	easy	easy	easy	easy	-	easy
Supernatant				yellow	yellow	yellow	-	yellow

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TOROID SUMMARY SHEET

Toroid Run No. 98(1)					98(2)			
Rotator No. 2					2			
Dates 6-27-56 - 6-29-56					6-29-56 - 7-2-56			
Hr. 41					65			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	Dist.	D-17	D-17	Dist.	Dist.	D-17	D-17	Dist.
	Water			Water	Water			Water
Calcination °C	-	800-8	800-8	-	-	800-8	800-8	-
Avg Part Dia, μ (Pre)	-	2.4	2.4	-	-	2.4	2.4	-
g Th/kg H ₂ O	-	1000	1000	-	-	1000	1000	-
Additive	Na ₂ P ₂ O ₇			Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇
Conc. M	0.1 M			0.01 M	0.1 M	0.01 M	0.1 M	0.01 M
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	90	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	246	-	263	251	244	-	264	251
CORROSION								
Toroid mg/dm ²	-	- 47	- 33	-	-	-108	-135	-
mpy	-	5.0	3.5	-	-	7.2	9.0	-
PINS								
Defilmed, mpy 347	12	12	9.7, 10.1	2.4, 1.8	8.5	y'	20, 18	y'
Ti-75A	23	11	7.0	0.3	21	y'	42 ^b	y'
Zr-2	WG	1.8	0.9	WG	2.1	y'	0.9	y'
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	18.5	1010	1123	5.1	-	567	1133	-
Cr	-	3.0	2.3	-	-	5.5	9.1	-
Ni	-	0.9	0.6	-	-	1.9	1.8	-
PO ₄	-	0.5	0.2	-	-	2.4	1.7	-
						2.3	1.2	-
mg/l, Cl	< 2	25						
PO ₄	11,600			1440	12,500	211	-	1940
pH Slurry	-	6.3	7.5	-	-	7.0	6.5	-
Supernate	8.9	7.0	-	7.2	8.0	7.1	-	7.1
Part. Size > 10 μ								
3-10 μ	-	0	2	-	-	0	7	-
1-3 μ	-	6	6	-	-	5	15	-
< 1 μ	-	46	39	-	-	47	49	-
Avg Dia, μ	-	48	53	-	-	48	29	-
	-	1.0	0.9	-	-	1.1	1.8	-
% Pour	-	80	77	-	-	58	45	-
% Recovery	-	96	103	-	-	103	120	-
Color	tan	tan	white	brown	brown	gray	brown	0
Subsidence	-	slow	slow	-	-	-	slow	-
Consistency	-	thin	thick	-	-	thin	thick	-
Wet Glass	-	fair	good	-	-	fair	-	-
Resuspension	-	easy	easy	-	-	difficult	easy	-
Supernatant	yellow	yellow	-	magnetic		turbid	yellow	yellow
					magnetic			

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TOROID SUMMARY SHEET

Toroid Run No. 98(3)					100			
Rotator No. 2					2			
D 3 7/2/56-7/6/56					7/24/56-8/6/56			
Hr. 90					282			
fps 26					26			
Toroid	M	N	O	P	M	N	O	P
Load - Identification	Distilled	D-17	D-17	Distilled	LO-2A	LO-2A	LO-2A	LO-2A
	Water			Water				
Calcination °C	-	800-8	800-8	-	1000-24	1000-2	1000-96	1000-4
Avg Part Dia, μ (Pre)	-	2.4	2.4	-	1.6	1.7	1.6	1.7
g Th/kg H ₂ O	0	1000	1000	-	1000	1000	1000	1000
Additive	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇				
Conc., M	0.1	0.01	0.1	0.01				
Atm	0	0	0	0	0	0	0	0
psi	90 ²	90	90	90	90	90	90	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	247	-	264	254	250	-	263	-
CORROSION								
Toroid mg/dm ²	-	-133	-178	-	-117	-97	-65	-91
mpy	-	6.4	8.6	-	1.8	1.5	1.0	1.4
PINS								
Defilmed, mpy 347	2.9	13(a")	15,15	1.7 ^(a) , 3.1	5.2 ^(b) , 3.4	3.7, 3.6	3.9, 3.0	3.3, 3.5
Ti-75A	16	8.4(a")	28	1.8(a")	2.5	3.6	1.1	1.9
Zr-2	0.4	2.2(a")	1.4	0.3(a")	-	-	WG	WG
Other								
Post-run: g Th/kg H ₂ O								
mg/g Th, Fe	-	536	1038	-	1090	1138	1072	1093
Cr	-	8.0	12.1	-	7.9	6.6	4.1	6.3
Ni	-	2.3	2.6	-	1.3	1.3	0.9	1.1
PO ₄	-	2.0	2.0	-	1.8	1.1	1.5	1.2
PO ₄	-	2.2	12	-				
mg/l, Cl	3	-	-	< 2	4	-	8	-
PO ₄	12,700	209	4464	2150				
Cr					264		48	
pH Slurry	-	7.1	9.5	-	5.9	5.6	5.5	6.0
Supernate	8.8	9.4	9.7	7.6	6.0	-	5.4	-
Part. Size > 10 μ								
3-10 μ	-	2	3	-	1	11	0	0
1-3 μ	-	3	12	-	6	9	6	5
< 1 μ	-	35	47	-	38	30	34	38
Avg Dia, μ	-	60	38	-	55	50	60	57
	-	0.7	1.4	-	0.8	1.0	0.7	0.7
% Pour	-	48	87	-	90	43	74	58
% Recovery	-	58	102	-	101	101	102	102
Color	Brown	Grey	Brown	0	Tan	Brown	Grey	Brown
Subsidence	-	-	-	-	Slow	Slow	Slow	Slow
Consistency	-	Thin	Thick	-	Thin	Thick	Thick	Thick
W/ Glass	-	Slight	Good	-	Slight	Good	-	Good
R/ Dispersion	-	Difficult	Easy	-	Easy	-	Easy	Easy
Supernatant	Yellow	Turbid	Yellow	Yellow	Yellow	-	Yellow	Yellow

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TOROID SUMMARY SHEET

Toroid Run No.					101(f")				102(b")			
Rotator No.					4				3			
Dates					7/31/56-8/10/56				8/17/56-8/21/56			
Hr.					225 Hours				97 Hours			
fps					26 fps				10 fps			
Toroid	E	F	G	H	I	J(b")	K	L				
Load - Identification	LO-12	LO-2A	200A	CS-21	200A	LO-12	200A	200A				
			Std. Slurry		Std. Slurry		Std. Slurry	Std. Slurry				
Calcination °C	800	800	800	800	800	800	800	800				
Avg Part Dia, μ (Pre)	3.4	2.1	10-15	0.6	10-15	3.4	10-15	10-15				
g Th/kg H ₂ O	1000	1000	1000	1000	1000	500	1500	500				
Additive												
Conc.												
Atm	0	0	0	0	0	0	0	0				
psi	90 ²	90 ²	90	90 ²	80 ²	80 ²	80 ²	80 ²				
Temp - Nominal	250	250	250	250	200	200	200	200				
Actual	248	257	269	252	196	206	191	-				
CORROSION												
Toroid mg/dm ²	-41	-42	-8	-25	0	-11	-27	-20				
mpy	0.8	0.8	0.2	0.5	0.0	0.5	1.2	0.9				
PINS												
Defilmed, mpy 347	3.0,3.0	6.1,5.1	4.2,3.7	2.9,3.6	2.4(j)	5.0,1.7	1.2(j) 1.3	2.3(j),5.9				
Ti-75A	3.7	3.6	7.0	4.3	WG (j)	0.3	0.2 (j)	WG (j)				
Zr-2	-	1.5	2.8	2.9	0.0 (j)	0.1	1.8	1.1 (j)				
Other												
Post-run: g Th/kg H ₂ O	926	-	-	1050	3560	890	1170	260				
mg/g Th, Fe	2.9	3.2	1.2	2.0	0.3	1.5	1.6	2.8				
Cr	0.7	0.6	0.3	0.4	0.0	0.5	0.4	0.9				
Ni	0.4	0.4	0.1	0.2	0.1	0.2	0.3	0.5				
mg/l, Cl					10	6	-	11				
pH Slurry	6.9	-	-	6.4	7.8	9.0	8.4	7.9				
Supernate	-	-	-	-	7.4	7.9	-	7.3				
Part. Size > 10 μ	2	1	4	3	98	4	97	97				
3-10 μ	4	6	2	4	-	23	-	-				
1-3 μ	18	18	9	18	-	34	-	-				
< 1 μ	76	75	85	75	-	39	-	-				
Avg Dia, μ	0.6	0.6	0.6	0.6	25	1.4	25	23				
% Pour	59	0	0	70	61	148	51	50				
% Recovery	88	91	152	119	-	-	-	-				
Color	Cream	Cream	Cream	Cream	Brown	White	Yellow	Brown				
Subsidence	Slow	-	-	Slow	0.37(w')	0.003(w')	0.17(w')	0.25(w')				
Consistency	Thick	Thick	Thick	Thick	Thin	Thick	Thin	Thin				
Wet Glass	Good	-	-	Good	Slight	Good	Slight	Sli				
Resuspension	-	-	-	-	Easy	Easy	Easy	Easy				
Supernatant								Yellow				
Subsidence Prerun (w')					0.0035	0.004	0.006	0.0065				

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TOROID SUMMARY SHEET

Toroid Run No.	103(b")				104			
Rotator No.	4				2			
D	8/17/56-8/21/56				8/21/56-9/4/56			
Hr.	97				330			
fps	(b") 20				26			
Toroid	E	F	G	H	M	N	O	P
Load - Identification	200A	200A	10-12	200A	CS-21	CS-21	CS-21	CS-21
	Std. Slurry	Std. Slurry		Std. Slurry				
Calcination °C	800	800	800	800	800	800	800	800
Avg Part Dia, μ (Pre)	10-15	10-15	3.4	10-15	0.6	0.6	0.6	0.6
g Th/kg H ₂ O	1000	1500	500	500	1000	1000	1000	1000
Additive					NaOH(pH 11)	NaOH(pH 11)	Na ₂ P ₂ O ₇	Na ₂ P ₂ O ₇
Conc., M					~ 0.01	~ 0.01	0.01	0.01
Atm	0	0	0	0	0	H ₂	0	H ₂
psi	80 ²	80	80 ²	80 ²	90 ²	30	90 ²	30 ²
Temp - Nominal	200	200	200	200	250	250	250	250
Actual	207	201	226	200	245	260	-	257
CORROSION								
Toroid mg/dm ²	-13	-45	-18	-29	-80	-257	-84	-125
mpy	0.6	2.0	0.8	1.3	1.1	3.4	1.1	1.6
PINS								
Defilmed, mpy 347	5.3(j)	2.3(j) 2.2	5.0, 4.7	0.6(j) 2.4	6.3 (b)	17. (b)	3.7 (b)	9.1 (b)
Ti-75A	WG (j)	0.0(j)	2.1	1.4 (j)	6.5	4.4(b)	5.4	3.0
Zr-2	WG (j)	2.0	1.1	WG (j)			0.2	0.2
Other A212B					4.8	4.4	4.2	6.2
Post-run: g Th/kg H ₂ O	666	1390	946	285	858	967	1065	880
mg/g Th, Fe	1.4	2.3	2.5	4.2	6.2	19.5	6.4	9.8
Cr	0.3	0.6	0.6	1.1	1.8	5.3	1.4	2.6
Ni	0.2	0.4	0.4	0.7	1.3	3.2	1.3	1.6
PO ₄							1.3	1.8
mg/l, Cl	-	21	-	68	< 2	-	< 2	8
Cr					175	-	145	10
pH Slurry	7.3	7.8	8.2	6.7	7.6	9.5	7.3	9.8
Supernate	-	6.5	-	6.7	7.6	-	7.5	9.7
Part. Size > 10 μ	95	37	3	96	6	4	2	3
3-10 μ	-	30	12	-	3	3	2	4
1-3 μ	-	16	24	-	4	39	5	11
< 1 μ	-	17	61	-	87	54	91	82
Avg Dia, μ	20	6.5	0.8	19	~ 0.1	0.9	~ 0.1	0.5
% Pour	39	79	79	59	67	55	92	79
% Recovery	-	-	-	-	85	84	-	-
Color	Brown	Tan	White	Brown	Cream	Brown	Cream	Grey
Subsidence (w')	0.22	0.014	0.00002	0.18	0.00025	0.00025	-	0.006
Consistency	Thin	-	Thick	-	Thin	Thick	Thin	Thin
Wet Glass	Slight	Fair	Good	Slight	Slight	Good	Slight	Slight
Re-suspension	Easy	Difficult	Easy	Easy	Difficult	Easy	Difficult	-
Supernatant							Turbid	
Subsidence Prerun (w')	0.0035	0.006	0.004	0.0065				

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TOROID SUMMARY SHEET

Toroid Run No.	105				106			
Rotator No.	3				4			
Dates	8/27/56-9/10/56				8/27/56-9/10/56			
Hr.	330				330			
fps	26				26			
Toroid	I	J	K	L	E	F	G	H
Load - Identification	CS-21	CS-21	CS-21	CS-21	CS-21	CS-21	CS-21	CS-21
Calcination °C	800	800	800	800	800	800	800	800
Avg Part Dia, μ (Pre)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive	NaOH	NaOH	NaH ₂ PO ₄ Na ₂ HPO ₄	NaH ₂ PO ₄ Na ₂ HPO ₄	NaOH	NaOH	Na ₂ SiO ₃	Na ₂ SiO ₃
Conc., M	0.01	0.01	0.01, 0.01	0.01, 0.01	0.01	0.01	0.01	0.01
Atm	H ₂ (pH 10)	O ₂ (pH 10)	H ₂ (pH 10)	O ₂ (pH 10)	H ₂ (pH 10)	O ₂ (pH 10)	H ₂	O ₂
psi	30	90	30	90	30	90	30	90
Temp - Nominal	250	250	250	250	250	250	250	250
Actual	253	252	258	-	259	252	289	253
CORROSION								
Toroid mg/dm ²	-232	-	-173	-80	-147	-67	-7	-70
mpy	3.1	-	2.3	1.1	1.9	0.9	0.1	0.9
PINS								
Defilmed, mpy 347	20(b)	-	17(b)	2.5	18(b)	3.9	5.6(f)	6.8
Ti-75A	7.8(b)	-	3.4	2.4	8.2(b)	6.8	4.1	20(b)
Zr-2	-	-	0.2	0.1	-	0.1	0.1	0.1
Other A212B	4.2	-	5.9	4.4	11.	5.2	4.1	8.0
Post-run: g Th/kg H ₂ O	1044	-	960	975	1165	878	-	776
mg/g Th, Fe	17.6	-	13.9	5.7	11.1	5.6	1.1	5.0
Cr	4.4	-	3.3	2.1	2.8	1.3	0.2	2.0
Ni	2.9	-	2.1	1.2	1.7	0.9	0.2	1.1
PO ₄			0.8	2.0				
Si							0.4	0.4
mg/l, Cl								
PO ₄			< 5	65				
Si								< 1
pH Slurry	8.1	-	9.2	6.7	8.8	7.0	-	6.7
Supernate	-	-	9.1	7.0	8.5	7.5	-	7.1
Part. Size > 10 μ	6	-	6	4	6	2	20	7
3-10 μ								
1-3 μ								
< 1 μ								
Avg Dia, μ	1.3	-	0.9	~ 0.2	1.0	0.5	0.9	0.5
% Pour	44	Dry	59	84	40	59	0	74
% Recovery	82	16	-	-	98	64	-	-
Color	Brown	-	Brown	Tan	Brown	Cream	-	Cream
Subsidence	0.0004 (w ²)	-	-	-	Slow	Slow	Slow	-
Consistency	Thick	-	Thin	Thin	Thick	Thin	Thick	Thin
Wet Glass	Good	-	Slight	Slight	Fair	Slight	-	Slight
Resuspension	Easy	-	Easy	Difficult	Easy	Easy	-	Easy
Supernatant	-	-	Turbid	-	-	Turbid	-	Turbid

TOROID SUMMARY SHEET

Toroid Run No. 107 (b")					108 (b")			
R tor No. 2					4			
Dates 9/7/56-1/11/56					9/13/56-9/17/56			
Hr. 100					100			
fps 26					20			
Toroid	M	N	O	P	E	F	G	H
Load - Identification	200A Std	LO-12	200A Std.	200A Std.	200A Std.	200A Std.	LO-12	200A Std.
	Slurry		Slurry	Slurry	Slurry	Slurry		Slurry
Calcination °C	800	800	800	800	800	800	800	800
Avg Part Dia, μ (Pre)	10-15	3,4	10-15	10-15	10-15	10-15	3,4	10-15
g Th/kg H ₂ O	1500	500	500	1000	1000	1500	500	500
Additive								
Conc.								
Atm	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂	0 ₂
psi	80 ²	80 ²	80 ²	80 ²	90 ²	90 ²	90 ²	90 ²
Temp - Nominal	200	200	200	200	300	300	300	300
Actual	200	208	-	215	303	335	0	295
CORROSION								
Toroid mg/dm ²	-48	-44	-87	-51	-	-48	-18	-28
mpy	2.1	1.9	3.8	2.2	-	2.1	0.8	1.2
PINS								
Defilmed, mpy 347	0.6(j), 1.0	1.7, 4.5	0.2(j), 1.3	1.3(j), 0.8	-	1.0(j), 0.9	3.0, 2.7	0.8(j), 0.7
Ti-75A	0.8 (j)	1.2	+ (j) +	+ (j) +	-	+ (j) +	7.1, 7.9	+ (j) +
Zr-2								
Other								
Post-run: g Th/kg H ₂ O	780	542	443	-	-	-	609	-
mg/g Th, Fe	2.7	5.7	12.0	3.7	-	2.5	2.6	3.9
Cr	0.5	1.4	2.6	0.7	-	0.6	0.7	1.0
Ni	0.5	1.2	2.1	0.8	-	0.5	0.4	0.8
mg/l, Cl	-	8	21	-				
pH Slurry	7.1	7.3	6.8	-	-	-	6.3	-
Supernate	7.5	7.6	7.1	-	-	8.3	7.7	7.5
Part. Size > 10 μ	2	2	2	11	-	5	1.2	5
3-10 μ	48	4	6	22	-	4	6	7
1-3 μ	39	22	14	17	-	91	16	80
< 1 μ	11	72	78	50	-	3	34	10
Avg Dia, μ	3.0	0.5	~ 0.2	1.0	-	2	44	3
% Pour	25	54	64	-	Dry	-	90	-
% Recovery	-	-	-	-	-	-	-	-
Color	Tan	Tan	Brown	Tan	-	Brown	White	Brown
Subsidence	Slow	Slow	Slow	-	-	Rapid	0.0007(w)	Rapid
Consistency	Thin	Thin	Thick	Thick	-	Thin	-	Thin
W/ Glass	Slight	Fair	Good	Good	-	Slight	Fair	Slight
Resuspension	Easy	Easy	Easy	Easy	-	Easy	Easy	Easy

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TOROID SUMMARY SHEET

Toroid Run No.	109 (c")				110 (c")			
Rotator No.	2				3			
Dates	10/25/56-10/29/56				10/25/56-10/29/56			
Hr.	100				99			
fps	10				26			
Toroid	M	N	O	P	I	J	K	L
Load - Identification	LO-14	LO-14	LO-14	LO-14	LO-14	200A Std Slurry	LO-14	200A Std Slurry
Calcination °C	800	800	800	800	800	800	800	800
Avg Part Dia, μ (Pre)	3.2	3.2	3.2	3.2	3.2	10-15	3.2	10-15
g Th/kg H ₂ O	1000	1000	1000	1000	1000	1000	1000	1000
Additive	Al ₂ O ₃ (h')	-	-	Al ₂ O ₃ (h')	Al ₂ O ₃ (h')	-	-	-
Conc.	140ppm Al	-	-	140ppm Al	140ppm Al	-	-	-
Atm	0 ²	0 ²	0 ²	0 ²	0 ²	0 ²	0 ²	0 ²
psi	80 ²	80 ²	80 ²	80 ²	80 ²	80 ²	80 ²	80 ²
Temp - Nominal	200	200	200	200	200	200	200	200
Actual	199	200	208	202	199	191	202	203
CORROSION								
Toroid mg/dm ²	-14	-21	-18	-21	-41	-7	-7	-11
mpy	0.6	0.9	0.8	0.9	1.8	0.3	0.3	0.5
PINS								
Defilmed, mpy 347	0.3,0.9	1.0,1.1	u'	u'	u'	1.6,2.9	u'	u'
	0.7,3.0	1.4,1.4				1.3,1.4		
Ti-75A	-	-	-	-	-	-	-	-
Zr-2	-	-	-	-	-	-	-	-
Other								
Post-run: g Th/kg H ₂ O	731	960	884	960	972	-	664	-
mg/g Th, Fe	0.9	1.4	1.1	1.4	2.6	0.8	0.3	1.2
Cr	0.3	0.3	0.4	0.4	0.7	0.3	0.2	0.4
Ni	0.1	0.2	0.2	0.1	0.4	0.2	0.1	0.1
Al	0.2	0.0	0.1	0.2	0.3	0.1	0.1	0.1
mg/l, Cl	6	7	7	5	4	-	2	-
pH Slurry	8.9	8.4	7.9	8.2	7.7	-	6.2	-
Supernate	7.2	7.4	6.5	6.9	7.1	-	6.6	-
Part. Size > 10 μ	10	6	4	2	2	10	14	2
3-10 μ	37	33	39	30	6	10	50	8
1-3 μ	37	40	41	47	27	5	23	22
< 1 μ	16	21	16	21	65	75	13	68
Avg Dia, μ	2.7	2.0	2.3	1.7	0.8	0.7	4.2	0.8
% Pour	-	-	-	-	-	0	-	0
% Recovery	-	-	-	-	-	-	-	-
Color	Cream	Cream	Cream	Cream	Cream	Cream	Cream	Cream
Subsidence	-	-	-	-	-	-	-	-
Consistency	Thin	Thick	Thick	Thick	Thick	Thick	Thin	Thin
Wet Glass	Fair	Good	Good	Good	Good	-	Slight	-
Resuspension	Easy	Easy	Easy	Easy	Easy	-	Easy	-

FOOTNOTES TO TABLE I

- a. A more complete description of the various oxides used is given in Table II.
- b. Pin showed localized attack at neck or at root (undercut).
- c. Summary of Run No. 15: ORNL CF-54-12-208.
- d. Summary of Run No. 16: ORNL CF-55-1-31.
- e. Summary of Run No. 17: ORNL CF-55-6-86.
- f. Summary of Run No. 18: ORNL CF-55-6-134.
- g. Summary of Run No. 19: ORNL CF-55-6-91.
- h. Summary of Run No. 20: ORNL CF-55-8-29.
- i. Summary of Run No. 21: ORNL CF-55-6-133.
- j. Deposit of thorium oxide on pins.
- k. Electropolished.
- l. Summary of Run No. 22: ORNL CF-55-8-30.
- m. Summary of Run No. 23: ORNL CF-55-8-31.
- n. Summary of Run No. 24: ORNL CF-55-8-32.
- o. Titanium toroid.
- p. "Split" toroid. See references 1 and 2 for details.
- q. Charges for Toroids F and G mixed up, invalidating run.
- r. Type 347 stainless steel in-line sheet coupons gave:

	<u>mg/dm²</u>	<u>mpy</u>
Coupon I	- 84	2.3
Coupon II	- 16	0.4
Insert I	-174	4.7

- s. 20-Toroid rotator.
- t. Run never completed.
- u. Summary of Run No. 59: ORNL CF-55-8-6.

v. Type 347 stainless steel in-line sheet coupons gave:

	<u>mg/dm²</u>	<u>mpy</u>
Coupon I	-20	0.7
Coupon II	-30	1.1
Insert I	0	0.0
Insert II	(Evidence of crevice or differential aeration attack.)	

w. Type 347 stainless steel in-line sheet coupons gave:

	<u>mg/dm²</u>	<u>mpy</u>
Coupon I	-68	1.8
Coupon II	-71	1.9
Insert I	-90	2.5
Insert II	-87	2.4

x. Concentration of sulfate in parts-per-million based on weight of thorium oxide using sulfate salts of the tabulated cations.

y. Type 347 stainless steel in-line sheet coupons gave:

	<u>mg/dm²</u>	<u>mpy</u>
Coupon I	-101	1.4
Coupon II	- 90	1.3
Insert I	- 95	1.3
Insert II	- 84	1.2

z. Milled in porcelain mill with alumina balls.

a'. Thorium oxide classified in Roller Elutriator.

b'. Uranyl sulfate run.

c'. Very severe attack; broke pin on removal.

d'. Zircaloy-2.

e'. Solids composed predominantly of thorium and aluminum.

f'. 54S aluminum.

g'. Exposed portion of pin completely consumed.

h'. Based on thorium oxide

i'. Pin extended from inner wall of toroid toward outer wall.

j'. Type 347 stainless steel in-line sheet coupons gave:

	<u>mg/dm²</u>	<u>mpy</u>
Coupon I	-200	3.1
Coupon II	-180	2.8
Insert I	-180	2.8
Insert II	-250	3.9

k'. Summary of Run No. 81: ORNL CF-56-2-72.

l'. Summary of Run No. 83: ORNL CF-56-5-182.

m'. Summary of Run No. 84: ORNL CF-56-2-140.

n'. Summary of Run No. 85: ORNL CF-56-3-81.

o'. Summary of Run No. 86: ORNL CF-56-6-64.

p'. Type 347 stainless steel in-line sheet coupons and inserts gave large weight losses but probably as a result of mechanical wear rather than corrosion (and/or erosion).

q'. Summary of Run No. 92: ORNL CF-56-9-59.

r'. No heat supplied by heaters.

s'. The slurry was not removed from the toroid and, therefore, there were no analyses.

t'. Analysis of centrifuged solids.

u'. No corrosion pin specimens.

v'. Includes attack during previous run.

w'. Settling rate in cm/sec at listed concentration.

x'. Test of pressure recording device during rotation with thoria slurry.

y'. Corrosion pin specimens were not examined but used in next run.

z'. A-212 Grade B carbon steel.

a''. Corrosion pin specimens exposed during two runs.

b''. Runs with the 200A Standard Slurry are discussed in greater detail in reference 7 which includes photographs of the thoria particles as well.

c''. Discussed in reference 8 which includes photographs of the thoria particles.

TABLE II

Summary of Analytical Data of Various Thorium Oxides

[illegible]

Thorium Oxide Batch	TO-10	Thorex	ø B-1	D-10	D-10	D-10	D-17(j)	D-17 SAR(j)	D-17	D-17	D-17	D-17	D-17
Max. Calcn. Temp. °C	900-24	650	650(o)	650	800-7	1000-7.5	650	650	800	800-4	800-8	800-9	1000-4
and Hours													
Pptn. Method	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate
Pptn. Temp.	10	40		40	40	40	40	40	40	40	40	40	40
Ident. (Source, Anal. code)	VDallred A-1324	Radioactive TO-1, A-137	B-825	A-1373	A-1374	A-1375	A-1348	A-1357 B-877	A-1209	A-1328	A-1329	A-1398	-
Spec. Surf. Area (M ² /g)	-	16.8	26.0	31.3	31.9	20.8	8.5	37.0	30.3	-	19.3	11.3	16.4
													-
Cryst. Size (Å)	-	205	112	117,129	168	507	107,108	107	-	181	293	211	-
Avg. Particle Diameter (μ)	0.7	2.7	10.6	1.5			2.1(i)	2.1(i)	-	2.1	2.4	2.1	2.3(i)
Distribution > 10 μ	0	19	53	17			10	10	-	8	13	8	12
3-10 μ	3	27	29	20			29	28	-	31	30	29	29
1-3 μ	21	41	12	23			37	38	-	39	47	42	40
< 1 μ	76	13	6	40			24	24	-	29	10	21	19
Chemical Analysis													
Th% (f)	-	84.6	86.1	86.2	87.0	87.7	86.1	85.6	85.9	-	-	85.3	-
Fe mg/kg	-	23	39	166	168	158	27	< 40	-	-	-	9	-
Cr	-	5	< 5	55	50	33	10	< 9	-	-	-	7	-
Ni	-	< 5	< 5	38	37	37	9	< 5	-	-	-	5	-
Al	-	30	60	40	45	45	< 20	< 5	-	-	-	50	-
SO ₄	-	105	-	556	570	510	300	< 160	160	-	-	155	-
Cl	-	17	-	< 10	10	< 10	< 10	< 40	< 10	-	-	< 10	-
F	-	< 10	-	12	14	< 10	< 10	< 25	< 10	-	-	< 10	-
C	-	920	1010	1400	530	360	1500	1570	-	-	-	210	-
Spectrographic Analysis													
Fe, ppm		200					10	5				200	
Cr		< 2000					< 10	< 50				< 200	
Ni		< 500					< 10	< 50				< 500	
Al		< 200					< 10	< 5				< 500	
Si		< 500					20	< 25				< 500	
Ca		-					< 20	< 500				-	
Cu		500					< 5	< 5				500	
Mg		< 500					< 10	< 5				< 500	

Thorium Oxide Batch	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-17	D-47	CS-4
Max. Calcn. Temp. °C and Hours	1000-5	1000-7	1200-5	1200-7	1200-9	1330-6.5	1400-2	1400-4	1400-24	1400-96	1600-4	800	650
Pptn. Method	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Circ.D-17
Pptn. Temp.	40	40	40	40	40	40	40	40	40	40	40		
Ident. (Source, Anal. code)	A-698	A-1332	A-1334	A-1335	A-1366	A-1370	A-1344	A-1368	A-1346	A-1347	A-1218	A-1225	A-793
		A-1333				B-829	A-1358	B-815	A-1360	A-1361	B-816	A-1372	B-818
Spec. Surf. Area (M ² /g) (a)		5.2,	2.4	2.3	2.0	1.3,	1.4	1.3,	1.16	0.89	0.60,	14.2	42.3
		5.6				1.5		1.39			0.62		
Cryst. Size (Å) (b)		795,893	1530	1710	1398	2333,	2500	2090-	4600	>5000	3200,	250	145
						2900		3070			>4000		
Avg. Particle Diameter (μ) (c)		2.8	2.6	2.8	2.3	2.7	2.7	2.2	2.8	2.6	2.4(i)	6.2(i)	< 1
Distribution > 10 μ		14	12	13	9	14	18	11	22	18	9	29	0
3-10 μ		33	33	35	30	33	28	28	26	26	29	36	4
1-3 μ		41	41	40	48	42	40	44	39	43	48	21	9
< 1 μ		12	14	12	13	11	14	17	13	13	14	14	87
Chemical Analysis													
Th% (f)	87.2	87.5	87.4	87.4	87.6		86.0	87.4,87.1	86.9	87.0	87	86.1	
Fe mg/kg		12	16	16	46		23	48,24	26	35	42	27	2000
Cr		7	15	13	6		7	11,7	8	5	< 7	5	520
Ni		< 5	< 5	8	5		< 5	< 5, < 5	< 5	< 5	< 5	6	260
Al		50	70	70	55		< 5	70, < 5	< 5	< 5	60	-	-
SO ₄		220	130	115	160		< 100	90, < 100	< 100	< 100	< 100	820	470
Cl		< 30	< 10	< 10	< 10		< 10	< 10, 40	40	40	< 10	< 10	
F		< 10	< 10	< 10	< 10		< 10	< 10, < 10	< 10	< 10	< 10	8	
C	220	280	90	90	120		60	50, 85	75	55	50	410	
Spectrographic Analysis													
Fe, ppm					< 5		5	5	5	5	8	5	
Cr					< 20		< 50	< 50	< 50	< 50	< 50	< 50	
Ni					< 20		< 20	< 20	< 20	< 20	< 50	< 20	
Al							< 5	< 5	< 5	< 5	5	< 5	
Si					50		< 25	< 25	< 25	< 25	< 50	5	
Ca							< 100	< 100	< 100	< 100	100	-	
Cu					< 5		< 5	< 5	< 5	< 5	< 5	20	
Mg					< 5		< 5	< 5	< 5	< 5	< 5	< 5	

Thorium Oxide Batch	CS-4	CS-5	CS-5	CS-21	CS-21	LO-1	LO-2A	LO-2A	LO-2A	LO-2A	LO-2A	LO-12	200A Std Slurry
Max. Calcn. Temp. °C	1000	1000-7	1200-5	(800)	1200-5	800	800	1000-2	1000-4	1000-24	1000-96	800	800
and Hours													
Pptn. Method	Circ.D-17	Circ.D-17	Circ.D-17	Circ LO-2	Circ LO2	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Circ LO-2
Pptn. Temp.						70	70	70	70	70	70	70	
Ident. (Source, Anal. code)	B-819	B-817	B-820	A-1288	A-1301	A-1323	A-1399	A-1400	A-1401	A-1402	A-1403	A-1427	A-1426
				B-757	A-1378							B-809	B-830
Spec. Surf. Area (M ² /g)	9.4	11.4	0.68	22.0,	2.4,	14.3	16.9	8.4	7.0	6.6	4.4	15.8	29.5
(a)				22.3	5.4								
Cryst. Size (Å) (b)	266	300	3500	247,	950,	264	232	462	478	667	862	224	235
				250	955								
Avg. Particle Diameter (μ) (c)	< 1	~ 0.3		0.6	0.7	2.3	2.1	1.7	1.7	1.6	1.6	3.4,	9.5,
												2.1(k)	15 (k)
Distribution > 10 μ	8	6		3	7	18	12	8	8	3	5	18,17	43,86
3-10 μ	7	6		6	11	25	27	24	24	28	26	36,32	42,5
1-3 μ	15	15		20	20	37	38	41	41	38	41	32,-	3,-
< 1 μ	70	73		71	62	20	23	27	27	31	28	14,-	12,-
Chemical Analysis													
Th% (f)		86.6		86.8	86.9	86.3	85.7	86.8	87.3	86.8	87.4	86.6	87.0
Fe mg/kg		106		87	91	20	54	20	28	21	18	30	431
Cr		219		21	17	< 5	6	6	5	5	5	< 5	157
Ni		180		18	10	< 5	< 5	5	< 6	< 5	< 5	< 5	61
Al		95		80	-	40	30	40	40	25	25	20	115
SO ₄		330		140	12	160	145	180	160	195	145	< 100	< 100
Cl		30		< 40	11	21	< 10	< 10	< 10	< 10	< 10	45	40
F		< 10		< 20	30		< 10	< 10	< 10	< 10	< 10	< 10	< 10
C		320		770	210		600	200	70	170	90	990	810
Spectrographic Analysis													
Fe, ppm				< 200	100	5	< 200	< 500	< 500	< 500	< 500	200	1000
Cr				< 50	< 100	< 20	< 2000	< 2000	< 2000	< 2000	< 2000	5000	5000
Ni				< 20	< 100	< 20	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Al				< 500	< 5	< 5	< 200	< 500	< 500	< 500	< 500	< 500	< 500
Si				< 500	< 10	< 20	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Ca				-	-	-	-	2000	2000	2000	2000	< 2000	< 2000
Cu				< 5	< 5	10	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Mg				< 200	5	< 10	< 500	< 500	< 500	< 500	< 500	< 500	< 500

Thorium Oxide Batch	LO-14	D-17		D-17				D-17			
		Coarse	Fine	m	Fract A	Fract B	Fract C	m	Fract A	Fract B	Fract C
Max. Calcn. Temp. °C and Hours	800	650	650	650	650	650	650	1200-7	1200-7	1200-7	1200-7
Pptn. Method	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate	Oxalate
Pptn. Temp.	70	40	40	40	40	40	40	40	40	40	40
Ident. (Source, Anal. code)	B-763	B-879	B-880	Repeat	A-1042	A-1050	A-1051	Repeat	A-1293	A-1294	A-1295
Spec. Surf. Area (M^2/g) (a)	18.7	36.1	35.0	37.0	35.5	35.2	35.2	2.3	2.70	2.80	5.13
Cryst. Size ($\text{\AA}$) (b)	203- 212	105	101	108	115	109	114	1710	1533	1715	1312
Avg. Particle Diameter (μ) (c)	3.2	2.7	1.1	2.1	3.7	1.3	0.4	2.8	4.9	1.2	0.5
Distribution > 10 μ	9	11	1	10	17	4	4	13	22	4	4
3-10 μ	42	35	4	29	42	8	2	35	43	5	2
1-3 μ	31	36	49	37	31	54	6	40	25	56	4
< 1 μ	18	18	46	24	10	34	88	12	10	35	90
Chemical Analysis											
Th% (f)	82.9	84.0	85.9	86.1				87.4			
Fe mg/kg	19	22	8	27				16			
Cr	< 5	< 5	< 5	10				13			
Ni	< 5	< 5	< 5	9				8			
Al	20	30	30	< 20				70			
SO ₄	< 100	425	350	300				115			
Cl	< 10	10	20	< 10				< 10			
F	< 10	-	-	< 10				< 10			
C	700	2300	2200	1500				90			
Spectrographic Analysis											
Fe, ppm	< 200	< 10	< 10	10							
Cr	< 500	5	< 5	< 10							
Ni	< 500	300	< 10	< 10							
Al	< 500	< 10	< 10	< 10							
Si	< 500	< 20	< 20	20							
Ca	< 2000	40	30	< 20							
Cu	< 500	< 5	< 5	< 5							
Mg	< 200	< 5	< 5	< 10							

[illegible]

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Thorium Oxide Batch	D-17				CS-5			
	(m)(n)	Fract A	Fract B	Fract C	(m)	Fract A	Fract B	Fract C
Max. Calcn. Temp. °C and Hours	1600-4	1600-4	1600-4	1600-4	1000-7	1000-7	1000-7	1000-7
Pptn. Method	Oxalate	Oxalate	Oxalate	Oxalate	Circ D-17	Circ D-17	Circ D-17	Circ D-17
Pptn. Temp.	40	40	40	40				
Ident. (Source, Anal. code)	Repeat	A-1312	A-1313	A-1314	Repeat	A-1037	A-1038	A-1039
Spec. Surf. Area (M ² /g) (a)	0.61	0.50	2.12	2.15	11.4	8.60	8.70	15.9
Cryst. Size (Å) (b)	3200, >4000	>10,000	~4000+	2700	300	307	304	257
Avg. Particle Diameter (μ) (c)	2.4	4.9	1.4	0.7	~0.3	1.2	0.8	~0.2
Distribution > 10 μ	9	22	2	3	6	2	2	4
3-10 μ	29	48	5	2	6	15	3	1
1-3 μ	48	26	70	9	15	42	30	4
< 1 μ	14	4	23	86	73	41	65	91
Chemical Analysis								
Th% (f)	87.0	87.2			86.6			
Fe mg/kg	42				106			
Cr	< 7				219			
Ni	< 5				180			
Al	60				95			
SO ₄	100				330			
Cl	< 10				30			
F	< 10				<10			
C	50	16			320			
Spectrographic Analysis								
Fe, ppm	8							
Cr	< 50							
Ni	< 50							
Al	< 5							
Si	< 50							
Ca	< 100							
Cu	< 5							
Mg	< 5							

FOOTNOTES TO TABLE II

- a. Analysis from laboratory supervised by W. R. Laing.
- b. Analysis by J. C. Richter (X-Ray Section, ORNL Metallurgy Division). The estimated precision was approximately ± 1 to $\pm 5\%$ when the size was $< 1000 \text{ \AA}$ and from about ± 6 to $\pm 15\%$ for sizes in excess of $1000 \text{ \AA}$.
- c. Analysis by gravitational sedimentation, generally in $0.001 \text{ M Na}_4\text{P}_2\text{O}_7$ using method of Leddicotte and Miller. (4,5)
- d. Analysis from laboratory supervised by O. Menis. Value reported was generally the average of at least two values agreeing to within 5% .
- e. Analysis from laboratory supervised by J. A. Norris.
- f. Theoretical, 87.9% .
- g. After calcination at 1800°C , the oxide was milled with iron balls and then treated with hydrochloric acid to remove iron.
- h. Average of two analysis of relatively good agreement. Values obtained in replicate analysis given on next line. The reason for the discrepancy is unknown.
- i. See reference 4 for all analyses.
- j. The thorium oxide identified as batch D-17 was removed from near the top of a barrel of the blended oxide, whereas the oxide identified as batch D-17 SAR was removed from near the bottom of the same barrel.
- k. Analysis by gravitational sedimentation in glycerine-water mixture of $0.005 \text{ M Na}_4\text{P}_2\text{O}_7$ of viscosity 19.53 centipoise at room temperature.
- l. Classified by air elutriation with Roller Elutriator. Data for the parent D-17 thorium oxide follows on the next line.
- m. Data for the as-calcined (or as-circulated) oxide are repeated for ready reference. This oxide was classified by gravitational sedimentation into three fractions whose data follow that of the parent oxide. Oxalic acid in aqueous solution was used as the dispersant and the acid adsorbed on the thorium oxide was subsequently thermally decomposed at a temperature lower than the minimum calcination temperature ($< 550^\circ\text{C}$). See reference 6 for details.
- n. Two classifications of D-17-1600-4 thorium oxide were carried out and the product fractions were not mixed.
- o. Unknown, but estimated from specific surface area and crystallite size values.

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