UNCLASSIFIED

OAK RIDGE NATIONAL LABORATORY

Operated By

UNION CARBIDE NUCLEAR COMPANY

UFC

L

POST OFFICE BOX P
OAK RIDGE, TENNESSEEExternal Transmittal
Authorized
ORNL
CENTRAL FILES NUMBER

CF-56-12-110

DATE: December 19, 1956

SUBJECT: Run Summary of HRT-CP 10

COPY NO. 85

TO: W. D. Burch

FROM: R. H. Winget

DISTRIBUTION

1. HRP Director's Off.	29. P. N. Haubenreich	56. A. M. Rom
2. G. M. Adamson	30. J. W. Hill	57. W. L. Ross
3. W. L. Albrecht	31. R. W. Horton	58. H. C. Savage
4. H. F. Bauman	32. G. H. Jenks	59. H. K. Search
5. S. E. Beall	33. D. M. Johnson	60. C. H. Secoy
6. E. G. Bohlmann	34. R. W. Jurgensen	61. C. L. Segaser
7. N. C. Bradley	35. S. I. Kaplan	62. I. Spiewak
8. R. E. Brooksbank	36. P. R. Kasten	63. R. W. Stoughton
9. N. A. Brown	37. A. S. Kitzes	64. J. T. Sutherland
10. F. R. Bruce	38. J. O. Kolb	65. J. A. Swartout
11. J. R. Buchanan	39. R. B. Korsmeyer	66. E. H. Taylor
12. W. D. Burch	40. K. A. Kraus	67. D. G. Thomas
13. R. D. Cheverton	41. J. A. Lane	68. T. H. Thomas
14. E. L. Compere	42. R. E. Leuze	69. D. S. Toomb
15. J. S. Culver	43. R. B. Lindauer	70. W. E. Unger
16. N. W. Curtis	44. M. I. Lundin	71. R. Van Winkle
17. W. K. Eister	45. R. N. Lyon	72. H. O. Weeren
18. J. R. Engel	46. J. P. McBride	73. R. R. Wiethaup
19. D. E. Ferguson	47. H. F. McDuffie	74. R. H. Winget
20. J. D. Flynn	48. H. M. McLeod	75. C. E. Winters
21. D. F. Frech	49. R. A. McNees	76. F. C. Zapp
22. C. H. Gabbard	50. E. C. Miller	77. ORNL Doc. Ref. Library, Y-12
23. W. R. Gall	51. E. O. Nurmi	78. Central Research Library
24. T. H. Gladney	52. L. F. Parsley	79-80. REED Library
25. J. C. Griess	53. D. M. Richardson	81. ORNL-RC
26. R. H. Guyman	54. G. W. Rivenbark	82-84. Laboratory Records
27. B. H. Hamling	55. R. C. Robertson	85-99. T.I.S.E.
28. P. H. Harley		

NOTICE

This document contains information of a preliminary nature and was prepared primarily for internal use at the Oak Ridge National Laboratory. It is subject to revision or correction and therefore does not represent a final report.

UNCLASSIFIED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

- A. Makes any warranty or representation, express or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or
- B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission to the extent that such employee or contractor prepares, handles or distributes, or provides access to, any information pursuant to his employment or contract with the Commission.

UNCLASSIFIED

Purpose

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

Summary

Approximately 1.5 kg of simulated solids were charged to the solids feed loop and the chemical plant at the rate of about 100 grams every four hours. At the conclusion of the additions, 12 liters of solution containing 781 grams of solids were drained without difficulty from the chemical plant. Thus it was satisfactorily demonstrated that several hundred grams of solids could be drained from the chemical plant. This amount, 781 grams, is about twice the quantity of solids expected to be collected and drained from one week of HRT operation. The over-all material balance for solids was 83.3% recovery. The concentration factor was 1700.

Procedure

After charging 36.9 liters of newly prepared UO_2SO_4 (7.5 mg/ml of U, 0.04 N H_2SO_4) solution to the system, the system was brought to a temperature of 271°C and 1220 psi. At this time, 100 grams of solids (40% Fe_2O_3 , 45% ZrO_2 , 13% Cr_2O_3 , 0.2% CuO) were charged to the loop by means of a sample bomb. Ten more additions of 100 grams each were made at four hour intervals, and one sample was taken approximately three hours after each addition. The final four 92 gram additions were made on the same schedule. Thus, a total of 1468 grams of solids were injected into the circulating system. The final sample was taken 7-1/2 hours after the last addition. To keep the uranium inventory constant, each solids bomb contained a weight of uranium equivalent to that removed as samples. At the conclusion of the run, the chemical plant was drained and rinsed three times and each solution analyzed for uranium and suspended solids. The solids loop was drained separately and rinsed one time. The entire system was then given three rinses to obtain a final material balance.

Results

The data for the run are shown in Table I which denotes the time and size of each addition and the concentration of suspended solids in mg/ml for each sample taken. Figure I is a plot of concentration of solids plotted against time. The 4.0 mg/ml and the 3.7 mg/ml concentrations are calculated values following each addition of solids. The dotted lines (following the slope of each line drawn between the calculated value and the value found by sampling three hours after each addition) assume that the solids removal rate remains constant until the next addition. The slopes of the lines appear to give a fairly uniform half life of about 80 minutes which compares favorably with previous runs. In this time, the system solution inventory is passed through the hydroclone over nine times at a flowrate of 0.75 gpm. From these figures a hydroclone efficiency of 7% is obtained which is satisfactory for these fine particles (50% were less than 0.7 microns).

The lowest concentration, based on analysis, was 0.05 mg/ml attained 7-1/2 hours after the last addition.

UNCLASSIFIED

At the conclusion of the run, the solution drained from the underflow pot system was drained with no difficulty and 781 grams of solids were recovered. This quantity of solids is about twice the amount expected to be collected during one week of HRT operation. Thus it was demonstrated that gross quantities of solids could be drained from the chemical plant with no fear of plugging.

Two rinses of the hydroclone loop produced an additional 247 grams for a 70% recovery in the chemical plant. The over-all material balance for solids was 83.3%, the highest recovery of any of the eight shakedown runs. The concentration factor was 1700. A breakdown of the material balance for solids is tabulated below:

	<u>Grams</u>	<u>Grams</u>	<u>% of Total</u>
Solids charged to the System		1468	100.0
Solids drained from Chemical Plant	781		53.2
Solids rinsed from Chemical Plant	<u>247</u>		<u>16.8</u>
Total solids from Chemical Plant		1028	70.0
Solids drained from Loop	15		1.0
Solids removed as samples	32		2.2
Solids from rinse of Loop	19		1.3
Solids from three rinses of Entire System	<u>129</u>		<u>8.8</u>
Total Solids Recovered		1222	83.3

Each of the flowing stream samples was analyzed for chloride and fluoride content. No chloride was detected in any of the flowing stream samples or in the solutions drained from the system at the conclusion of the run. Fluoride was found in eight of the seventeen samples with a high value of 1.8 ppm; however, no fluoride was detected in the solutions drained from the system. This fact leaves some doubt as to the validity of the analyses for fluoride concentrations.

The total Ni found in the circulating system based on flowing stream sample analyses averaged 0.5 grams with an erratic variation between 0.1 grams to 1.4 grams. There was no trend upward. The total Ni found in the solution drained from the chemical plant plus the solution drained from the solids feed loop was 0.9 grams compared to the average of 0.5 grams determined by flowing stream sample analyses.

Uranium balance for this run was 97%; however, volume losses were less than 0.5% and variations in uranium analyses could account for this apparent loss.

R. H. Winget

R. H. Winget

RHW/nh

UNCLASSIFIED

-4-

HRT-CP 10

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
100	4.0*	No sample	pulled, solids added at	2300,	11/29/56	
None	0.86	CFH-10-1	3	280	1300	0200, 11/30/56
100	4.0*	No sample	pulled, solids added at	0300,	11/30/56	
None	0.89	CFH-10-3	7	280	1310	0600, 11/30/56
100	4.0*	No sample	pulled, solids added at	0700,	11/30/56	
None	0.37	CFH-10-5	11	276	1225	1000, 11/30/56
100	4.0*	No sample	pulled, solids added at	1100,	11/30/56	
None	1.42	CFH-10-7	15	280	1300	1400, 11/30/56
100	4.0*	No sample	pulled, solids added at	1500,	11/30/56	
None	0.84	CFH-10-9	19	285	1300	1800, 11/30/56
100	4.0*	No sample	pulled, solids added at	1845,	11/30/56	
None	1.36	CFH-10-11	20-1/4	280	1300	1915, 11/30/56
None	0.25	CFH-10-13	22-3/4	280	1350	2145, 11/30/56
100	4.0*	No sample	pulled, solids added at	2300,	11/30/56	
None	1.15	CFH-10-15	26-3/4	286	1450	0145, 12/1/56
100	4.0*	No sample	pulled, solids added at	0245,	12/1/56	
None	1.05	CFH-10-17	30-3/4	280	1350	0545, 12/1/56
100	4.0*	No sample	pulled, solids added at	0645,	12/1/56	
None	1.07	CFH-10-19	34-3/4	275	1300	0945, 12/1/56
100	4.0*	No sample	pulled, solids added at	1100,	12/1/56	
None	1.05	CFH-10-21	38-3/4	277	1300	1345, 12/1/56
100	4.0*	No sample	pulled, solids added at	1500,	12/1/56	
None	0.69	CFH-10-23	42-1/2	280	1400	1730, 12/1/56
92	3.7*	No sample	pulled, solids added at	1830,	12/1/56	
None	0.14	CFH-10-25	46-1/2	280	1300	2130, 12/1/56
92	3.7*	No sample	pulled, solids added at	2230,	12/1/56	
None	0.49	CFH-10-27	50-1/2	280	1300	0130, 12/2/56
92	3.7*	No sample	pulled, solids added at	0230,	12/2/56	
None	0.68	CFH-10-29	54-1/2	280	1500	0530, 12/2/56
92	3.7*	No sample	pulled, solids added at	0630,	12/2/56	
None	0.16	CFH-10-31	58-1/2	280	1700	0930, 12/2/56
None	0.05	CFH-10-33	63	265	2000	1400, 12/2/56

*Calculated solids concentration.

UNCLASSIFIED

○ Analysis
 ▽ Calculated

5

Fig. HRT CP-10 SOLIDS CONCENTRATION vs OPERATING TIME OF HYDROCLONE