AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

**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Historical Document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This is a **historical document** that is being released for public availability.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.

DECLASSIFIED

(CLASSIFICATION)

DOCUMENT NO.

HW-75607

SERIES AND COPY NO.

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCT OPERATION - RICHLAND, WASHINGTON

April 1, 1963

PRODUCTION TEST IP-550-I:
ROUTINE MONITORING FOR MODERATOR
OXIDATION RATES

☐ 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

R. E. Baars

ISSUING FILE

ROUTE TO:

PAYROLL NO.

LOCATION

FILES ROUTE
DATE

SIGNATURE AND DATE

R + Baars

17425

17-45

4-17-63

RTE 4-17-63

Return to Files

R. E. Baars 20121

326

OCT 22 '63

DECLASSIFIED

(CLASSIFICATION)

DECLASSIFIED

HW-75607

This document classified by

[Signature]

This document consists of
10 pages.

PRELIMINARY REPORT

This report was prepared only for use within General Electric Company in the course of work under Atomic Energy Commission Contract AT(45-1)-1350. Any views or opinions expressed in the report are those of the author only.

PRODUCTION TEST IP-550-I:
ROUTINE MONITORING FOR MODERATOR OXIDATION RATES

by

R. E. Baars
Process Engineering Unit
Process Technology Subsection
Research and Engineering Section
IRRADIATION PROCESSING DEPARTMENT

Classified by [redacted] and Declassified To

DECLASSIFIED

By Authority of CG-PR-2
D.S. [redacted] 3-15-94
By [redacted] 4-6-94
Verified By [redacted]
J. E. [redacted] 4-15-94

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

NOTICE

This report was prepared for use within General Electric Company in the course of work under Atomic Energy Commission Contract AT(45-1) - 1350, and any views or opinions expressed in the report are those of the author only. This report is subject to revision upon collection of additional data.

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, expressed 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, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

DECLASSIFIED

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DECLASSIFIED

-2-

HW-75607

DISTRIBUTION

1. AEC-RLOO: PM Midkiff
2. AEC-RLOO: RL Plum
3. AEC-RLOO: CN Zangar
4. TW Ambrose-FW Vanwormer
5. ER Astley
6. JT Baker
7. JW Baker
8. RS Bell
9. MA Clinton-RE Baars
10. RG Clough
11. JP Cooke
12. RF Corlett
13. BR Cremer
14. AE DeMers
15. RE Dunn
16. WJ Ferguson
17. EJ Filip
18. GC Fullmer
19. SM Graves
20. OH Greager
21. CN Gross
22. AK Hardin
23. PJ Hollifield
24. LC Lessor
25. CG Lewis
26. AR Maguire
27. WW McIntosh
28. JE Morrissey
29. R Neidner
30. R Nilson
31. CA Priode
32. WH Radtke
33. RW Reid
34. A Russell
35. BA Ryan
36. OC Schroeder
37. HG Spencer
38. RE Spicka
39. AP Vinther
40. SA Wood
41. PJ Zimmerman
42. 300 Files
43. Record Center

DECLASSIFIED

-3-

HW-75607

PRODUCTION TEST IP-550-I:
ROUTINE MONITORING FOR MODERATOR OXIDATION RATES

OBJECTIVES

The objectives of this production test are:

1. To authorize the outage time involved in installing and removing oxidation monitors for the reactors, and
2. To specifically define sample design, spacing of samples in the channels, and residence times to insure adequate routine monitoring of moderator oxidation rates.

This production test is concerned with B, C, D, DR, F, and H reactors. Similar requirements have been specified in PITTA IP-20-I¹ for KE and KW reactors.

BASIS AND JUSTIFICATION

Oxidation of the reactor moderator adversely affects its load bearing capacity. At some degree of oxidation, the capacity will be sufficiently reduced that localized stack crumbling and associated problems of replacement would significantly complicate reactor maintenance and operation. It is thus necessary to maintain control over the extent of oxidation so as to preclude this eventuality, or to prolong it indefinitely into the future.

The most direct means presently available for monitoring oxidation rates is to expose small graphite samples in bare process channels. The rate of oxidation is determined from the weight loss of the samples and the time of exposure at operating conditions. Interpretation of the rates thus obtained is not straightforward and much yet remains to be investigated with respect to precise interpretation. However, the results obtained can be used effectively to discern when rates are out of control, and to some lesser extent, on what the cause of the rates is and what corrective action is in order.

Additionally, information on the character of stack oxidation leading to a better understanding thereof can be obtained. This production test, however, is primarily concerned with the use of the oxidation samples as routine monitors.

DISCUSSION

The exposure of small samples has been used as a technique for monitoring stack oxidation rates since about 1953, under authorization of PT-105-532E (PT IP-20-I)^{2,3}. This authorization was cancelled in June, 1962, due to OPG 44.1 which

¹Wardley, R E, Process Improvement Transition Authorization IP-20-I, Increased Graphite Temperature Limits and Use of Nitrogen in the K Reactors, HW-73991, June 13, 1962, ~~SECRET~~.

²Wardley, R E., Production Test 105-532-E, Graphite Burnout Monitoring Program, HW-29739, October 23, 1953, ~~SECRET~~.

³Wardley, R.E., Production Test 105-532-E, Supplement A, Graphite Burnout Monitoring Program, HW-30571, January 4, 1954, ~~SECRET~~.

DECLASSIFIED

HW-75607

limiting a maximum duration of two years for any production test. Process Standard B-010 is presently being revised, and will include a requirement to permanently devote at least one process channel per reactor to the exposure of oxidation monitors. This production test specifies the details of sample and sample carrier design, sample spacing, and residence times, and authorizes outage time for the changeout of samples.

It was primarily the high peak oxidation rates to the samples plus the front to rear burnout profiles obtained from the sample spacing which led to the recent tightening of air in-leakage requirements at the several reactors. The usefulness of the monitors, however, was less than it could have been due to long residence times and inadequate placement of samples in the channels. Long residence times are undesirable because of the time lag in detecting high rates, if such occur, and because of the difficulty of correlating high rates with a particular phase of operating history. Poor placement of samples (frequently only three locations--extreme upstream, moderator centerline, and extreme downstream positions) may well have caused further delay in finding evidence of high oxidation rates.

The optimum residence time is of the order of three months. Longer residence times will, as described above, lead to delays in discovering high rates, and, if such occur, make it more difficult to judge the cause and thus the appropriate corrective action. Shorter residence times will tend to magnify less significant occurrences, and will decrease the accuracy of the rates being measured; also production losses due to outage time for changeout of samples will be greater for shorter times. There will occasionally be circumstances when lesser residence times are justifiable, and provisions for these cases are made.

At the present time, one process channel is permanently devoted to oxidation monitors at each reactor, except C, where three are in service. One channel per reactor permanently removed from production is felt to be all that is currently justified for these purposes. However, it is desirable to explore the local variation of oxidation rates within the reactors. Such information can be obtained from normal channels which are out of service temporarily. The need for the outage time to cover installation of samples in such channels is taken into account.

DETAILS OF PROPOSED PROGRAM

The standard oxidation samples will be 0.4375" in diameter by 4" long, and will be located in sample carriers of one of the following two designs:

Open Carriers

Hollow cylinders of graphite 1.25" O.D., 0.75" I.D., and 17 to 22" long, with perforated walls, and shaped on the downstream ends to facilitate insertion and removal from the channel.

Open-Closed Carriers

Similar to the above design but compartmented so that the downstream one-half of the carrier totally encloses the samples with graphite.

DECLASSIFIED

-5-

HW-75607

The open carriers will normally contain five samples; the open-closed carriers will normally carry four samples with two in each half of the carrier. The standard charge make-up and spacing will be as follows (also see Figure 1):

<u>Carrier Number</u>	<u>Centered at</u>	<u>Carrier Type</u>
1	300" from front of stack*	Open
2	266" from front of stack	Open
3	212" from front of stack	Open
4	190" from front of stack	Open-Closed
5	168" from front of stack	Open
6	145" from front of stack	Open-Closed
7	123" from front of stack	Open
8	101" from front of stack	Open-Closed
9	79" from front of stack	Open
10	35" from front of stack	Open

Additional standard or non-standard carriers and/or samples may be charged in the free space between carriers 1 and 2; 2 and 3; or 9 and 10; or may be substituted for carriers 4, 6, or 8 (open-closed carriers). In any event, non-standard carriers must meet the following criteria:

1. Maximum O.D. - 1.5 inches
2. Maximum Length - 22 inches, minimum length - 6 inches (8 inches at DR and H).
3. Small samples located within carriers shall be long enough so that there is small likelihood of falling out, or the carrier design shall be such that they cannot fall out.
4. The probability of interfering with installation or removal of standard boats and samples is small.

Standard samples shall be made of nuclear graphite of a grade equivalent to portion of the stack in which they will be exposed. (Investigations of the need for this requirement are being initiated.) Every effort shall be made to avoid using standard samples which contain catalytic impurities.⁴

Individual charges shall have a residence of three months. However, with changing operating conditions, this time may be lengthened upon agreement between Processing and Process Tech. Residence times may be less than three months (but not less than 20 operating days) when there is cause to believe that oxidation rates have been excessive, or in order to obtain a fast evaluation of some change in operating conditions.

*Add 84 inches to obtain distance from the ex-reactor end of front gunbarrel.

⁴Ryan, F.A., Localized Oxidation in Nuclear Graphite, HW-73859 Rev., August 14, 1962.

DECLASSIFIED

HW-75607

It is not the intent of this program to discourage new approaches to investigating moderator burnout. However, standardization of routine monitors and of charge makeup and spacing is needed if adequate routine monitoring is to be accomplished.

It is desired eventually to also measure the weight loss rate on the sample carriers. To do this, it is necessary to prevent contaminating the carrier with iron oxide and other corrosion products in the gunbarrel. To this end, the use of short sections of process tubes in the gunbarrels, front and rear, is authorized. The tubing is strictly for charge-discharge purposes and will be removed on completing a sample changeout operation.

SCHEDULE

This production test shall be effective upon completion of all authorizing signatures. Those samples in residence at the effective date of authorization shall be changed out upon reaching three months residence time, as earlier specified. The duration of this production test is two years from date of authorization.

COSTS

Cost Code

XXX-5R30-XXX-78

Production Loss

Approximately one hour of front and rear elevator time is needed to accomplish a sample changeout. Frequently, sample changeouts can be performed on unscheduled outages or at such times during a scheduled outage that a net loss of operating time is not incurred. To the extent required, however, twelve hours of outage time per year per reactor is authorized. This allowance assumes four routine and four short-term changeouts per permanent oxidation channel, plus six changeouts in other than permanent oxidation channels.

<u>Cost</u>	<u>Production Loss/Year</u>	<u>Outage Time</u>	<u>Front & Rear Elevator Time</u>
(Per reactor per year)	Approx. 900 MWD (B, D, DR, F, and H)	12 hours	12 hours
	1000 MWD (C reactor)		

A minimum of one process channel per reactor shall be devoted continuously to the exposure of oxidation samples for routine monitoring. The production loss associated therewith is in addition to that quoted above for sample changeout.

RESPONSIBILITIES

1. Processing Operation

Each Processing Operation will be responsible for scheduling routine sample

DECLASSIFIED

HW-75607

changeouts as previously specified with the Irradiation Testing Unit.

2 Testing Sub-Section

The Irradiation Testing Unit (ITU) will be responsible for sample changeouts as requested, and will be responsible for notifying the appropriate HLO component of scheduled changeouts. ITU will be responsible for assuring that non-standard sample designs are feasible to install and remove and will have the authority to refuse to charge particular samples from this standpoint unless the additional risk is separately authorized by supplement to this production test. ITU will be responsible for supplying operating time data to the appropriate HLO component. ITU shall inform the manager of the affected reactor of the details of any non-standard samples planned for insertion into his reactor. Unless ITU is notified otherwise, the manager's concurrence will be assumed.

3 Process Technology Sub-Section

The Process Technology Sub-Section will be responsible for arranging with HLO to supply samples and carriers and to determine the weight loss rate of exposed samples, for auditing compliance with the provisions of the production test; and for interpretation of the oxidation rates determined; and recommendations for corrective action where warranted.

4 Process and Reactor Development Sub-Section

The Process and Reactor Development Sub-Section shall be responsible for assisting in the interpretation of the routine monitor results, for programming such additional investigative work as may be pertinent to interpretation of monitor results; and, in general, for evaluating the effects of graphite oxidation rates and for developing technical bases for limits.

Engineer,
Process Engineering Unit

RE 14015:103

DECLASSIFIED

-8-

HW-75607

APPROVALS

R. W. Reid, Manager
Process Technology Subsection
Research and Engineering Section

R. E. Dunn, Manager
C Processing Operation
B-C Reactors Operation
Manufacturing Section

R. Nilson, Acting Manager
Process and Reactor Development Subsection
Research and Engineering Section

W. J. Ferguson, Manager
B-C Reactors Operation
Manufacturing Section

C. G. Lewis, Manager
Testing Subsection
Research and Engineering Section

J. T. Baker, Manager
D Processing Operation
D-DR Reactors Operation
Manufacturing Section

O. H. Greager, Manager
Research and Engineering Section

E. J. Filip, Manager
DR Processing Operation
D-DR Reactors Operation
Manufacturing Section

C. A. Priode, Manager
Production Operation
Manufacturing Section

A. R. Maguire, Manager
D-DR Reactors Operation
Manufacturing Section

E. R. Astley, Manager
Applied Reactor Engineering
Manufacturing Section

J. W. Baker, Manager
F Processing Operation
F Reactor Operation
Manufacturing Section

G. H. Graves, Manager
B Processing Operation
B-C Reactors Operation
Manufacturing Section

DECLASSIFIED

HW-75607

APPROVALS (Cont.)

C. N. Gross, Manager
F Reactor Operation
Manufacturing Section

A. E. Vinther, Manager
H Processing Operation
H Reactor Operation
Manufacturing Section

W. W. McIntosh, Manager
H Reactor Operation
Manufacturing Section

O. C. Schroeder, Manager
Manufacturing Section

FIGURE - 1
SPACING FOR STANDARD CHARGE

- Open Type Carriers
- Open - Closed Type Carriers

**DATE
FILMED**

6/22/94

END