UNCLASSIFIED **OAK RIDGE NATIONAL LABORATORY**

Operated By

UNION CARBIDE NUCLEAR COMPANY

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

57-6-40

DATE: June 12, 1957

COPY NO. 66

SUBJECT: Fuel Feed Cooler Performance Test
HRT Test Number II-A-17a,b.

TO: R. Van Winkle

FROM: D. E. Frech

DISTRIBUTION

1. HRP Director's Office	20. R. J. Harvey	40. C. L. Segaser
2. W. L. Albrecht	21. P. N. Haubenreich	41. A. J. Sharenberger
3. H. F. Bauman	22. J. W. Hill, Jr.	42. M. J. Skinner
4. S. E. Beall	23. J. P. Jarvis	43. I. Spiewak
5. N. C. Bradley	24. R. W. Jurgensen	44. W. Terry
6. N. A. Brown	25. S. I. Kaplan	45. R. Van Winkle
7. J. R. Buchanan	26. J. O. Kolb	46. W. E. Unger
8. W. D. Burch	27. J. A. Lane	47. B. H. Webster
9. R. D. Cheverton	28. M. I. Lundin	48. K. W. West
10. C. W. Collins	29. H. A. McLain	49. R. H. Winget
11. J. S. Culver	30. H. M. McLeod	50. F. C. Zapp
12. J. R. Engel	31. R. A. McNees	51. ORNL Doc. Reference
13. J. D. Flynn	32. R. C. Moren	Library, Y - 12
14. D. F. Frech	33. R. M. Pierce	52. Central Res. Library
15. C. H. Gabbard	34. D. M. Richardson	53. - 54. REED Library
16. W. R. Gall	35. G. W. Rivenbark	55. - 57. Laboratory Records
17. T. H. Gladney	36. R. C. Robertson	<u>EXTERNAL DISTRIBUTION</u>
18. R. H. Guymon	37. J. N. Robinson	58. F. C. Moesel, AEC
19. P. H. Harley	38. R. E. Schappel	59. - 65. Westinghouse
	39. H. K. Search	PAR Project
		66. - 80. TISE - AEC

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.

Summary

A test of the fuel feed cooler indicates that performance is satisfactory and that a heat balance in cooling water may be used to calculate fuel feed rate within 10% of actual flow rate.

Procedure

Steam at 20 psig. was applied to evaporators to produce 100°C temperature in the fuel dump tanks. The fuel feed pump and fuel feed cooler were put into operation. Feed was collected at the broken flange in line 110. The following data were recorded on page 83 of the Data Log Book: Feed inlet and exit temperatures at the fuel feed cooler, measured feed rate, cooling water inlet and exit temperatures and cooling water flow rate.

Results

Design specifications from CF-55-5-43 R. Van Winkle, Fuel Feed Cooler (Item 17), May 5, 1955 and test results are listed on the attached data sheet. The cooler is designed to cool 13.5 pounds per minute of fuel feed from its boiling temperature to approximately 50°C maximum.

In the first and second runs 17.5 and 13.9 lbs./min. were cooled from 98°C to 53°C and 52°C, respectively. Heat removed during the first run was 1361 BTU/min, which exceeds the specified 1215 BTU/min and demonstrates that the cooler meets design specifications. However, the observed over-all heat transfer coefficients were about 10% lower than those that were calculated at test conditions using methods by which the original design was specified.

Using the test data, a check was made on the accuracy of determining fuel feed rate from the cooling water heat gain. "Calculated Feed Rate" was obtained by dividing the "C. W. Heat Gain" by feed temperature difference (ΔT). The figures differed from measured feed rate by 4% or less, except in the 4th. run, where feed rate and cooling water rate were low and the error was 9.8%. Thus, accuracy of this method of computing feed rate is good.

UNCLASSIFIED

- 3. -

FUEL FEED COOLER PERFORMANCE TEST DATA

	DESIGN SPECIFICATION	TEST RESULTS			
		1	2	3	4
Reading of HIC - 115	--	100	75	50	35
CW Inlet Temp. °C	(85°F Max.) 29.4° Max.	24	24	24	24
CW Exit Temp. °C	--	49	51	54	70
CW Δ T °C	--	25	27	30	46
CW Rate, o/o on FI - 819 100% = 6.6 gpm	--	55	42.5	22.5	8
CW Rate Gpm	assumed 5	3.63	2.805	1.485	.528
CW Heat Gain BTU/min.	1215	1361	1136	668	364
Feed Inlet Temp °C	100	98	98	97	96
Feed Exit Temp. °C	~ 50 Max.	53	52	49	45
Feed Δ T °C	--	45	46	48	51
Feed Rate Lbs/min.	(810 lb/hr) 13.5	17.5	13.9	8	4.4
*Obs. Over-all heat transfer coefficient BTU/hr-°F-ft. ²		158	137	89	69
** Calculated over-all heat transfer coefficient*		173	148	99	58
Calculated feed Rate lbs/min.	--	16.8	13.7	7.73	3.97
Error lbs/min	--	- .7	-.2	-.27	-.43
Error %	--	- 4.0	-1.4	-3.0	-9.8
*Based on Inside Diameters; **Calculated using methods in CF-55-5-43 applied to test conditions.					

UNCLASSIFIED