

Franke, Mark

From: Miller, Craig L [Craig.Miller@pgnmail.com]
Sent: Saturday, January 16, 2010 1:24 PM
To: Lake, Louis; Thomas, George; Carrion, Robert; 'trowe@wje.com'; Sealey, Mac
Cc: Williams, Charles R.
Subject: RE: Failure Mode 2.6 for Review and Comment
Attachments: (1) FM 2.6 Exhibit 3 Cylinder Tests exterior wall 28 days.pdf; (2) FM 2.6 Exhibit 4c Petrographic Mactec 2009-11-11.pdf; (3) FM 2.6 Exhibit 4a Petrographic Erlin Hime May 1976.pdf; (4) FM 2.6 Exhibit 4b Petrographic CTL.PDF; (5) FM 2.6 Exhibit 5 - Strength and Modulus of Elasticity-Core Samples.pdf

Second (and last) email for FM 2.6.

Thank you,

Craig

From: Miller, Craig L
Sent: Saturday, January 16, 2010 1:19 PM
To: 'louis.lake@nrc.gov'; 'George.Thomas2@nrc.gov'; 'rpc1@nrc.gov'; 'trowe@wje.com'; Sealey, Mac
Cc: Williams, Charles R.
Subject: Failure Mode 2.6 for Review and Comment

Mr. Lake and others,

Attached for your review is the draft of FM 2.6 and some of its exhibits. Due to file size, this FM will be delivered in two separate emails. If you have any questions, please contact Charles Williams or myself.

Thank you,

Craig Miller

Cylinder Tests exterior wall - 28 days

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
RB Structure Summary:						
			Standard Variation:	605.23	451 Samples	Ave. Fc: 5650
727550-2 Mix Summary:						
			Standard Variation:	541.071	200 Samples	Ave. Fc: 5774
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2071	C	5360
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2071	D	5550
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2072	D	5750
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2072	C	5040
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2073	D	5570
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2073	C	5130
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2074	C	5320
727550-2	641	132	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2074	D	5520
641 Pour Summary:						
			Standard Variation:	238.627	8 Samples	Ave. Fc: 5405
727550-2	642	122	EXTERIOR WALL BUTTRESS 1 - 6, PERSONNEL	2077	D	5590
727550-2	642	122	EXTERIOR WALL BUTTRESS 1 - 6, PERSONNEL	2077	C	5780
727550-2	642	122	EXTERIOR WALL BUTTRESS 1 - 6, PERSONNEL	2078	C	5500
727550-2	642	122	EXTERIOR WALL BUTTRESS 1 - 6, PERSONNEL	2078	D	5340
642 Pour Summary:						
			Standard Variation:	183.553	4 Samples	Ave. Fc: 5553
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2117	C	5840
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2117	D	5570
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2118	C	5820
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2118	D	5780
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2119	C	5590
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2119	D	5750
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2120	C	5570
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2120	D	5700
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2121	D	5320
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2121	C	5430
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2122	D	5640
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2122	C	5710
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2123	D	5640
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2123	C	5660
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2124	C	6170
727550-2	666	160	EXTERIOR WALL BUTTRESS 3 - 4, EQUIPMENT	2124	D	5780
666 Pour Summary:						
			Standard Variation:	189.56	16 Samples	Ave. Fc: 5686
727550-2	742	160	SECONDARY SHIELD WALL, SE QUADRANT	2224	C	5850
727550-2	742	160	SECONDARY SHIELD WALL, SE QUADRANT	2224	D	6420
742 Pour Summary:						
			Standard Variation:	403.051	2 Samples	Ave. Fc: 6135
727550-2	743	240	EXTERIOR WALL BUTTRESS 3 - 4	2225	C	5470
727550-2	743	240	EXTERIOR WALL BUTTRESS 3 - 4	2225	D	5750
727550-2	743	240	EXTERIOR WALL BUTTRESS 3 - 4	2226	D	6230
727550-2	743	240	EXTERIOR WALL BUTTRESS 3 - 4	2226	C	5680

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
743	Pour Summary:		Standard Variation: 321.183	4	Samples	Ave. Fc: 5783
727550-2	746	160	SECONDARY SHIELD WALL, NORTH	2231	D	4630
727550-2	746	160	SECONDARY SHIELD WALL, NORTH	2231	C	5520
746	Pour Summary:		Standard Variation: 629.325	2	Samples	Ave. Fc: 5075
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2232	C	6740
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2232	D	5640
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2233	C	5780
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2233	D	5730
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2234	D	5520
727550-2	747	250	EXTERIOR WALL BUTTRESS 3 - 4	2234	C	5750
747	Pour Summary:		Standard Variation: 441.316	6	Samples	Ave. Fc: 5860
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2239	C	5870
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2239	D	6010
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2240	C	5220
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2240	D	5680
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2241	D	5310
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2241	C	5310
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2242	C	5130
727550-2	753	160	SECONDARY SHIELD WALL & INCORE PIT	2242	D	5130
753	Pour Summary:		Standard Variation: 346.276	8	Samples	Ave. Fc: 5458
727550-2	754	160	SECONDARY SHIELD WALL, NW QUADRANT	2243	C	5470
727550-2	754	160	SECONDARY SHIELD WALL, NW QUADRANT	2243	D	5660
754	Pour Summary:		Standard Variation: 134.350	2	Samples	Ave. Fc: 5565
727550-2	759	170	SECONDARY SHIELD WALL, SE QUADRANT	2249	C	6080
727550-2	759	170	SECONDARY SHIELD WALL, SE QUADRANT	2249	D	5910
759	Pour Summary:		Standard Variation: 120.208	2	Samples	Ave. Fc: 5995
727550-2	765	170	SECONDARY SHIELD WALL, NE QUADRANT	2257	C	5500
727550-2	765	170	SECONDARY SHIELD WALL, NE QUADRANT	2257	D	5980
727550-2	765	170	SECONDARY SHIELD WALL, NE QUADRANT	2258	C	5750
727550-2	765	170	SECONDARY SHIELD WALL, NE QUADRANT	2258	D	5680
765	Pour Summary:		Standard Variation: 198.557	4	Samples	Ave. Fc: 5728
727550-2	768	170	SECONDARY SHIELD WALL, SE QUADRANT	2261	C	5130
727550-2	768	170	SECONDARY SHIELD WALL, SE QUADRANT	2261	D	5240
768	Pour Summary:		Standard Variation: 77.7817	2	Samples	Ave. Fc: 5185
727550-2	769	250	EXTERIOR WALL BUTTRESS 1 - 6	2262	C	5840
727550-2	769	250	EXTERIOR WALL BUTTRESS 1 - 6	2262	D	5480
727550-2	769	250	EXTERIOR WALL BUTTRESS 1 - 6	2263	C	5310
727550-2	769	250	EXTERIOR WALL BUTTRESS 1 - 6	2263	D	5680
769	Pour Summary:		Standard Variation: 231.283	4	Samples	Ave. Fc: 5578
727550-2	774	180	SECONDARY SHIELD WALL, NE QUADRANT	2270	D	5310

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
727550-2	774	180	SECONDARY SHIELD WALL, NE QUADRANT	2270	C	5730
727550-2	774	180	SECONDARY SHIELD WALL, NE QUADRANT	2271	D	5480
727550-2	774	180	SECONDARY SHIELD WALL, NE QUADRANT	2271	C	5480
774	Pour Summary:		Standard Variation: 173.013	4	Samples	Ave. Fc: 5500
727550-2	776	131	CFT-1A ROOM NORTH WALL	2273	D	5700
727550-2	776	131	CFT-1A ROOM NORTH WALL	2273	C	6070
776	Pour Summary:		Standard Variation: 261.63	2	Samples	Ave. Fc: 5885
727550-2	783	160	FUEL HANDLING CANAL NORTH WALL	2280	C	5640
727550-2	783	160	FUEL HANDLING CANAL NORTH WALL	2280	D	5180
727550-2	783	160	FUEL HANDLING CANAL NORTH WALL	2281	C	5680
727550-2	783	160	FUEL HANDLING CANAL NORTH WALL	2281	D	5380
783	Pour Summary:		Standard Variation: 234.663	4	Samples	Ave. Fc: 5470
727550-2	795	160	SECONDARY SHIELD WALL, SE QUADRANT	2290	C	6300
727550-2	795	160	SECONDARY SHIELD WALL, SE QUADRANT	2290	D	6120
727550-2	795	160	SECONDARY SHIELD WALL, SE QUADRANT	2291	C	5240
727550-2	795	160	SECONDARY SHIELD WALL, SE QUADRANT	2291	D	5500
795	Pour Summary:		Standard Variation: 501.863	4	Samples	Ave. Fc: 5790
727550-2	797	170	FUEL HANDLING CANAL NORTH WALL	2295	C	5310
727550-2	797	170	FUEL HANDLING CANAL NORTH WALL	2295	D	6720
727550-2	797	170	FUEL HANDLING CANAL NORTH WALL	2297	C	6190
727550-2	797	170	FUEL HANDLING CANAL NORTH WALL	2297	D	6010
797	Pour Summary:		Standard Variation: 582.373	4	Samples	Ave. Fc: 6058
727550-2	805	160	FUEL HANDLING CANAL SOUTH & WEST WALL	2303	D	5660
727550-2	805	160	FUEL HANDLING CANAL SOUTH & WEST WALL	2303	C	5340
727550-2	805	160	FUEL HANDLING CANAL SOUTH & WEST WALL	2304	D	5320
727550-2	805	160	FUEL HANDLING CANAL SOUTH & WEST WALL	2304	C	5360
805	Pour Summary:		Standard Variation: 160.831	4	Samples	Ave. Fc: 5420
727550-2	810	109	RETAINING WALL, SW	2308	D	5480
727550-2	810	109	RETAINING WALL, SW	2308	C	5480
810	Pour Summary:		Standard Variation: 0	2	Samples	Ave. Fc: 5480
727550-2	813	180	FUEL HANDLING CANAL NORTH WALL	2312	C	6010
727550-2	813	180	FUEL HANDLING CANAL NORTH WALL	2312	D	5480
727550-2	813	180	FUEL HANDLING CANAL NORTH WALL	2313	C	5480
727550-2	813	180	FUEL HANDLING CANAL NORTH WALL	2313	D	6040
813	Pour Summary:		Standard Variation: 314.894	4	Samples	Ave. Fc: 5753
727550-2	815	131	SOUTH WALL CFT-1A ROOM	2315	D	5310
727550-2	815	131	SOUTH WALL CFT-1A ROOM	2315	C	5340
815	Pour Summary:		Standard Variation: 21.2132	2	Samples	Ave. Fc: 5325
727550-2	817	170	SECONDARY SHIELD WALL, SW QUADRANT	2317	C	5660
727550-2	817	170	SECONDARY SHIELD WALL, SW QUADRANT	2317	D	6310

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
727550-2	817	170	SECONDARY SHIELD WALL, SW QUADRANT	2318	C	5940
727550-2	817	170	SECONDARY SHIELD WALL, SW QUADRANT	2318	D	5960
817	Pour Summary:		Standard Variation: 266.255	4	Samples	Ave. Fc: 5968
727550-2	820	135	CFT-1A ROOM SLAB & WALL	2321	C	5570
727550-2	820	135	CFT-1A ROOM SLAB & WALL	2321	D	5610
820	Pour Summary:		Standard Variation: 28.2843	2	Samples	Ave. Fc: 5590
727550-2	821	118	RETAINING WALL, SW	2322	C	6190
727550-2	821	118	RETAINING WALL, SW	2322	D	6350
821	Pour Summary:		Standard Variation: 113.137	2	Samples	Ave. Fc: 6270
727550-2	825	255	RING GIRDER, BUTTRESS 6	2329	C	6540
727550-2	825	255	RING GIRDER, BUTTRESS 6	2329	D	6370
825	Pour Summary:		Standard Variation: 120.208	2	Samples	Ave. Fc: 6455
727550-2	826	255	RING GIRDER, BUTTRESS 4	2330	C	4700
727550-2	826	255	RING GIRDER, BUTTRESS 4	2330	D	4930
826	Pour Summary:		Standard Variation: 162.635	2	Samples	Ave. Fc: 4815
727550-2	827	180	SECONDARY SHIELD WALL, SW QUADRANT	2331	C	5660
727550-2	827	180	SECONDARY SHIELD WALL, SW QUADRANT	2331	D	5520
727550-2	827	180	SECONDARY SHIELD WALL, SW QUADRANT	2332	C	5590
727550-2	827	180	SECONDARY SHIELD WALL, SW QUADRANT	2332	D	5660
827	Pour Summary:		Standard Variation: 67.0199	4	Samples	Ave. Fc: 5608
727550-2	828	115	RETAINING WALL, SW	2335	D	5710
727550-2	828	115	RETAINING WALL, SW	2335	C	5710
828	Pour Summary:		Standard Variation: 0	2	Samples	Ave. Fc: 5710
727550-2	829	255	RING GIRDER, BUTTRESS 2	2333	D	5310
727550-2	829	255	RING GIRDER, BUTTRESS 2	2333	C	5940
829	Pour Summary:		Standard Variation: 445.477	2	Samples	Ave. Fc: 5625
727550-2	830	143	CFT-1A ROOM WALLS	2334	D	6190
727550-2	830	143	CFT-1A ROOM WALLS	2334	C	5660
830	Pour Summary:		Standard Variation: 374.767	2	Samples	Ave. Fc: 5925
727550-2	841	170	FUEL HANDLING CANAL SOUTH WALL	2349	C	6370
727550-2	841	170	FUEL HANDLING CANAL SOUTH WALL	2349	D	6380
727550-2	841	170	FUEL HANDLING CANAL SOUTH WALL	2350	D	6080
727550-2	841	170	FUEL HANDLING CANAL SOUTH WALL	2350	C	6300
841	Pour Summary:		Standard Variation: 139.613	4	Samples	Ave. Fc: 6283
727550-2	843	172	SECONDARY SHIELD WALL, NW QUADRANT	2351	C	6010
727550-2	843	172	SECONDARY SHIELD WALL, NW QUADRANT	2351	D	6230
843	Pour Summary:		Standard Variation: 155.563	2	Samples	Ave. Fc: 6120
727550-2	844	180	SECONDARY SHIELD WALL, NW QUADRANT	2352	D	6560
727550-2	844	180	SECONDARY SHIELD WALL, NW QUADRANT	2352	C	6310

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
844	Pour Summary:		Standard Variation: 176.777	2	Samples	Ave. Fc: 6435
727550-2	846	180	FUEL HANDLING CANAL, SOUTH WALL	2354	C	6560
727550-2	846	180	FUEL HANDLING CANAL, SOUTH WALL	2354	D	6540
727550-2	846	180	FUEL HANDLING CANAL, SOUTH WALL	2355	D	5660
727550-2	846	180	FUEL HANDLING CANAL, SOUTH WALL	2355	C	5780
846	Pour Summary:		Standard Variation: 481.768	4	Samples	Ave. Fc: 6135
727550-2	853	160	EL 160 FLOOR SLAB, NW	2361	D	6560
727550-2	853	160	EL 160 FLOOR SLAB, NW	2361	C	6190
727550-2	853	160	EL 160 FLOOR SLAB, NW	2362	D	5660
727550-2	853	160	EL 160 FLOOR SLAB, NW	2362	C	5840
853	Pour Summary:		Standard Variation: 398.026	4	Samples	Ave. Fc: 6063
727550-2	865	206	ELEVATOR SHAFT	2382	D	5480
727550-2	865	206	ELEVATOR SHAFT	2382	C	5500
865	Pour Summary:		Standard Variation: 14.1421	2	Samples	Ave. Fc: 5490
727550-2	946	267	RING GIRDER; 0 - 60 DEGREES	2509	C	5550
727550-2	946	267	RING GIRDER; 0 - 60 DEGREES	2509	D	5540
946	Pour Summary:		Standard Variation: 7.07107	2	Samples	Ave. Fc: 5545
727550-2	951	267	RING GIRDER; 180 - 240 DEGREES	2519	D	6170
727550-2	951	267	RING GIRDER; 180 - 240 DEGREES	2519	C	6260
951	Pour Summary:		Standard Variation: 63.6396	2	Samples	Ave. Fc: 6215
727550-2	953	267	RING GIRDER; 0 - 300 DEGREES	2521	D	6770
727550-2	953	267	RING GIRDER; 0 - 300 DEGREES	2521	C	6930
953	Pour Summary:		Standard Variation: 113.137	2	Samples	Ave. Fc: 6850
727550-2	954	267	RING GIRDER; 60 - 120 DEGREES	2522	C	5700
727550-2	954	267	RING GIRDER; 60 - 120 DEGREES	2522	D	5770
954	Pour Summary:		Standard Variation: 49.4975	2	Samples	Ave. Fc: 5735
727550-2	974	270	RING GIRDER; 90 - 150 DEGREES	2560	C	6370
727550-2	974	270	RING GIRDER; 90 - 150 DEGREES	2560	D	5280
974	Pour Summary:		Standard Variation: 770.746	2	Samples	Ave. Fc: 5825
727550-2	976		DOME POUR G1, AZ 45 - 135	2579	C	6560
727550-2	976		DOME POUR G1, AZ 45 - 135	2579	D	6190
727550-2	976		DOME POUR G1, AZ 45 - 135	2580	D	6030
727550-2	976		DOME POUR G1, AZ 45 - 135	2580	C	6470
976	Pour Summary:		Standard Variation: 245.544	4	Samples	Ave. Fc: 6313
727550-2	978		DOME POUR G1, AZ 225 - 315	2586	C	6330
727550-2	978		DOME POUR G1, AZ 225 - 315	2586	D	6690
978	Pour Summary:		Standard Variation: 254.558	2	Samples	Ave. Fc: 6510
727550-2	980		DOME POUR G2, AZ 135 - 225	2595	C	4600
727550-2	980		DOME POUR G2, AZ 135 - 225	2595	D	5910

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
980	Pour Summary:		Standard Variation: 926.31	2	Samples	Ave. Fc: 5255
727550-2	981		DOME POUR G2, AZ 315 - 45	2598	D	6010
727550-2	981		DOME POUR G2, AZ 315 - 45	2598	C	5550
981	Pour Summary:		Standard Variation: 325.269	2	Samples	Ave. Fc: 5780
727550-2	983		DOME POUR H3, AZ 180 - 270	2610	C	5270
727550-2	983		DOME POUR H3, AZ 180 - 270	2610	D	5680
727550-2	983		DOME POUR H3, AZ 180 - 270	2612	D	4630
727550-2	983		DOME POUR H3, AZ 180 - 270	2612	C	4830
983	Pour Summary:		Standard Variation: 468.713	4	Samples	Ave. Fc: 5103
727550-2	987		DOME POUR H4, AZ 90 - 180	2628	C	6030
727550-2	987		DOME POUR H4, AZ 90 - 180	2628	D	4930
987	Pour Summary:		Standard Variation: 777.817	2	Samples	Ave. Fc: 5480
727550-2	988		DOME POUR H4, AZ 270 - 360	2629	D	5320
727550-2	988		DOME POUR H4, AZ 270 - 360	2629	C	5800
988	Pour Summary:		Standard Variation: 339.411	2	Samples	Ave. Fc: 5560
727550-2	994	269	DOME POUR R2, AZ 70 - 160	2652	C	5310
727550-2	994	269	DOME POUR R2, AZ 70 - 160	2652	D	4790
727550-2	994	269	DOME POUR R2, AZ 70 - 160	2653	C	4880
727550-2	994	269	DOME POUR R2, AZ 70 - 160	2653	D	4780
994	Pour Summary:		Standard Variation: 250.732	4	Samples	Ave. Fc: 4940
727550-2	996	269	DOME POUR R2, AZ 250 - 340	2666	C	4920
727550-2	996	269	DOME POUR R2, AZ 250 - 340	2666	D	5040
727550-2	996	269	DOME POUR R2, AZ 250 - 340	2667	C	5180
727550-2	996	269	DOME POUR R2, AZ 250 - 340	2667	D	4970
996	Pour Summary:		Standard Variation: 112.953	4	Samples	Ave. Fc: 5028
727550-2	998	269	DOME POUR R1, AZ 160 - 250	2684	C	5090
727550-2	998	269	DOME POUR R1, AZ 160 - 250	2684	D	4560
727550-2	998	269	DOME POUR R1, AZ 160 - 250	2685	C	5360
727550-2	998	269	DOME POUR R1, AZ 160 - 250	2685	D	4900
998	Pour Summary:		Standard Variation: 336.291	4	Samples	Ave. Fc: 4978
727550-2	999	269	DOME POUR R1, AZ 340 - 70	2686	D	4810
727550-2	999	269	DOME POUR R1, AZ 340 - 70	2686	C	4950
999	Pour Summary:		Standard Variation: 98.9949	2	Samples	Ave. Fc: 4880
727550-2	1012		DOME POUR P12	2885	C	6560
727550-2	1012		DOME POUR P12	2885	D	6670
727550-2	1012		DOME POUR P12	2886	D	5910
727550-2	1012		DOME POUR P12	2886	C	6230
1012	Pour Summary:		Standard Variation: 343.645	4	Samples	Ave. Fc: 6343
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3080	C	6630
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3080	D	6610

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3081	D	6580
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3081	C	7000
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3082	D	6510
727550-2	1045	118	EQUIP HATCH SHIELD FLOOR SLAB	3082	C	6670
1045	Pour Summary:		Standard Variation: 171.891	6	Samples	Ave. Fc: 6667
727550-2	1047		EQUIP HATCH SHIELD SLAB & EAST WALL	3083	C	6210
727550-2	1047		EQUIP HATCH SHIELD SLAB & EAST WALL	3083	D	6790
1047	Pour Summary:		Standard Variation: 410.122	2	Samples	Ave. Fc: 6500
727550-2	1052	129	EQUIP HATCH SHIELD WALL & ROOF	3086	D	6840
727550-2	1052	129	EQUIP HATCH SHIELD WALL & ROOF	3086	C	6760
727550-2	1052	129	EQUIP HATCH SHIELD WALL & ROOF	3087	D	6260
727550-2	1052	129	EQUIP HATCH SHIELD WALL & ROOF	3087	C	6000
1052	Pour Summary:		Standard Variation: 402.451	4	Samples	Ave. Fc: 6465
727550-2	1062	146	EQUIP HATCH SHIELD WEST WALL	3090	C	6350
727550-2	1062	146	EQUIP HATCH SHIELD WEST WALL	3090	D	6670
1062	Pour Summary:		Standard Variation: 226.274	2	Samples	Ave. Fc: 6510
727550-2	1069	149	EQUIP HATCH SHIELD ROOF	3094	D	7150
727550-2	1069	149	EQUIP HATCH SHIELD ROOF	3094	C	7090
727550-2	1069	149	EQUIP HATCH SHIELD ROOF	3095	D	6140
727550-2	1069	149	EQUIP HATCH SHIELD ROOF	3095	C	5860
1069	Pour Summary:		Standard Variation: 657.115	4	Samples	Ave. Fc: 6560
727550-2	1089		EQUIP HATCH SHIELD REMOVABLE WALL SEC	3110	C	6210
727550-2	1089		EQUIP HATCH SHIELD REMOVABLE WALL SEC	3110	D	6470
1089	Pour Summary:		Standard Variation: 183.848	2	Samples	Ave. Fc: 6340
727550-2 Mix Summary:			Standard Variation: 541.071	200	Samples	Ave. Fc: 5774
DM-5 Mix Summary:			Standard Variation: 508.316	239	Samples	Ave. Fc: 5640
DM-5	51	93	RB6A	731	D	5390
DM-5	51	93	RB6A	731	C	5360
DM-5	51	93	RB6A	732	D	5520
DM-5	51	93	RB6A	732	C	5470
DM-5	51	93	RB6A	733	D	4850
DM-5	51	93	RB6A	733	C	4880
DM-5	51	93	RB6A	734	C	4990
DM-5	51	93	RB6A	734	D	5060
DM-5	51	93	RB6A	735	D	5160
DM-5	51	93	RB6A	735	C	4920
DM-5	51	93	RB6A	736	C	4670
DM-5	51	93	RB6A	736	D	4760
DM-5	51	93	RB6A	737	D	4790
DM-5	51	93	RB6A	737	C	4740
DM-5	51	93	RB6A	738	D	5590

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	51	93	RB6A	738	C	5240
DM-5	51	93	RB6A	739	C	5340
DM-5	51	93	RB6A	739	D	5240
DM-5	51	93	RB6A	740	D	4920
DM-5	51	93	RB6A	740	C	4920
DM-5	51	93	RB6A	741	D	5130
DM-5	51	93	RB6A	741	C	5200
DM-5	51	93	RB6A	742	C	4530
DM-5	51	93	RB6A	742	D	5010
DM-5	51	93	RB6A	743	C	5340
DM-5	51	93	RB6A	743	D	5220
DM-5	51	93	RB6A	744	D	4880
DM-5	51	93	RB6A	744	C	4930
DM-5	51	93	RB6A	745	D	5480
DM-5	51	93	RB6A	745	C	5340
DM-5	51	93	RB6A	746	D	5240
DM-5	51	93	RB6A	746	C	5130
DM-5	51	93	RB6A	747	C	5480
DM-5	51	93	RB6A	747	D	5390
DM-5	51	93	RB6A	748	C	5780
DM-5	51	93	RB6A	748	D	5870
51	Pour Summary:		Standard Variation: 312.748	36	Samples	Ave. Fc: 5160
DM-5	184	103	SECONDARY SHIELD & LETDOWN HX WALLS	1226	D	5040
DM-5	184	103	SECONDARY SHIELD & LETDOWN HX WALLS	1226	C	4990
DM-5	184	103	SECONDARY SHIELD & LETDOWN HX WALLS	1228	C	6030
DM-5	184	103	SECONDARY SHIELD & LETDOWN HX WALLS	1228	D	5940
184	Pour Summary:		Standard Variation: 561.605	4	Samples	Ave. Fc: 5500
DM-5	219	114	SECONDARY SHIELD WALL & LETDOWN HX WA	1291	D	5870
DM-5	219	114	SECONDARY SHIELD WALL & LETDOWN HX WA	1291	C	5870
DM-5	219	114	SECONDARY SHIELD WALL & LETDOWN HX WA	1292	C	5730
219	Pour Summary:		Standard Variation: 80.8290	3	Samples	Ave. Fc: 5823
DM-5	276	120	EXTERIOR WALL BUTTRESS 1 - 2	1437	C	5360
DM-5	276	120	EXTERIOR WALL BUTTRESS 1 - 2	1437	D	5200
DM-5	276	120	EXTERIOR WALL BUTTRESS 1 - 2	1438	D	5480
DM-5	276	120	EXTERIOR WALL BUTTRESS 1 - 2	1438	C	5480
276	Pour Summary:		Standard Variation: 132.665	4	Samples	Ave. Fc: 5380
DM-5	281	120	EXTERIOR WALL BUTTRESS 5 - 6	1443	D	6370
DM-5	281	120	EXTERIOR WALL BUTTRESS 5 - 6	1443	C	5180
DM-5	281	120	EXTERIOR WALL BUTTRESS 5 - 6	1444	D	5080
DM-5	281	120	EXTERIOR WALL BUTTRESS 5 - 6	1444	C	5020
281	Pour Summary:		Standard Variation: 641.736	4	Samples	Ave. Fc: 5413

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	282	120	EXTERIOR WALL BUTTRESS 4 - 5	1445	C	6280
DM-5	282	120	EXTERIOR WALL BUTTRESS 4 - 5	1445	D	6050
DM-5	282	120	EXTERIOR WALL BUTTRESS 4 - 5	1446	D	5610
DM-5	282	120	EXTERIOR WALL BUTTRESS 4 - 5	1446	C	5660
282	Pour Summary:		Standard Variation:	320.728	4 Samples	Ave. Fc: 5900
DM-5	290	130	EXTERIOR WALL BUTTRESS 2 - 3	1459	D	6600
DM-5	290	130	EXTERIOR WALL BUTTRESS 2 - 3	1459	C	6350
DM-5	290	130	EXTERIOR WALL BUTTRESS 2 - 3	1460	D	5590
DM-5	290	130	EXTERIOR WALL BUTTRESS 2 - 3	1460	C	5480
290	Pour Summary:		Standard Variation:	554.046	4 Samples	Ave. Fc: 6005
DM-5	296	120	EXTERIOR WALL BUTTRESS 1 - 6	1485	C	5130
DM-5	296	120	EXTERIOR WALL BUTTRESS 1 - 6	1485	D	6010
DM-5	296	120	EXTERIOR WALL BUTTRESS 1 - 6	1486	D	6370
DM-5	296	120	EXTERIOR WALL BUTTRESS 1 - 6	1486	C	5470
296	Pour Summary:		Standard Variation:	552.178	4 Samples	Ave. Fc: 5745
DM-5	300	130	EXTERIOR WALL BUTTRESS 1 - 2	1487	C	5910
DM-5	300	130	EXTERIOR WALL BUTTRESS 1 - 2	1487	D	5590
DM-5	300	130	EXTERIOR WALL BUTTRESS 1 - 2	1488	D	6300
DM-5	300	130	EXTERIOR WALL BUTTRESS 1 - 2	1488	C	5380
300	Pour Summary:		Standard Variation:	401.040	4 Samples	Ave. Fc: 5795
DM-5	305	130	EXTERIOR WALL BUTTRESS 5 - 6	1497	C	6770
DM-5	305	130	EXTERIOR WALL BUTTRESS 5 - 6	1497	D	6510
DM-5	305	130	EXTERIOR WALL BUTTRESS 5 - 6	1498	C	6650
DM-5	305	130	EXTERIOR WALL BUTTRESS 5 - 6	1498	D	6770
305	Pour Summary:		Standard Variation:	123.693	4 Samples	Ave. Fc: 6675
DM-5	310	130	EXTERIOR WALL BUTTRESS 4 - 5	1504	C	5800
DM-5	310	130	EXTERIOR WALL BUTTRESS 4 - 5	1504	D	5850
DM-5	310	130	EXTERIOR WALL BUTTRESS 4 - 5	1505	D	5570
DM-5	310	130	EXTERIOR WALL BUTTRESS 4 - 5	1505	C	5430
310	Pour Summary:		Standard Variation:	197.21	4 Samples	Ave. Fc: 5663
DM-5	325	140	EXTERIOR WALL BUTTRESS 5 - 6	1525	D	5680
DM-5	325	140	EXTERIOR WALL BUTTRESS 5 - 6	1525	C	5660
DM-5	325	140	EXTERIOR WALL BUTTRESS 5 - 6	1526	C	6190
DM-5	325	140	EXTERIOR WALL BUTTRESS 5 - 6	1526	D	6190
325	Pour Summary:		Standard Variation:	300.333	4 Samples	Ave. Fc: 5930
DM-5	349	109	RETAINING WALL	1561	D	5910
DM-5	349	109	RETAINING WALL	1561	C	6100
DM-5	349	109	RETAINING WALL	1562	C	6170
DM-5	349	109	RETAINING WALL	1562	D	6050
349	Pour Summary:		Standard Variation:	109.962	4 Samples	Ave. Fc: 6058

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	350	109	RETAINING WALL	1563	D	6120
DM-5	350	109	RETAINING WALL	1563	C	5820
350	Pour Summary:		Standard Variation: 212.132	2	Samples	Ave. Fc: 5970
DM-5	361	103	INCORE ROOM ENTRANCE WALLS	1576	C	5940
DM-5	361	103	INCORE ROOM ENTRANCE WALLS	1576	D	5480
361	Pour Summary:		Standard Variation: 325.269	2	Samples	Ave. Fc: 5710
DM-5	364	140	EXTERIOR WALL BUTTRESS 2 - 3	1579	D	5520
DM-5	364	140	EXTERIOR WALL BUTTRESS 2 - 3	1579	C	5320
DM-5	364	140	EXTERIOR WALL BUTTRESS 2 - 3	1580	D	5680
DM-5	364	140	EXTERIOR WALL BUTTRESS 2 - 3	1580	C	5820
364	Pour Summary:		Standard Variation: 215.019	4	Samples	Ave. Fc: 5585
DM-5	367	170	EXTERIOR WALL BUTTRESS 1 - 2	1582	C	6650
DM-5	367	170	EXTERIOR WALL BUTTRESS 1 - 2	1582	D	6240
DM-5	367	170	EXTERIOR WALL BUTTRESS 1 - 2	1583	C	6300
DM-5	367	170	EXTERIOR WALL BUTTRESS 1 - 2	1583	D	6190
367	Pour Summary:		Standard Variation: 208.247	4	Samples	Ave. Fc: 6345
DM-5	379	107	INCORE ROOM ENTRANCE	1600	C	5700
DM-5	379	107	INCORE ROOM ENTRANCE	1600	D	5750
379	Pour Summary:		Standard Variation: 35.3553	2	Samples	Ave. Fc: 5725
DM-5	385	103	SECONDARY SHIELD WALL, SE QUADRANT	1613	D	5390
DM-5	385	103	SECONDARY SHIELD WALL, SE QUADRANT	1613	C	6230
DM-5	385	103	SECONDARY SHIELD WALL, SE QUADRANT	1614	C	6000
DM-5	385	103	SECONDARY SHIELD WALL, SE QUADRANT	1614	D	5520
385	Pour Summary:		Standard Variation: 396.022	4	Samples	Ave. Fc: 5785
DM-5	395	103	SECONDARY SHIELD WALL, NE QUADRANT	1630	C	5250
DM-5	395	103	SECONDARY SHIELD WALL, NE QUADRANT	1630	D	5520
395	Pour Summary:		Standard Variation: 190.919	2	Samples	Ave. Fc: 5385
DM-5	415	200	EXTERIOR WALL BUTTRESS 2 - 3	1655	C	5540
DM-5	415	200	EXTERIOR WALL BUTTRESS 2 - 3	1655	D	5480
DM-5	415	200	EXTERIOR WALL BUTTRESS 2 - 3	1656	D	5610
DM-5	415	200	EXTERIOR WALL BUTTRESS 2 - 3	1656	C	5570
415	Pour Summary:		Standard Variation: 54.7723	4	Samples	Ave. Fc: 5550
DM-5	417	114	SECONDARY SHIELD WALL, SE QUADRANT	1660	C	4950
DM-5	417	114	SECONDARY SHIELD WALL, SE QUADRANT	1660	D	5480
DM-5	417	114	SECONDARY SHIELD WALL, SE QUADRANT	1661	D	5060
DM-5	417	114	SECONDARY SHIELD WALL, SE QUADRANT	1661	C	5280
417	Pour Summary:		Standard Variation: 235.708	4	Samples	Ave. Fc: 5193
DM-5	442	114	SECONDARY SHIELD WALL, NE QUADRANT	1706	C	5750
DM-5	442	114	SECONDARY SHIELD WALL, NE QUADRANT	1706	D	6190
DM-5	442	114	SECONDARY SHIELD WALL, NE QUADRANT	1707	D	5430

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	442	114	SECONDARY SHIELD WALL, NE QUADRANT	1707	C	5520
442	Pour Summary:		Standard Variation:	339.546	4 Samples	Ave. Fc: 5723
DM-5	450	103	SECONDARY SHIELD WALL, SW QUADRANT	1708	D	6150
DM-5	450	103	SECONDARY SHIELD WALL, SW QUADRANT	1708	C	6130
DM-5	450	103	SECONDARY SHIELD WALL, SW QUADRANT	1709	D	5840
DM-5	450	103	SECONDARY SHIELD WALL, SW QUADRANT	1709	C	5570
450	Pour Summary:		Standard Variation:	274.393	4 Samples	Ave. Fc: 5923
DM-5	461	114	PRIMARY SHIELD WALL	1733	D	5520
DM-5	461	114	PRIMARY SHIELD WALL	1733	C	5640
DM-5	461	114	PRIMARY SHIELD WALL	1734	D	5750
DM-5	461	114	PRIMARY SHIELD WALL	1734	C	5090
DM-5	461	114	PRIMARY SHIELD WALL	1735	D	5980
DM-5	461	114	PRIMARY SHIELD WALL	1735	C	5520
DM-5	461	114	PRIMARY SHIELD WALL	1736	D	6100
DM-5	461	114	PRIMARY SHIELD WALL	1736	C	5680
461	Pour Summary:		Standard Variation:	309.146	8 Samples	Ave. Fc: 5660
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1821	C	5750
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1821	D	5660
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1822	C	5310
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1822	D	4780
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1823	D	5130
DM-5	477	103	SECONDARY SHIELD WALL, NW QUADRANT	1823	C	5130
477	Pour Summary:		Standard Variation:	363.355	6 Samples	Ave. Fc: 5293
DM-5	478	114	SECONDARY SHIELD WALL, SW QUADRANT	1824	C	5660
DM-5	478	114	SECONDARY SHIELD WALL, SW QUADRANT	1824	D	5590
DM-5	478	114	SECONDARY SHIELD WALL, SW QUADRANT	1825	D	5310
DM-5	478	114	SECONDARY SHIELD WALL, SW QUADRANT	1825	C	5240
478	Pour Summary:		Standard Variation:	206.074	4 Samples	Ave. Fc: 5450
DM-5	482	123	SECONDARY SHIELD WALL, SE QUADRANT	1846	C	4850
DM-5	482	123	SECONDARY SHIELD WALL, SE QUADRANT	1846	D	5150
482	Pour Summary:		Standard Variation:	212.132	2 Samples	Ave. Fc: 5000
DM-5	483	123	SECONDARY SHIELD WALL, NE QUADRANT	1847	C	5310
DM-5	483	123	SECONDARY SHIELD WALL, NE QUADRANT	1847	D	5610
483	Pour Summary:		Standard Variation:	212.132	2 Samples	Ave. Fc: 5460
DM-5	484	123	SECONDARY SHIELD WALL, EAST SIDE	1848	C	4860
DM-5	484	123	SECONDARY SHIELD WALL, EAST SIDE	1848	D	5040
484	Pour Summary:		Standard Variation:	127.279	2 Samples	Ave. Fc: 4950
DM-5	488	118	PRIMARY SHIELD WALL	1853	D	5340
DM-5	488	118	PRIMARY SHIELD WALL	1853	C	5360
488	Pour Summary:		Standard Variation:	14.1421	2 Samples	Ave. Fc: 5350

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	492	122	PRIMARY SHIELD WALL	1858	C	5250
DM-5	492	122	PRIMARY SHIELD WALL	1858	D	5340
DM-5	492	122	PRIMARY SHIELD WALL	1859	C	5520
DM-5	492	122	PRIMARY SHIELD WALL	1859	D	5040
492	Pour Summary:		Standard Variation:	199.562	4 Samples	Ave. Fc: 5288
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1877	C	4970
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1877	D	5570
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1878	C	4970
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1878	D	5570
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1879	D	5520
DM-5	495	114	SECONDARY SHIELD WALL, NW QUADRANT	1879	C	5310
495	Pour Summary:		Standard Variation:	286.386	6 Samples	Ave. Fc: 5318
DM-5	498	115	NORTH WALL INCORE INSTR PIT	1883	C	6190
DM-5	498	115	NORTH WALL INCORE INSTR PIT	1883	D	6120
498	Pour Summary:		Standard Variation:	49.4975	2 Samples	Ave. Fc: 6155
DM-5	499	131	EAST END FUEL TRANSFER CANAL	1884	D	5750
DM-5	499	131	EAST END FUEL TRANSFER CANAL	1884	C	6000
DM-5	499	131	EAST END FUEL TRANSFER CANAL	1885	D	5680
DM-5	499	131	EAST END FUEL TRANSFER CANAL	1885	C	5730
499	Pour Summary:		Standard Variation:	143.062	4 Samples	Ave. Fc: 5790
DM-5	502	240	EXTERIOR WALL BUTTRESS 1 - 2	1886	D	5770
DM-5	502	240	EXTERIOR WALL BUTTRESS 1 - 2	1886	C	5410
DM-5	502	240	EXTERIOR WALL BUTTRESS 1 - 2	1887	C	5780
DM-5	502	240	EXTERIOR WALL BUTTRESS 1 - 2	1887	D	5850
502	Pour Summary:		Standard Variation:	198.221	4 Samples	Ave. Fc: 5703
DM-5	507	123	NORTH WALL INCORE INSTR PIT	1892	D	6510
DM-5	507	123	NORTH WALL INCORE INSTR PIT	1892	C	6330
507	Pour Summary:		Standard Variation:	127.279	2 Samples	Ave. Fc: 6420
DM-5	511	228	EXTERIOR WALL BUTTRESS 5 - 6	1913	D	6720
DM-5	511	228	EXTERIOR WALL BUTTRESS 5 - 6	1913	C	6460
DM-5	511	228	EXTERIOR WALL BUTTRESS 5 - 6	1914	D	6930
DM-5	511	228	EXTERIOR WALL BUTTRESS 5 - 6	1914	C	7160
511	Pour Summary:		Standard Variation:	298.482	4 Samples	Ave. Fc: 6818
DM-5	521	123	SECONDARY SHIELD WALL, SW QUADRANT	1925	C	6830
DM-5	521	123	SECONDARY SHIELD WALL, SW QUADRANT	1925	D	7060
521	Pour Summary:		Standard Variation:	162.635	2 Samples	Ave. Fc: 6945
DM-5	526	123	SECONDARY SHIELD WALL, NW QUADRANT	1930	D	6350
DM-5	526	123	SECONDARY SHIELD WALL, NW QUADRANT	1930	C	6560
DM-5	526	123	SECONDARY SHIELD WALL, NW QUADRANT	1931	D	5980
DM-5	526	123	SECONDARY SHIELD WALL, NW QUADRANT	1931	C	6370

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
526	Pour Summary:		Standard Variation:	242.556	4 Samples	Ave. Fc: 6315
DM-5	534	123	SECONDARY SHIELD WALL, WEST SIDE	1950	D	6510
DM-5	534	123	SECONDARY SHIELD WALL, WEST SIDE	1950	C	6280
534	Pour Summary:		Standard Variation:	162.635	2 Samples	Ave. Fc: 6395
DM-5	537	131	SECONDARY SHIELD WALL, EAST SIDE	1953	D	6130
DM-5	537	131	SECONDARY SHIELD WALL, EAST SIDE	1953	C	6120
DM-5	537	131	SECONDARY SHIELD WALL, EAST SIDE	1954	C	6030
DM-5	537	131	SECONDARY SHIELD WALL, EAST SIDE	1954	D	6100
537	Pour Summary:		Standard Variation:	45.0925	4 Samples	Ave. Fc: 6095
DM-5	559	131	SECONDARY SHIELD WALL, NW QUADRANT	1988	D	6540
DM-5	559	131	SECONDARY SHIELD WALL, NW QUADRANT	1988	C	6300
DM-5	559	131	SECONDARY SHIELD WALL, NW QUADRANT	1989	D	6050
DM-5	559	131	SECONDARY SHIELD WALL, NW QUADRANT	1989	C	6050
559	Pour Summary:		Standard Variation:	235.018	4 Samples	Ave. Fc: 6235
DM-5	566	131	SECONDARY SHIELD WALL, SW QUADRANT	1997	D	6370
DM-5	566	131	SECONDARY SHIELD WALL, SW QUADRANT	1997	C	5980
DM-5	566	131	SECONDARY SHIELD WALL, SW QUADRANT	1998	D	5590
DM-5	566	131	SECONDARY SHIELD WALL, SW QUADRANT	1998	C	5980
566	Pour Summary:		Standard Variation:	318.434	4 Samples	Ave. Fc: 5980
DM-5	568	131	SECONDARY SHIELD WALL, WEST SIDE	1994	C	5240
DM-5	568	131	SECONDARY SHIELD WALL, WEST SIDE	1994	D	5750
568	Pour Summary:		Standard Variation:	360.624	2 Samples	Ave. Fc: 5495
DM-5	570	104	RC DRAIN TANK ROOM WALLS	1999	D	5220
DM-5	570	104	RC DRAIN TANK ROOM WALLS	1999	C	5220
570	Pour Summary:		Standard Variation:	0	2 Samples	Ave. Fc: 5220
DM-5	585	135	FLOOR SLAB, EAST SIDE	2012	D	5640
DM-5	585	135	FLOOR SLAB, EAST SIDE	2012	C	5220
DM-5	585	135	FLOOR SLAB, EAST SIDE	2013	C	5620
DM-5	585	135	FLOOR SLAB, EAST SIDE	2013	D	6010
DM-5	585	135	FLOOR SLAB, EAST SIDE	2014	C	5750
DM-5	585	135	FLOOR SLAB, EAST SIDE	2014	D	5750
585	Pour Summary:		Standard Variation:	258.515	6 Samples	Ave. Fc: 5665
DM-5	595	107	ROOF SLAB, RC DRAIN TANK ENTRY	2022	C	6050
DM-5	595	107	ROOF SLAB, RC DRAIN TANK ENTRY	2022	D	5800
595	Pour Summary:		Standard Variation:	176.777	2 Samples	Ave. Fc: 5925
DM-5	607	133	SECONDARY SHIELD WALL, SE QUADRANT	2035	D	5270
DM-5	607	133	SECONDARY SHIELD WALL, SE QUADRANT	2035	C	5010
607	Pour Summary:		Standard Variation:	183.848	2 Samples	Ave. Fc: 5140
DM-5	611	138	SECONDARY SHIELD WALL, SW QUADRANT	2039	C	5610
DM-5	611	138	SECONDARY SHIELD WALL, SW QUADRANT	2039	D	5500

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
611	Pour Summary:		Standard Variation: 77.7817	2 Samples	Ave. Fc:	5555
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2042	C	5750
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2042	D	5590
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2043	C	5470
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2043	D	5680
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2044	D	5010
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2044	C	5850
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2045	D	5820
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2045	C	5840
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2046	D	5110
DM-5	613	135	REFUEL CANAL FLOOR SLAB	2046	C	5220
613	Pour Summary:		Standard Variation: 316.832	10 Samples	Ave. Fc:	5534
DM-5	619	138	SECONDARY SHIELD WALL, NE QUADRANT	2053	D	5160
DM-5	619	138	SECONDARY SHIELD WALL, NE QUADRANT	2053	C	5430
619	Pour Summary:		Standard Variation: 190.919	2 Samples	Ave. Fc:	5295
DM-5	638	143	SECONDARY SHIELD WALL, SE QUADRANT	2070	D	5310
DM-5	638	143	SECONDARY SHIELD WALL, SE QUADRANT	2070	C	5450
638	Pour Summary:		Standard Variation: 98.9949	2 Samples	Ave. Fc:	5380
DM-5	648	143	SECONDARY SHIELD WALL, SW QUADRANT (N	2094	D	4790
DM-5	648	143	SECONDARY SHIELD WALL, SW QUADRANT (N	2094	C	5380
648	Pour Summary:		Standard Variation: 417.193	2 Samples	Ave. Fc:	5085
DM-5	649	143	SECONDARY SHIELD WALL, NE QUADRANT	2095	C	5020
DM-5	649	143	SECONDARY SHIELD WALL, NE QUADRANT	2095	D	4530
649	Pour Summary:		Standard Variation: 346.482	2 Samples	Ave. Fc:	4775
DM-5	650	140	SECONDARY SHIELD WALL, NW QUADRANT (N	2096	D	5550
DM-5	650	140	SECONDARY SHIELD WALL, NW QUADRANT (N	2096	C	5540
DM-5	650	140	SECONDARY SHIELD WALL, NW QUADRANT (N	2097	D	6190
DM-5	650	140	SECONDARY SHIELD WALL, NW QUADRANT (N	2097	C	5320
650	Pour Summary:		Standard Variation: 375.322	4 Samples	Ave. Fc:	5650
DM-5	653	143	FUEL TRANSFER CANAL WALL	2100	D	5770
DM-5	653	143	FUEL TRANSFER CANAL WALL	2100	C	6240
DM-5	653	143	FUEL TRANSFER CANAL WALL	2101	C	5680
DM-5	653	143	FUEL TRANSFER CANAL WALL	2101	D	5500
DM-5	653	143	FUEL TRANSFER CANAL WALL	2102	D	6400
DM-5	653	143	FUEL TRANSFER CANAL WALL	2102	C	6150
653	Pour Summary:		Standard Variation: 356.127	6 Samples	Ave. Fc:	5957
DM-5	662	119	ROOF SLAB, RC DRAIN TANK	2112	C	6130
DM-5	662	119	ROOF SLAB, RC DRAIN TANK	2112	D	6000
662	Pour Summary:		Standard Variation: 91.9239	2 Samples	Ave. Fc:	6065
DM-5	669	143	SECONDARY SHIELD WALL, NW QUADRANT	2128	D	5020

Detail and Summary of 28 days Cylinder Tests for Containment Building

Mix	Pour	Elev	Description	Cylinder	A	Fc
DM-5	669	143	SECONDARY SHIELD WALL, NW QUADRANT	2128	C	4860
669	Pour Summary:		Standard Variation:	113.137	2 Samples	Ave. Fc: 4940
DM-5	Mix Summary:		Standard Variation:	508.316	239 Samples	Ave. Fc: 5640
T-21510	Mix Summary:		Standard Variation:	213.604	12 Samples	Ave. Fc: 3791
T-21510	230	114	TEMPORARY & SECONDARY SHIELD WALL	1322	D	4000
T-21510	230	114	TEMPORARY & SECONDARY SHIELD WALL	1322	C	3890
230	Pour Summary:		Standard Variation:	77.7817	2 Samples	Ave. Fc: 3945
T-21510	608	119	EL. 119 MEZZANINE FLOOR, SOUTH	2036	C	3590
T-21510	608	119	EL. 119 MEZZANINE FLOOR, SOUTH	2036	D	3770
608	Pour Summary:		Standard Variation:	127.279	2 Samples	Ave. Fc: 3680
T-21510	740	119	EL 119 MEZZANINE FLOOR, WEST	2222	D	3630
T-21510	740	119	EL 119 MEZZANINE FLOOR, WEST	2222	C	3590
740	Pour Summary:		Standard Variation:	28.2843	2 Samples	Ave. Fc: 3610
T-21510	760	168	ELEVATOR WALLS	2250	D	3700
T-21510	760	168	ELEVATOR WALLS	2250	C	3590
760	Pour Summary:		Standard Variation:	77.7817	2 Samples	Ave. Fc: 3645
T-21510	780	160	EL 160 FLOOR SLAB, NE	2276	C	3710
T-21510	780	160	EL 160 FLOOR SLAB, NE	2276	D	3710
780	Pour Summary:		Standard Variation:	0	2 Samples	Ave. Fc: 3710
T-21510	807	119	MEZZANINE EL 119, WEST	2306	C	4240
T-21510	807	119	MEZZANINE EL 119, WEST	2306	D	4070
807	Pour Summary:		Standard Variation:	120.208	2 Samples	Ave. Fc: 4155
T-21510	Mix Summary:		Standard Variation:	213.604	12 Samples	Ave. Fc: 3791
RB	Structure Summary:		Standard Variation:	605.23	451 Samples	Ave. Fc: 5650



engineering and constructing a better tomorrow

November 11 2009

Mr. Craig Miller
Progress Energy
(352) 795-6486 ex 1026
Craig.miller@pgnmail.com

Subject: **Report of Petrographic Observations
Crystal River Containment Wall
Steam Generator Replacement Project
Crystal River Nuclear Generating Facility, Florida
MACTEC Project No. 6468-09-2535**

Dear Mr.

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to present this report of our petrographic observations performed on two concrete cores that were shipped to our laboratory under chain of custody. An additional core was received under chain of custody for limited observations. It is our understanding the two cores submitted for petrographic observations are from an area of the containment wall where a fracture was discovered running parallel to the surface at a depth of approximately 8 to 9 inches. We understand the core that was submitted for limited observations was from an area where the subject fracture had not occurred.

The cores submitted are as follows:

Core Number	Laboratory Number Assigned by MACTEC	Description of the Core
5	21269	From an area where the fracture had occurred
2	21270	From an area where the fracture had not occurred
7	21271	From an area where the fracture had occurred

Each core was photo documented as received and then saw cut longitudinally into halves. Each half was labeled with the same sample number and then A and B were added to designate the halves. As requested the B half for cores 21269 and 21270 were shipped to CTL Group in Skokie Illinois. The B half of core 21271 is being held for possible future use. The A half's of the cores were used for our analysis.

The purpose of our work was to perform a petrographic analysis of samples 21269A and 21271A and limited observations of sample 21270A. It is our understanding that you also require specific information

*Crystal River Concrete Core Observations
Report of Petrographic Observations
Crystal River Nuclear Generating Facility, Florida*

*November 11, 2009
MACTEC Project No. 6468-09-2535*

relative to the age of the fractured surfaces on samples 21269A and 21271A. Sample 21270A was used as a control sample that did not have a fractured surface.

Petrographic Observations

A Petrographic Analysis is a visual and microscopic analysis of cementitious materials performed by a qualified petrographer. Petrographic examinations are typically performed on polished sections or thin sections. Polished sections are generally cut sections that have been lapped (ground flat and smooth) and polished and are observed using reflected polarized light microscopes at magnifications of up to 80X. Thin sections are samples mounted to glass slides and ground to specific thicknesses (generally 20, 30, or 40 microns depending on the application) and observed using transmitted polarized light microscopes at magnifications of up to 600X.

A petrographic evaluation may be performed to identify and describe a specific item of interest such as the presence or extent of distress in concrete, or to provide a general characterization and measure of quality of the materials being evaluated. The petrographic evaluation of concrete examines the constituents of the concrete including coarse aggregates, fine aggregates, embedded items, hardened paste, and air void structure. The examination identifies cracking present in the concrete, indications of corrosion, extent of damage from external sources, aggregate reaction, chemical attack, sulfate attack, freeze thaw cracking, acid attack, and other mechanisms of deterioration. The petrographic examination can also estimate the water to cement ratio, look for indications of mineral additives and unhydrated cement particles in the paste, look for indications of bleed water and excess porosity in the concrete, look for indications of curing procedures used and methods of finishing, observe micro cracking present and other conditions within the concrete which might give information on the overall quality or the quality of any particular constituent material. Aggregate mineralogy, rock types, and mineral crystal structure can be identified when thin sections are viewed under a transmitted polarized light microscope.

TEST RESULTS AND OBSERVATIONS

PETROGRAPHIC OBSERVATIONS

The petrographic analysis was performed in general accordance with the applicable sections of ASTM C 856-04 Standard Practice for Petrographic Examination of Hardened Concrete. The results of our petrographic analysis are on the attached sheets, Summary of Petrographic Observations of Hardened Concrete. Photographs from our examination are attached. A summary of our observations and discussion are as follows.

*Crystal River Concrete Core Observations
Report of Petrographic Observations
Crystal River Nuclear Generating Facility, Florida*

*November 11, 2009
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Aggregate

The coarse aggregate generally consisted of a natural carbonate crushed rock with a maximum size of 3/4 inch. The rocks types observed included limestone, fossiliferous limestone, and a few particles of chert and/or limestone and chert. The particles were generally angular to sub-rounded in shape and fairly evenly distributed. The coarse aggregate appeared to comprise approximately 50% of the total aggregate quantity with the remaining fraction being fine aggregate.

On sample 21271, there were 4 coarse aggregate pieces on the cut surface of the core that retained moisture (and moisture in the surrounding paste) longer than other portions of the sample. These pieces are shown in Photographs 5, 6, 7, and 8. One of the pieces (Photograph 5 for core 21271) had a darkened rim. A thin section was prepared from the piece in photograph 7 and this piece contained microcrystalline quartz and radial silica and exhibited localized evidence of alkali silica reaction.

The fine aggregate was observed to be a natural siliceous sand consisting mostly of quartz. The particles were generally sub-angular to sub-rounded in shape and fairly evenly distributed.

Cement Paste

The cement paste was medium light gray (Reference colors from The Geological Society of America Rock-Color Chart, 1991). The paste appeared moderately hard and not easily scratched with a hardened steel point. The concrete appeared to have been placed at a moderately low water to cement ratio, possibly in the range of 0.4 to 0.5. Indication of placement at a high water to cement ratio such as significant bleed channels and water gain voids were not observed.

Air Voids, Voids, and Cracks

The concrete appeared to be air entrained and had a total air content estimated to be around 2 to 3%. The voids were generally small and spherical. Some air void clustering was observed around a few coarse aggregate particles. The air void distribution was moderately un-even and some small areas lacked air entrainment. There was limited mineral growth observed in some of the air voids. Calcium hydroxide was observed lining some air voids.



- Location - Type	
Alteration: - Degree & Type - Reaction Products - Location - Identification	Not observed
Nature and Condition of Surface	There appeared to be white paint on the exterior surface of the core
Treatments	
Estimated water-cement ratio (based on visual observations only)	Appeared to have a moderately low w/c ratio possibly in the range of 0.4 to 0.5
Estimated cement content (based on visual observations only)	Appeared to have a moderately high cement content
PASTE:	
Color (GSA rock color chart 1991)	Medium light gray
Hardness	Appeared moderately hard when scratched with a hardened steel point
Porosity	Did not appear very porous. It took from 10 minutes to over 20 minutes to absorb 15 micro liter drops of water.
Carbonation	The outer ¼ to ½ inch of the exterior surface was carbonated. The fractured surface was not carbonated.
Residual un-hydrated Cement: - Distribution - Particle Size - Abundance - Composition	Some un-hydrated/partially hydrated cement particles were observed
Mineral Admixtures: - Size - Abundance - Identification	Fly-ash was not observed
Contamination: - Size - Abundance - Identification	Not observed

Equipment Used:

Cannon EOS Digital Rebel with 50mm macro lens and microscope adapters
 AmScope 7X to 45X stereo zoom microscope (with and without polarized light)
 Olympus BH-2 polarized light microscope
 Zeiss Photomicroscope II polarized light microscope
 Aven Digital Microscope
 Starrett 6 inch rule SN 109000003

Note: No M&TE used is subject to calibration requirements.

MACTEC

Fractures	particle. One end of the core contained a fractured surface. There were some other minor fractures on the end with the fractured surface. There were some fractures associated the chert particle discussed previously.
Embedded Items - Shape - Size - Location - Type	Not observed
Alteration: - Degree & Type - Reaction Products - Location - Identification	Not observed
Nature and Condition of Surface	There appeared to be white paint on the
Treatments	exterior surface of the core
Estimated water-cement ratio (based on visual observations only)	Appeared to have a moderately low w/c ratio possibly in the range of 0.4 to 0.5
Estimated cement content (based on visual observations only)	Appeared to have a moderately high cement content
PASTE:	
Color (GSA rock color chart 1991)	Medium light gray
Hardness	Appeared moderately hard when scratched with a hardened steel point
Porosity	Did not appear very porous. It took from 10 minutes to over 20 minutes to absorb 15 micro liter drops of water.
Carbonation	The outer ¼ to ½ inch of the exterior surface was carbonated. The fractured surface was not carbonated.
Residual un-hydrated Cement: - Distribution - Particle Size - Abundance - Composition	Some un-hydrated/partially hydrated cement particles were observed
Mineral Admixtures: - Size - Abundance - Identification	Fly-ash was not observed
Contamination: - Size - Abundance - Identification	Not observed

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PETROGRAPHIC STUDIES OF CONCRETEFORCONSTRUCTION ENGINEERING CONSULTANTS

* * * * *

SUMMARY AND DISCUSSION

The specimen represented air-entrained concrete made with crushed fossiliferous coarse aggregate and siliceous fine aggregate and a low water-cement ratio paste. There was no evidence that the aggregates had been either chemically or physically unsound.

The specimen was from an area where fractures had existed for a period of time and where moisture had been present. That was demonstrated by secondary deposits on fracture surfaces.

The specimen was relatively small. Larger specimens from different areas of the structure would be desirable for examination in order to obtain a better representation of the concrete.

* * * * *

INTRODUCTION

Reported herein are the results of petrographic studies of a concrete fragment submitted by J. Artuso of Construction Engineering Consultants. The specimen is from the dome of the containment structure of the Florida Power Corporation, Crystal River, Unit III.

Requested by Mr. Artuso were petrographic studies for evaluating the specimen, and particularly for evidence of features that would cause volume instability.

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STUDIES

Specimen - The specimen was an elongated fragment having nominal lateral dimensions of 5 inches, and a maximum thickness of about $3/4$ inch.

All surfaces were fracture surfaces except for a shallow channel about $3/32$ inch wide and $1/8$ inch deep. The channel appears to be the terminal area of a saw cut.

Petrographic Studies - Coarse aggregate of the specimen was a buff to light brown, fine-grained, fossiliferous limestone having a maximum nominal size of $3/4$ inch. The fine aggregate was a siliceous sand composed principally of quartz.

The aggregates were not particularly well graded, as evidenced by deficiencies of the finer sizes of the coarse aggregate and the coarser sizes of the fine aggregate.

There was no evidence that the aggregates had been chemically or physically unsound. Particular attention was directed to alkali-silica reactivity with respect to the coarse aggregate because a similar type of aggregate does contain a highly reactive variety of chert. Neither the chert nor the product of the reaction of the chert with alkalies (alkali-silica gel) was present.

Paste of the specimen was medium dark grey, firm, and contained abundant residual and relict cement. The quality of the paste reflects a low water-cement ratio.

Air occurred as small, discrete, spherical voids that occasionally were very slightly distorted, and as coarser irregularly shaped voids. The spherical voids are characteristic of entrained air voids; the irregularly shaped voids, of entrapped air. The air content of the specimen is estimated to be $5\frac{1}{2}$ percent and the parameters of the air-void system are judged to be effective for protecting critically saturated concrete exposed to cyclic freezing.

On one of the lateral surfaces were secondary deposits composed of tufts of fine acicular (ettringite) ($3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{CaSO}_4 \cdot 31\text{H}_2\text{O}$), and calcite (CaCO_3). (Ettringite) was also present as tufts in some air voids just below the fracture surface.

The fragment was not uniformly thick; it tapered to a knife-like edge. Along that edge, were fine fractures

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oriented subparallel to the long axis of the fragment. The fractures transected coarse aggregate particles. On those fracture surfaces were secondary deposits similar to those described above.

The secondary compounds demonstrate that the fragment was from an area where fractures present for a period of time had been exposed to moisture.

May 10, 1976

Erlin, Hime Associates, Inc.

Bernard Erlin wyl

by Bernard Erlin, President
Petrographer

Copy No. 1

Report for
Progress Energy

CTLGroup Project No. 059169

**Petrographic Examination of Concrete Half
Core from Delaminated Containment Wall,
Crystal River, Florida**

November 2, 2009

Submitted by:
Derek Brown

COA #4731

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REPORT OF PETROGRAPHIC EXAMINATION

Date: November 2, 2009

CTLGroup Project No.: 059169

Petrographic Examination of Concrete Half Core from Delaminated Containment Wall, Crystal River, Florida

One saw cut half concrete core labeled Core #5 (Figs. 1 and 2) was received on October 27, 2009 from Mr. Jerzy Zemajtis, Project Manager, CTLGroup on behalf of Mr. Paul Fagan of Progress Energy, Crystal River, Florida. According to Mr. Zemajtis, the core represents the outer portion of concrete from a containment wall and the core is fractured at its inner surface at a delamination that was found to be present when access was gained to the wall interior. The delamination is approximately at a depth of 200 mm (8.0 in.) where horizontal post tensioning ducts are present.

Petrographic examination (ASTM C856-04) of the core was requested in order to determine, if possible, if the delamination is a recent feature, or alternatively if it occurred at some earlier time in the age of the structure.

FINDINGS AND CONCLUSIONS

The following findings result from the petrographic examination.

Based on the general appearance, and both the physical and microstructural properties, the fracture at the point of delamination is most likely a fairly recent event. However, it is not possible to be completely definitive about the time frame since an older fracture, if subsequently well protected from air and moisture ingress, may also have similar characteristics.

The fracture surface passes through, not around the aggregates particles, is moderately hard, and does not exhibit loose surface debris. There is an absence of significant microcracking in the general vicinity of the fracture, and only limited evidence of surface deposits (slight efflorescence).

Carbonation to any significant depth from the fracture surface into the outer concrete is not observed (Fig. 3). Incipient carbonation is exhibited in thin section at the immediate fracture surface (Fig. 6a). However, an older delamination surface that was not exposed to air due to the depth of outer concrete, and other possible wall coverings, may also have such an absence of carbonation.

The cement hydration adjacent to the fracture is well advanced and comparable to that of the body of the core (Figs. 6b and 6c). This suggests that there was no moisture ingress to the fracture surface, over a period of time long enough, to change the general degree of hydration. This is supported by an absence of secondary deposits within air voids adjacent to the fracture surface.

Additional Comments

The concrete represented by Core #5 is well consolidated and free of any cracks or excessive microcracks (Fig. 4). The concrete consists of crushed carbonate rock coarse aggregate and natural sand fine aggregate, well distributed in a portland cement paste. No evidence is exhibited of any deleterious chemical reactions involving the cement paste and / or aggregates. The concrete could be considered marginally air entrained based on an approximate volume of 1 to 2% of small, spherical entrained air voids in the hardened cement paste (Fig. 5).

Based on the physical properties and microstructure of the hydrated cement paste, and the tight aggregate to paste bond, lack of major cracks and microcracks, and absence of a materials-related distress mechanism, the concrete is considered to be in good condition.

Further details of the petrographic examination are given in the following image and data sheets.

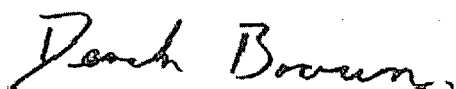
METHODS OF TEST

Petrographic examination of the provided sample was performed in accordance with ASTM C 856-04, "Standard Practice for Petrographic Examination of Hardened Concrete." The core was visually inspected and photographed as received. The core half was ground (lapped) on the saw cut surface to produce a smooth, flat, semi-polished surface. Lapped and freshly broken surfaces of the concrete were examined using a stereomicroscope at magnifications up to 45X.

For thin-section study, small rectangular blocks were cut from the core inner surface fracture region and within the body of the core. One side of each block was lapped to produce a smooth, flat surface. The blocks were cleaned and dried, and the prepared surfaces mounted on separate ground glass microscope slides with epoxy resin. After the epoxy hardened, the thickness of the mounted blocks was reduced to approximately 20 μm (0.0008 in.). The resulting thin sections were examined using a polarized-light (petrographic) microscope at magnifications up to 400X to study aggregate and paste mineralogy and microstructure.

Estimated water-cement ratio (w/c), when reported, is based on observed concrete and paste properties including, but not limited to: 1) relative amounts of residual (unhydrated and partially hydrated) portland cement clinker particles, 2) amount and size of calcium hydroxide crystals, 3) paste hardness, color, and luster, 4) paste-aggregate bond, and 5) relative absorbency of paste as indicated by the readiness of a freshly fractured surface to absorb applied water droplets. These techniques have been widely used by industry professionals to estimate w/c.

Depth and pattern of paste carbonation was initially determined by application of a pH indicator solution (phenolphthalein) to freshly cut and original fractured concrete surfaces. The solution imparts a deep magenta stain to high pH, non-carbonated paste. Carbonated paste does not change color. The extent of paste carbonation was confirmed in thin-section.



Derek Brown
Senior Microscopist
Microscopy Group

DB/DB

- Notes:
1. Results refer specifically to the sample submitted.
 2. This report may not be reproduced except in its entirety.
 3. The sample will be retained for 30 days, after which it will be discarded unless we hear otherwise from you.

PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE, ASTM C 856

STRUCTURE: Containment wall

DATE RECEIVED: October 27, 2009

LOCATION: Crystal River

EXAMINED BY: Derek Brown

SAMPLE

Client Identification: Core #5.

CTLGroup Identification: 2452601.

Dimensions: Core diameter = 95 mm (3.75 in.). Core length = approximately 197 mm (7.75 in.); partial wall thickness.

Top End: Even, slightly rough formed surface.

Bottom End: Uneven and rough; fractured core end.

Cracks, Joints, Large Voids: Text.

Reinforcement: None observed in the core supplied.

AGGREGATES

Coarse: Crushed rock composed of carbonate rock type.

Fine: Natural quartz sand.

Gradation & Top Size: Visually appears evenly graded to an observed top size of 18 mm (0.75 in.).

Shape, Texture, Distribution: Coarse- Sub rounded to angular, slightly irregular to rough, evenly distributed. Fine- Rounded to sub angular, slightly smooth to somewhat rough, evenly distributed

PASTE

Color: Medium gray, uniform coloration throughout the length of the core.

Hardness: Moderately hard at the outer surface and in the body of the core. At the fracture surface the paste is also moderately hard.

Luster: Subvitreous.

Paste-Aggregate Bond: Tight. Freshly fractured surfaces pass through aggregate particles.

Air Content: Estimated 2 to 4% total. Approximately 1 to 2% of the total air is larger entrapped air voids of up to 3 mm (0.12 in.) in size, plus a few large voids of 4 to 10 mm (0.16

to 0.4 in.). Somewhat uneven distribution of voids. Marginally air entrained based on the very low volume of moderate to small sized spherical air voids in the hardened cement paste.

Depth of Carbonation: 4 to 5 mm (0.16 to 0.20 in.) as measured from the outer surface. Negligible when measured from the inner fractured core surface.

Calcium Hydroxide*: Estimated 6 to 12% of small to medium sized crystals evenly distributed throughout the paste, and around aggregate to paste interfaces. Estimation of the volume is difficult due to the presence of calcite fines in the cement paste.

Residual Portland Cement Clinker Particles*: Estimated 4 to 8%. Some large cement particles, particularly belite clusters, of up to 0.15 mm in size suggest a portland cement as produced more than 30 years ago.

Supplementary Cementitious Materials*: None observed by the core supplied.

Secondary Deposits: None observed either in the body of the core and or near the fracture surface.

MICROCRACKING: A small number of medium length (5 to 10 mm), randomly orientated microcracks are evenly distributed throughout the body of the core. At the fractured end of the core there was no observed increase in microcracking relative to the body of the core.

ESTIMATED WATER-CEMENT RATIO: Moderate to moderately high (0.50 to 0.60) but estimation may be biased upwards due to the well advanced degree of hydration / apparent old age of the concrete.

MISCELLANEOUS:

1. Water droplets applied to freshly fractured surfaces were somewhat slowly absorbed by the hardened cement paste.
2. Some small areas of the inner fractured surface of the core, as received, exhibit a thin white haze of efflorescence-like substance suggesting leaching of lime in solution from within the core, or alternatively, moisture on or flowing past the fractured surface at the delamination position within the wall.
3. A moderate volume of fine calcite particles is present within the hardened cement paste, most likely from coarse aggregate crusher fines.

*percent by volume of paste

Core No.	Pour No.	Mix	Cylinder ID Number	Compressive Strength [psi]										Density	Current			
				7 days	28 days	90 days	Fc Ratios				Fc	Ec	Poisson					
				ave.	ave.	ave	7/28 days	90/28 days	Cur./28 days	Cur./90 days	ave							
63	472	DM-5		1799	5080		5840							2.54	7530			
				1799	4950		5570								7650			
				1800	4390		5480											
				1800	4630	4763	5200	5523			86%		137%			7590	3.30E+06	0.21
65	425	DM-5		1670	4580		5480		6560					2.57	5990			
				1670	4630		5680		6050						6800			
				1671	3540		5310		6180									
				1671	3870	4155	5660	5533	6010	6200	75%	112%	116%	103%		6395	2.70E+06	0.18
66	388	DM-5		1623	3340		5390		7000					2.56	6830			
				1623	3540		5200		6830						6370			
				1624	3890		4860		6400									
				1624	4300	3768	4900	5088	5780	6503	74%	128%	130%	101%		6600	3.10E+06	0.22
40	475	DM-5		1809	4160		4510		5750					2.57	6100			
				1809	4000		4740		6010						6610			
				1810	3910		5870		6150						6600			
				1810	4160	4058	5650	5193	5520	5858	78%	113%	124%	110%		6437	3.05E+06	0.22
31	487	SCM m*	Bay 0010	1851	4530		5290		5780						8810			
		DM-5	panel K	1851	4600		5020		6100									
				1852	4830		5500		6930									
				1852	4920		5320		6920									
				1853	4670		5340		6770									
				1853	4740	4715	5620	5348	6720	6537	88%	122%	165%	135%		8810		
45	452	SCM m*	Bay 0014	1712	4240		5700		6380						8310			
		DM-5	panel L	1712	4100		5450		6460						8970			
				1713	4990		6210		6740									
				1713	5010	4585	6030	5848	7340	6730	78%	115%	148%	128%		8640		
16	712	DM-5M			4900		6240		6650					2.54	8220			
					4810		6190		6650						8030			
					5020		5410		7290						7520			
					5040	4943	5360	5800	7470	7015	85%	121%	137%	113%		7923	3.90E+06	0.24
60	Hatch	727550-2												2.47				
59	Hatch	727550-2		3088	4670		6540		6860					2.46	7520		3.35E+06	0.25
					4860		6810		6540									
						4765		6675		6700	71%	100%	113%	112%		7520		

* Grout cores with aggregate inclusions

Average:	80%	116%	134%	115%	2.53	7366	7489	3.23E+06	0.22
Max:	88%	128%	165%	135%	2.57	8970	8810	3.90E+06	0.25
Min:	71%	100%	113%	101%	2.46	5990	6395	2.70E+06	0.18
Count:	8	7	8	7	7	16	8	6	6