**Cover Sheet for a Hanford
Historical Document
Released for Public Availability**

Released 1994

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

DISCLAIMER

This is a **historical document** that is being released for public availability. This was made from the best available copy. Neither the United States Government nor any agency thereof, nor Battelle Memorial Institute, 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.** The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

HW-65863

SERIES AND COPY NO.

DATE _____

July 14, 1960

☒ RESTRICTED - DATA
THIS DOCUMENT CONTAINS RESTRICTED INFORMATION AS
CLASSIFIED IN THE COMINT ENERGY ACT OF 1954.
ITS TRANSMISSION FOR THE DISSEMINATION OF ITS
CONTENT IN ANY MANNER TO AN UNAUTHORIZED
PERSON IS PROHIBITED.

TITLE

DEVELOPMENT TEST IP-342-AG
INCREASE OF BULK OUTLET WATER TEMPERATURE
105-DR

☐ OTHER OFFICIAL CLASSIFIED INFORMATION

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U. S. C. , SECS. 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AUTHOR

O. E. Adams, Jr.
J. W. Hedges
S. S. Jones

CIRCULATING
RECEIVED 100

AUG 01 1960

RETURN 10

THIS DOCUMENT IS NOT TO BE LEFT UNATTENDED WHERE AN UNAUTHORIZED PERSON MAY HAVE ACCESS TO IT. WHEN IN USE, IT MUST BE STORED IN AN APPROVED LOCKED CUSTODIARY WITHIN AN APPROVED GUARDED AREA. WHILE IT IS YOUR RESPONSIBILITY AND UNTIL YOU HAVE OBTAINED A SIGNED RECEIPT FROM CLASS FILES, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF THE PROJECT AND FROM ANY UNAUTHORIZED PERSON. ITS TRANSMITTAL TO, AND STORAGE AT YOUR PLACE OF RESIDENCE IS PROHIBITED. IT IS NOT TO BE REPRODUCED. IF ADDITIONAL COPIES ARE REQUIRED, OBTAIN THEM FROM THE RELATED ISSUING FILE. PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

ROUTE TO:

PAYROLL NO.

LOCATION

FILE	ROUTE	DATE
------	-------	------

SIGNATURE AND DATE

AUG 31 1960

PPHickman 9/20/00
MELD 10-8-65

RECORD
COPY

Indefinite Retention

Disposal Date

Authority

Authority

DECLASSIFIED

MASTER

DECLASSIFIED

HW-65863
Page 1

DEVELOPMENT TEST IP-342-AG

INCREASE OF BULK OUTLET WATER TEMPERATURE
105-DR

By

O. E. Adams
Reactor Engineering
RESEARCH AND ENGINEERING OPERATION
IRRADIATION PROCESSING DEPARTMENT

J. W. Hedges
Maintenance Engineering
D-DR REACTORS OPERATION
IRRADIATION PROCESSING DEPARTMENT

S. S. Jones
Reactor Engineering
RESEARCH AND ENGINEERING OPERATION
IRRADIATION PROCESSING DEPARTMENT

July 14, 1960

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of R. M. Sten
CGPR-2, 1-25-94
By J. E. Savely 2-3-94
Verified By J. Mally 2-11-94

~~RESTRICTED DATA - This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmission or the disclosure of its contents in any manner by an unauthorized person is prohibited.~~

This document classified by

R. E. Trumble

This document consists of
12 pages, No. 11 of
36 copies.

DISTRIBUTION

DECLASSIFIED

1. O. E. Adams
2. G. O. Amy
3. E. R. Astley/G. J. Rogers
4. C. R. Barker
5. R. G. Benham
6. J. H. Brown
7. H. C. Copeland
8. M. L. Faught
9. S. M. Graves
10. O. H. Greager
- 11. A. K. Hardin
12. H. W. Heacock/F. J. Kempf
13. J. W. Hedges
14. R. R. Henderson/R. L. Loundagin
15. P. H. Hutton
16. R. T. Jessen
17. S. S. Jones
18. D. S. Lewis/R. K. Wahlen
19. R. R. Meyers/D. C. Greenhalgh
20. W. H. Radtke
21. R. W. Reid
22. L. P. Reinig
23. W. D. Richmond
24. E. R. Rudock
25. O. C. Schroeder
26. R. L. Scott
27. R. M. Scott
28. H. G. Spencer
29. R. E. Trumble
30. E. C. Wood
31. 300 File
32. Record Copy
- 33-36 Extras

DECLASSIFIED

HW-65863
Page 3

DEVELOPMENT TEST IP-342-AG

INCREASE OF BULK OUTLET WATER TEMPERATURE

OBJECTIVE

The object of this test is to determine the DR-Reactor effluent system characteristics under 95°C bulk temperature operation. This proposed bulk temperature increase from 93.5 to 95°C represents a 33 percent decrease in the bulk temperature suppression below the boiling point. A major aim of this test will be to evaluate the degree of increased maintenance at this higher temperature operation.

BASIS AND JUSTIFICATION

Approximately 5,000 mw days of production per year can be gained at the 105-DR Reactor by increasing bulk outlet temperatures from 93.5°C to 95°C during the operating period when bulk outlet temperatures limit reactor operating levels.

This gain in production can be realized for less than \$1,000 in plant modifications if such operation does not harmfully affect reactor operating continuity.

Because the total effect of increased bulk outlet temperature cannot be accurately determined through stress calculations, and because it is known that some reactor piping components are already overstressed it is proposed to install sufficient stress monitoring equipment to determine the magnitude of existing stresses and to determine the increase in these stresses as a result of short periods of operation at 95°C bulk outlet temperature.

This test is complementary too, but not a completion of, the testing program described for the DR bulk temperature increase program. (HW-60864 "DR" Reactor Bulk Temperature Program, S. S. Jones, October 15, 1959.) It will primarily serve to indicate the amount and degree of effluent piping maintenance problems associated with this higher temperature operation. This test is not designed to answer the important problem of the risks associated with bulk temperature surges into the boiling region. A test exploring this aspect of the bulk temperature problem may be performed after the model studies into the boiling range are completed.

In addition the results of this test may well point out conditions which are unwise under present operating limits and thereby serve as a guide to improved maintenance of critical reactor piping components.

DECLASSIFIED

HW-65863
Page 4

TEST PREPARATION AND INSTRUMENTATION

A considerable degree of effluent system instrumentation has already been installed under Production Test IP-278-A. This will be used and also additional instrumentation will be required. The location of both the new and the old instrumentation is shown in the diagram accompanying this production test.

The function of this instrumentation is summarized as follows:

1. CROSSHEADER: Vibration and Strain Gage Equipment: To measure the combined effect of high flow and high bulk outlet temperatures upon the outlet crossheaders and their inlet and outlet fittings.
2. REAR RISER: Motion, Vibration, Temperature, and Pressure, and Strain Gage Equipment: To measure the effects of flow vibration and cross-header thermal motion upon the riser piping. And also to measure the rear riser pressure and temperature for the determination of the approach to boiling of the bulk effluent.
3. CROSSOVER: Pressure and Strain Gage Equipment: To determine the effects of initial boiling in this minimum pressure section of the system; and to obtain stress loadings as an indication of system life and maintenance problems.
4. DOWNCOMER: Water Level, Pressure, Temperature, and Strain Gage Equipment: To determine the approach to the critical condition of downcomer flooding and to measure the pressure and strain dynamics associated with increased flow and temperature operation.
5. EFFLUENT LINE: Temperature and Pressure: To measure the potential for effluent line boiling.

PROCEDURE

This test will be accomplished in the following manner:

1. Install the Deadman switch and PCCF-Bulk Outlet Temperature Interlock as specified in Design Change 367. (\$1,000 cost).
2. Install strain gages, pressure and temperature sensing elements, vibration pickups, and motion indicating equipment as shown on the attached drawing during any available outages in July and August. (This will require switching of "goggle valves" to insure safety to installation crews.)
3. Operate with strain gages installed through one operating cycle to permit these gages to stabilize. All reactor flow shall be to the far downcomer.

DECLASSIFIED

HW-65863

Page 5

PROCEDURE continued

4. Take an initial set of readings at the levels of flow and production shown on the attached data sheets during the next startup following the stabilizing cycle. Operation at 95°C bulk outlet for this test shall be limited to four hours at this time. Reactor levels during the startup cycle shall be held at each level approximately 15 minutes to insure that a complete set of readings is obtained.
5. Repeat these readings at a second operational startup to verify the initial readings.
6. At some interval to be specified by DR Processing Operation flows shall be divided between the two downcomers to determine what affect high flows through crossover lines to downcomer piping may have on vibration of risers and crossheaders.

When the data has been accumulated it will be analyzed and a report issued covering in detail the risks of operating at both 93.5°C and 95°C bulk outlet temperatures.

COSTS

It is estimated that this test will cost approximately \$13,000. These tests will be funded from D-DR operating expense.

OUTAGE TIME

Approximately two hours of "D" elevator time will be required for installation of vibration pickup and motion indicating sight gages. Work on installation of the strain gages on the riser to downcomer system should not interfere with normal rear face use of the "D" elevator.

HAZARDS

This test involves a 30 percent decrease in the operating bulk temperature suppression below the boiling point. Above 90°C any bulk temperature increase involves the probability of increased effluent system damage for any given bulk temperature surge. On a statistical basis the frequency of high temperature surges will be reduced by the use of the control rod "deadman" switch and certain limitations concerning poison columns. This Production Test does incur an increased risk, however, in that a given temperature surge may cause more effluent system damage. This is balanced by a decrease in the probability of any severe temperature surge and by the short duration of the proposed test operation at 95°C.

STANDARDS

No deviation from Process Standards is authorized by this test.

DECLASSIFIED

HW-65863
Page 6

RESPONSIBILITIES

- a. DR-Processing - Safety, operating continuity, and funding of this test.
- b. Research and Engineering Operation (W. H. Radtke). overall test coordination;
(S. S. Jones and O. E. Adams) analysis of results..
- c. Materials Development (FEO). (R. L. Loundagin). Continued development of downcomer strain gages and consulting service on proper installation of these gages.
- d. Plant Engineering (H. C. Copeland). Installation and read-out of temperature and pressure sensing elements. (P. H. Hutton) Installation and read-out of vibration monitoring equipment.
- e. Radiographic Testing Operation (R. L. Scott). Fabrication of new strain gages; supervision of installation and operation of strain gage read-out equipment.
- f. D-DR Maintenance - Providing of craft labor to install test equipment in the field.
- g. D-DR Maintenance Engineering - Procurement and installation of motion indicating equipment.

J. W. Hedges, Supervisor
D-DR MAINTENANCE ENGINEERING

O. E. Adams Jr, Engineer
REACTOR ENGINEERING

S. S. Jones, Engineer
REACTOR ENGINEERING

7-14-60

Page 7

[illegible]

(over fill-in)

Page 8

Sensing Element	Cold Flow ÷ 1000 gpm 25 40 60 80	5% Equil.	50%	75%	93.5	95°C
<u>STRAIN GAUGE</u>					Bulk Outlet	Bulk Outlet
Riser @ 23½ X Hdr, Inside Bend AS-4-A						
" Compensating Gage						
" Inside Bend AS-4-B						
" Compensating Gage						
" Inside Bend AS-4-C						
" Compensating Gage						
23½ X Hdr - Outside Bend AS-5-A						
" Compensating Gage						
" - Outside Bend AS-5-B						
" Compensating Gage						
" - Outside Bend AS-5-C						
" Compensating Gage						
Riser @ 23½ X Hdr, Outside Bend AS-6-A						
" Compensating Gage						
" AS-6-B						
" Compensating Gage						
" AS-6-C						
" Compensating Gage						
45½ X Hdr - Outside Bend AS-7-A						
" Compensating Gage						
" - Outside Bend AS-7-B						
" Compensating Gage						
" - Outside Bend AS-7-C						
" Compensating Gage						
Riser @ 45½ X Hdr, AS-8-A						
" Compensating Gage						
" AS-8-B						
" Compensating Gage						
" AS-8-C						
" Compensating Gage						
Riser to Crossover Line AS-9-A						
" Compensating Gage						
" AS-9-B						
" Compensating Gage						
" AS-9-C						
" Compensating Gage						
" AS-10-A						
" Compensating Gage						
" AS-10-B						
" Compensating Gage						
" AS-10-C						
" Compensating Gage						
" AS-11-A						
" Compensating Gage						
" AS-11-B						
" Compensating Gage						
" AS-11-C						
" Compensating Gage						

Page 9

25 40 60 80

5% Equil., 50%, 75%, 93.5 95°C

<u>STRAIN GAUGE</u>		Bulk Outlet	Bulk Outl
Riser to Crossover Line	AS-12-A		
"	Compensating Gage		
"	AS-12-B		
"	Compensating Gage		
"	AS-12-C		
"	Compensating Gage		
Riser Below Concrete	AS-13-A		
"	Compensating Gage		
"	AS-13-B		
"	Compensating Gage		
"	AS-13-C		
"	Compensating Gage		
"	AS-14-A		
"	Compensating Gage		
"	AS-14-B		
"	Compensating Gage		
"	AS-14-C		
"	Compensating Gage		
Riser Above Concrete	AS-15-A		
"	Compensating Gage		
"	AS-15-B		
"	Compensating Gage		
"	AS-15-C		
"	Compensating Gage		
"	AS-16-A		
"	Compensating Gage		
"	AS-16-B		
"	Compensating Gage		
"	AS-16-C		
"	Compensating Gage		
Crossover Line Dwnstrm Valve	BS-1-A		
"	Compensating Gage		
"	BS-1-B		
"	Compensating Gage		
"	BS-1-C		
"	Compensating Gage		
Crossover Elbow Side	BS-2-A		
"	Compensating Gage		
"	BS-2-B		
"	Compensating Gage		
"	BS-2-C		
"	Compensating Gage		
Crossover Elbow Bottom	BS-3-A		
"	Compensating Gage		
"	BS-3-B		
"	Compensating Gage		
"	BS-3-C		
"	Compensating Gage		
Crossover Elbow 45°	BS-4-A		
"	Compensating Gage		
"	BS-4-B		
"	Compensating Gage		
"	BS-4-C		
"	Compensating Gage		

Page 10

5% Equil. 50% 75% 93.5% 95°C

<u>STRAIN GAUGE</u>		Bulk Outlet	Bulk Outlet
Top of Downcomer	CS-1		
"	Compensating Gage		
"	CS-2		
"	Compensating Gage		
"	CS-3-		
"	Compensating Gage		
Tray #1 Bottom Beam	DS-1-A		
"	Compensating Gage		
"	DS-1-B		
"	Compensating Gage		
"	DS-1-C		
"	Compensating Gage		
Tray #1 Wall	DS-2-A		
"	Compensating Gage		
"	DS-2-B		
"	Compensating Gage		
"	DS-2-C		
"	Compensating Gage		
Tray #1 Bottom Beam	DS-3-A		
"	Compensating Gage		
"	DSO-1-A		
"	Compensating Gage		
Tray #7 Bottom Beam	JS-4-A		
"	Compensating Gage		
"	JS-4-B		
"	Compensating Gage		
"	JS-4-C		
"	Compensating Gage		
Tray #7 Wall	JS-5-A		
"	Compensating Gage		
"	JS-5-B		
"	Compensating Gage		
"	JS-5-C		
"	Compensating Gage		
Tray #7 Bottom Beam	JS-3-A		
"	Compensating Gage		
"	JSO-1-A		
"	Compensating Gage		
Dwncomer Wall Opp.Tray #7	JS-4-A		
"	Compensating Gage		
Dwncomer Base	IS-1-A		
"	Compensating Gage		

HW-65863
Page 11

[illegible]

DECLASSIFIED

HW-65863
Page 12

APPROVALS

E. C. Wood

J. H. Brown, Manager
Process & Reactor Development Operation
IRRADIATION PROCESSING DEPARTMENT

D. S. Lewis

E. C. Wood, Manager
Equipment Development Operation
IRRADIATION PROCESSING DEPARTMENT

W. D. Richmond for

R. W. Reid, Manager
Process Technology Operation
IRRADIATION PROCESSING DEPARTMENT

D. S. Lewis, Manager
DR Processing Operation
IRRADIATION PROCESSING DEPARTMENT

W. D. Richmond, Manager
D-DR Reactor Operation
IRRADIATION PROCESSING DEPARTMENT

Date of Issue August 26, 1960

DATE

FILMED

5 / 31 / 94

END