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HRT-CP 9Purpose

To determine if the underflow receiver could be drained after having collected several hundred grams of solids.

Summary

Of a total of 666 grams of solids injected in the system during Run No. 9, 377 grams (56.5%) was recovered in the hydroclone loop with a total recovery including samples of 75.1%. Although only 106 grams of solids were recovered in the initial drain of the underflow pot, two rinses produced an additional 271 grams. Each drain was accomplished without difficulty and there were no signs of plugging. The concentration factor was 1130.

After an addition of solids, the concentration of solids decreased with an average half period of approximately one hour.

Procedure

Thirty-two liters of the clear supernate from run HRT-CP-8 were charged to the system along with four liters of newly prepared UO_2SO_4 for run CP-9. The system was brought to 280°C and 1500 psi with a flow rate of 0.75 gpm through the hydroclone. The first four solids injections each contained 64 grams. After each solids addition, three samples were taken at four-hour intervals. This schedule was altered after the fourth solids addition because the temperature of the motor end of P-1 pump rose to 124°C from a normal operating temperature of 70°C. The pump was apparently gas binding and after bleeding the pump several times during the next eight hours, the temperature of the motor returned to normal. Four more solids additions of about 100 grams each were made at eight-hour intervals, with two samples taken between each injection. The run was terminated due to a leak from the flange on HCV-P-1-4 valve, failure of the rupture disc on the shakedown loop, and a recurrence of the overheating of P-1.

A total of 666 grams of solids was injected into the system during the run. The chemical plant was drained and rinsed twice, and the solids loop was rinsed in an effort to obtain a material balance.

Results

The data for the run are shown in Table 1. Fig. 1 presents a plot of concentration of solids in mg/ml against time of hydroclone operation. Also shown are the calculated values of the solids at the time of each solids addition. From Fig. 1, it can be seen that solids concentrations for the 64-gram additions dropped by a factor 8-10 in four hours of operation. The half life of 1-1/3 hours calculated for these additions represents time for the solution inventory to circulate through the hydroclone seven times.

After each of the four 100 gram additions, the solids concentrations decreased with a half-life of one hour. In eight hours, forty passes through the clone dropped the average calculated solids concentration from 3.1 mg/ml to 0.03 mg/ml, a factor of over 100.

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A total of 106 grams of solids was found in the 9.5 liters drained from the underflow receiver system. Two rinses of the chemical plant produced an additional 271 grams of solids. Both the draining and the rinses of the chemical plant were accomplished without difficulty. Thus a total of 377 grams of solids or 56.6% of the original solids were recovered from the chemical plant. Draining of the solids feed loop yielded only 9.5 grams or about 1.5% of the total solids charged. The over-all material balance on solids recovery was 75.1%. The concentration factor was 1130. A breakdown of solids recovered is tabulated below:

	<u>Grams</u>	<u>Grams</u>	<u>% of Total</u>
Solids charged to the system		666	100.0
Solids drained from chemical plant	106		15.9
First rinse of chemical plant	114		17.1
Second rinse of chemical plant	<u>157</u>		<u>23.6</u>
Total solids from chemical plant		377	56.6
Solids drained from the loop	10		1.5
Solids removed as samples	4		0.6
Rinse of entire system	107		16.1
Solids from solution vented	<u>2</u>		<u>0.3</u>
Total solids recovered		500	75.1

Each of the flowing stream samples was analyzed for chloride and fluoride concentrations. The fluoride content in the flowing stream samples averaged 3.4 ppm compared to 2.7 ppm of fluoride in the solutions drained from the chemical plant and the solids loop. The highest concentration of chloride found in the flowing stream samples was 2.0 ppm compared to an average of 0.6 ppm for all samples. The total Ni found in the circulating system averaged 0.14 grams with a range from no Ni detected to a high of 11 ppm of Ni.

The uranium balance for this run was 92%. Known leaks of uranium during pump ventings and during sampling probably accounted for these losses.

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Table I

Grams Solids Added	Concentration Suspended Solids, mg/ml	Sample Code	Time Sample Pulled After Clone in Operation, hrs	Solution Temp. °C	Pressure In System psi	Time, Date Sample Taken
64	3.07	CFH-9-3	1/2	280	1580	0130, 11/24/56
None	0.046	CFH-9-4	4-1/2	280	1550	0530, 11/24/56
None	0.078	CFH-9-5	8-1/2	280	1500	0930, 11/24/56
None	0.025	CFH-9-7	12-1/2	280	1500	1330, 11/24/56
64	2.5*	No sample pulled, solids added, 1445, 11/24/56				
None	0.232	CFH-9-9	18-1/4	280	1500	1915, 11/24/56
None	0.028	CFH-9-11	22-1/4	280	1500	2315, 11/24/56
None	0.031	CFH-9-12	26-1/4	280	1500	0315, 11/25/56
64	2.625	CFH-9-14	27-1/4	274	1450	0415, 11/25/56
None	0.316	CFH-9-15	31-1/4	280	1510	0815, 11/25/56
None	0.020	CFH-9-17	35-1/4	280	1580	1215, 11/25/56
None	0.215	CFH-9-19	39-1/4	281	1475	1615, 11/25/56
64	2.5*	No sample pulled, solids added, 1800, 11/25/56				
None	0.296	CFH-9-21	45-1/4	278	1500	2215, 11/25/56
None	0.033	CFH-9-22	49-1/4	280	1500	0215, 11/26/56
None	0.042	CFH-9-23	58-1/2	280	1875	1135, 11/26/56
110	4.0*	No sample pulled, solids added at 1300, 11/26/56				
None	0.239	CFH-9-26	64	278	1590	1700, 11/26/56
None	0.026	CFH-9-28	67	274	1500	2000, 11/26/56
100	4.0*	No sample pulled, solids added at 2100, 11/26/56				
None	0.575	CFH-9-30	72	278	1500	0100, 11/27/56
None	0.030	CFH-9-32	75	278	1660	0400, 11/27/56
100	4.0*	No sample pulled, solids added at 0500, 11/27/56				
None	0.502	CFH-9-34	80	280	1850	0900, 11/27/56
None	0.028	CFH-9-37	83	276	1850	1200, 11/27/56
100	4.0*	No sample pulled, solids added at 1300, 11/27/56				

*Calculated

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Fig. 1. HRT-CP-9 SOLIDS CONCENTRATION vs OPERATING TIME OF HYDROCLONE

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