AIIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910

301/587-8202

Centimeter

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 mm

1 2 3 4 5

Inches

MANUFACTURED TO AIIM STANDARDS
BY APPLIED IMAGE, INC.

[redacted] **DECLASSIFIED**

(CLASSIFICATION)

GENERAL ELECTRIC

HANFORD ATOMIC PRODUCTS OPERATION - RICHLAND, WASHINGTON

DOCUMENT NO.

RL-REA-477 D

SERIES AND COPY NO.

A

DATE

July 6, 1965

[redacted] RESTRICTED DA[redacted] DATA AS DEFINED IN [redacted] ACT OF 1954. ITS TRA[redacted] OF ITS [redacted] ANY MANNER TO AN [redacted] IS PROHIBITED.

TITLE

MONTHLY RECORD REPORT - [redacted] JUNE 1965
RESEARCH AND ENGINEERING OPERATION
IRRADIATION PROCESSING DEPARTMENT

☐ 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

T. W. Ambrose

ISSUING FILE

CIRCULATING COPY
RECEIVED 300 AREA
JUL 13 1965
RETURN TO
TECHNICAL INFORMATION FILES

THIS DOCUMENT MUST [redacted] T UNATTENDED OR WHERE AN UNAUTHORIZED PERSON MAY [redacted] ACCESS TO IT. WHEN NOT [redacted] MUST BE STORED IN AN APPRO[redacted] KED REPOSITORY [redacted] APPROVED GUARDED AR[redacted] LE IT IS YOUR POSSESSION [redacted] AVE OBTAI[redacted] RED RECEIPT FROM CLASS[redacted] ES, IT IS YOUR RESPONS[redacted] KEEP IT AND ITS [redacted] WITHIN THE LIMITS OF TH[redacted] ECT AND FROM ANY UNAU[redacted] ERSON. ITS TRANS[redacted], AND STORAGE AT YOUR PLACE [redacted] ESIDENCE IS PROHIBIT[redacted] NOT TO BE DUPL[redacted] ADDITIONAL COPIES ARE REQUIRED, [redacted] TAIN THEM FROM [redacted] ED ISSUING FILE. ALL [redacted] READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPAC[redacted] VIDED BELOW.

ROUTE TO:	PAYROLL NO.	LOCATION	FILES ROUTE DATE	SIGNATURE AND DATE
[redacted]				

MASTER

DECLASSIFIED

54-3000-340 (3-57) AEC-GE RICHLAND, WASH.

[redacted]
(CLASSIFICATION)

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DECLASSIFIED [redacted] RL-REA-477 D

MONTHLY RECORD REPORT

RESEARCH AND ENGINEERING OPERATION
IRRADIATION PROCESSING DEPARTMENT

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.

By

T. W. Ambrose

JUNE 1965

NOTICE!

This report was prepared for use within General [illegible] Company in the course of work [illegible] Contract AT(45-1) [illegible]

DISTRIBUTION

1. Battelle-Northwest - Attn: FW Albaugh
2. Battelle-Northwest - Attn: ER Irish
3. TW Ambrose
4. GF Bailey
5. LV Barker
6. RS Bell
7. CE Bowers
8. MA Clinton
9. RE Dunn
10. JH Ferguson
11. GC Fullmer
12. SM Graves
13. CN Gross
14. AK Hardin
15. TW Hauff
16. RD Jensen
17. PC Jerman
18. RT Jessen
19. FE Kruesi, DuPont Co., Savannah River
20. MC Leverett
21. CG Lewis
22. AR Maguire/JM Fouts
23. WW McIntosh
24. RV Myers
25. SL Nelson
26. R Nilson
27. GF Owsley
28. T Prudich
29. RW Reid
30. JS Stoakes
31. OA Towler, DuPont Co., Savannah River
32. FF Vlacil
33. WK Woods
34. 700 Area File
35. Record File
36-40. Extra Copies

Classification Cancelled and Changed To
DECLASSIFIED
By Authority of RM Hen
4-20-94, CG-PR-2
By JE Savely 4-21-94
Verified By DJ Kristen 4/21/94

RE[redacted]

T[redacted] document contains restri[redacted] as[redacted] Act of 1954. [redacted] or the disclosure of [redacted]ents in [redacted] to an [redacted]uthorized person is proh[redacted]

This document consists of ____ pages. [redacted] A.

E[redacted]g

DECLASSIFIED

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

TRIPS

Name	Firm & Location	Date	Purpose
SS Jones	Albrook Lab, WSU	6/3-4/65	Observe downcomer model transient tests
RD Jensen	AEC Headquarters Germantown, Md.	6/8-11/65	To discuss Pu computer model
PC Jerman	General Atomic San Diego, Calif.	6/14/65	Discuss radiation protection problems
	Los Angeles, Calif.	6/15-17/65	Attend annual meeting of Health Physics Society
WK Woods	ORNL, Oak Ridge, Tenn.	6/16/65	Discuss clean U-233
	AEC-Div. of Reac. Dev. & Tech., Wash., D. C.	6/17/65	Discuss clean U-233
	Babcock & Wilcox Lynchburg, Va.	6/18/65	Discuss clean U-233
GF Bailey PD Gross	du Pont, Savannah River	6/17-18/65	Discuss current Reactor technology and diversification programs
GF Owsley	Savannah River Plant Aiken, S. Carolina	6/17-18/65	Discuss mutual technical problems
	Gatlinburg, Tenn.	6/19-20/65	Attend ANS-3 Standards Subcommittee Mtg.
	Gatlinburg, Tenn.	6/21-23/65	Attend ANS Mtg.
SM Graves	Savannah River Plant Aiken, South Carolina	6/18/65	Discuss confinement
	Gatlinburg, Tenn.	6/21-24/65	Attend ANS Mtg.
KL Hladek	Gatlinburg, Tenn.	6/21-24/65	Attend ANS Mtg.
	National Lead Co. of Ohio Cinncinati, Ohio	6/25/65	Discuss current uranium fabrication [redacted]ogy
A Russell	Carbon Conference Cleveland, Ohio	6/~~21-25~~/65	Conference on carbon

[redacted]

DECLASSIFIED

[redacted]

TRIPS

Name	Firm & Location	Date	Purpose
WK Alexander	Electron Beam Techniques Plainville, Conn.	6/22/65	Inspect welding of ribbed Zircaloy process tubes
	Nuclear Metals Concord, Mass.	6/23/65	Discuss zirconium alloy technology

VISITORS

Name	Firm & Location	Date	Purpose
FE Rom PM Finnegan	Lewis Research Center NASA Cleveland, Ohio	6/8/65	Discuss irradiation of tests for NASA
HL Hodges	Atomics International Canoga Park, Calif.	6/16-17/65	Discuss design details of AI test and SNAP discharge procedures; witness flow test
Peter Pallo RA Gerber	Hackensack Water Co. New Milford, N. J.	6/23-24/65	To obtain information concerning Hanford water treatment process
DB West E Babbe	Atomics International Canoga Park, California	6/23-25/65	Check-out of 115-2 control console and observe charging of 115-2 capsule

ORGANIZATION AND PERSONNEL

	Exempt		Nonexempt		Rotational	
	May	June	May	June	May	June
Management & Administration	3	3	2	2	0	0
Process & Reactor Development	21	22	3	3	0	0
Process Technology	22	22	7	7	0	1
Operational Physics	12	10	3	3	0	1
Testing	20	19	27	27	0	2
	78	76	42	43	0	4

Administration: Alta L. Sweany, Stenographer, new hire 6/10/65.

Operational Physics: C. E. Hughey, Engineer, transferred to CPD 6/15/65.
E. H. Lockwood, Engineer, ROF (optional retirement) 6/30/65.

DECLASSIFIED

[redacted]

Testing: J. R. Spink, Sr. Engineer, transferred to Process and Reactor Development Subsection 6/1/65.
L. D. Carpenter, Technician, promoted to Engineer 6/1/65.
K. E. Fields, Technician, promoted to Engineer 6/1/65.
J. P. Davis, Technician, rehire (summer employee) 6/1/65.
Merle E. Jensen, Steno-Typist, new hire 6/17/65.
G. L. Wilfert, Engineer, deactivated on Educational Leave of Absence 6/18/65.
K. W. Gerdes, Engineer, transferred to Air Conditioning Dept. 6/25/65.

DECLASSIFIED

[redacted]

RESEARCH AND ENGINEERING

PROCESS AND REACTOR DEVELOPMENT

REACTOR FUELS

Depleted Uranium Irradiations

The status of the E-D load as of June 18, 1965, is as follows:

	B Reactor	KE Reactor
Exposure, MWD/T	1575	1775
% Pu-240	20.0	20.4
Kg/T	1.8	2.1
No. of Columns	92	75
Tons Depleted	10.7	10.8
Kg Plutonium	19.3	22.2

(41 kg of 19-20% Pu-240 Pu)

The extended operation appears to be going smoothly, and the relatively high graphite temperature coefficient of reactivity calculated for the E-D has now been noticed at B Reactor.

Supplements to the authorizing documents are being prepared to allow an extension of the irradiation time to produce 25 wt% Pu-240. One depleted element failure in each loading prior to obtaining the desired exposure would, however, terminate the irradiation. Examination of three columns of elements, discharged from the KE Reactor at an exposure of approximately 1500 MWD/T, revealed that the elements are behaving very well. The downstream elements of the columns have started to film, but no evidence of even moderate corrosion attack was observed.

Thoria Irradiations

The sharp reduction in failures of thoria elements indicates that the increased examination and testing that was instituted in March has been effective. All thoria elements for the initial program have been charged. The central zone irradiations will be completed by the first week of July. The fringe loadings will be discharged by August 1, 1965.

DECLASSIFIED

[redacted]

[redacted]

STATUS REPORT OF PRODUCTION TESTS

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
IP-216-A	Normal production natural and enriched fuel elements.	19	All	Normal variable goal.		Provides for monitoring the performance of a sample of all normal production material to assist in development of Quality Index for production fuel. Test is continuous.
IP-669-A	Depleted U target elements.	92	B	2200 MWD/T	1575 MWD/T	Irradiation of ten tons of depleted elements for production of 18 w/o Pu-240. Irradiation extended to permit production of up to 25 w/o Pu-240.
IP-694-A	Depleted U target elements.	75	KE	2400 MWD/T	1775 MWD/T	Irradiation of 12 tons of depleted elements for production of 18 w/o Pu-240. Irradiation extended to permit production of up to 25 w/o Pu-240.
[redacted]A-31	Thorium oxide target elements.	193	KW	175 operating days	180 operating days	Initial loading of thoria elements in fringe zone process tubes for production of clean U-233. Elements charged during September 30, 1964, outage.
PITA-31	ThO_2 target elements.	166	D	165 operating days	177 operating days	Production of clean U-233. Elements charged during October 19, 1964, outage.
PITA-31	ThO_2 target elements.	168	B	160 operating days	162 operating days	Production of clean U-233. 140 columns of elements charged during November 14, 1964, outage; 28 columns charged during January 7, 1965, outage.

DECLASSIFIED

STATUS REPORT OF PRODUCTION TESTS (cont'd.)

Test No.	Type Metal	Tubes	Reactor	Goal Exposure	Current Exposure	Remarks
PITA-31	ThO_2 target elements.	168	C	165 operating days	131 operating days	Production of clean U-233. Elements charged during December 24, 1964, outage.
PITA-31	ThO_2 target elements.	190	KE	150 operating days	143 operating days	Production of clean U-233. Elements charged during December 31, 1964, outage.
PITA-33	ThO_2 target elements.	126	KW (core)	47 operating days		Production of clean U-233. First cycle of elements charged during November 29, 1964, outage. Charge-discharge accomplished January 23, 1965, and April 3, 1965. Final discharge accomplished during June 1, 1965, outage.
[redacted]TA-33	ThO_2 target elements.	131	KW (core)	47 operating days	33 operating days	Production of clean U-233. Elements charged during January 4, 1965, outage. Charge-discharge accomplished March 1, 1965, and May 4, 1965.
PITA-35	ThO_2 target elements.	95	KE (core)	42 operating days		Production of clean U-233. Elements charged during February 24, 1965, outage. Charge-discharge accomplished April 10, 1965. Final discharge accomplished during May 20, 1965, outage.
PITA-35	ThO_2 target elements.	89	KE (core)	42 operating days	27 operating days	Production of clean U-233. Elements charged during April 10, 1965, outage. Charge-discharge undertaken on May 20, 1965.

DECLASSIFIED

REACTOR ENGINEERING

Brittle Fracture - 190-C Tanks

Dr. E. R. Parker, of the University of California, met with engineering and manufacturing personnel on June 4, to review the results of chemical analyses made on the 190-C process water tanks. It is his conclusion that under certain conditions, the 190-C tanks must be judged as susceptible to brittle fracture failure. Accordingly, the stress level in the 190-C tanks will be maintained below 10,000 psi during those months when the inlet water temperature is below 40 F. In addition, the application of thin coatings of insulating material to the outside of the tanks to reduce the likelihood of high surface stresses being caused by sudden changes in ambient conditions is being evaluated.

Increased Graphite Temperature Limit Test - F Reactor

The desired graphite temperature of 750 C in the F test was maintained for only a relatively short time. Apparent improvement in graphite thermal conductivity and reduced power level has prevented maximum graphite temperatures from exceeding much above 700 C during the past month. Oxidation rates are not significantly different than in the initial phase of the testing program when the temperature limit was increased from 650 to 700 C. Despite the fact that graphite temperatures could not be maintained as high as desired, preliminary results indicate that an increase in graphite temperature beyond the present limit is feasible from the standpoint of graphite oxidation with a CO_2 atmosphere. In addition, no significant increase in the reaction between graphite and water vapor has been detected during the three-month period the test has been in effect.

Downcomer Flow and Temperature Limits

Tests at the Albrook Laboratory have been made on a basic C Reactor downcomer model. Minor modifications to the model also permitted simulation of the B and D Reactor downcomers. New test results indicate negligible dynamic pressurization even with reasonably rapid coolant temperature transients.

Zircaloy Hydriding

Analyses of Zircaloy nozzle inserts removed from KE Reactor have been completed. The total hydrogen content varied from 86 to 570 ppm. Process tubes from two of the channels from which these nozzle inserts came were also removed for hydride evaluation, with the following results:

Tube No.	Max. Tube H_2 Conc.	Nozzle Insert H_2 Conc.
2169	361 ppm	175 ppm
4372	740 ppm	139 ppm

DECLASSIFIED

These data indicate that there is no correlation between the hydrogen content of the nozzle inserts and the process tubes. It is planned to examine 24 more nozzle inserts before drawing any final conclusions.

Zircaloy coupons with various surface conditions are being exposed in KE Reactor process tubes to obtain further information on the conditions resulting in process tube hydriding in the reactor environment. The first coupon holder was removed after approximately five-weeks exposure. The following table lists the results:

Number of Coupons	Coupon Material and Surface Conditions	Results
2	Annealed Zircaloy-2 sheet, vapor blasted one side - etched one side.	Hydride case about one mil thick on both sides.
2	As above, except Zircaloy-4.	Same results
2	K tube material - as-received on inside - vapor blasted outside.	Same results.
2	K tube material - etched both sides.	Some hydriding along edges where scraped by sample holder.
2	K tube material - etched and autoclaved both sides.	No hydride found.
2	K tube material - etched and air oxidized @ 500 C for ten minutes.	About one mil case.
3	K tube material - etched and annodized - 100 volts in KOH.	Same results.

Additional coupon holders have been prepared. Stainless steel will be used to determine if the galvanic couple between Zircaloy and aluminum is a factor in the rate of hydriding. Stainless steel is cathodic to Zircaloy whereas aluminum is anodic.

Ex-reactor exposure of samples in process water has given somewhat similar results except that no evidence of hydriding of etched samples was found.

A test has been run to determine if self-support fuel elements would damage an autoclave film. The equivalent of six charges was pushed through an autoclaved K Reactor process tube. It was found that most of the oxide film was removed along the bottom of the tube. This test would indicate that simple autoclaving will not be adequate to give long-term protection.

DECLASSIFIED

Ribbed Zircaloy Process Tubes

Fabrication of three full-length, ribbed Zircaloy process tubes is proceeding on schedule at the plant of Electron Beam Techniques, Plainville, Connecticut. Inspection of these tubes is scheduled for the week of June 21.

Graphite-Water Vapor Reaction Studies

Oxidation tests are now in progress in a BNW mockup. The tests are being run at a graphite temperature of 950 C and a water vapor concentration of 5200 ppm (corresponds to an inlet dewpoint of $\sim$+30 F). Operation at these conditions will continue for several weeks and then be changed to obtain a range of temperatures and water vapor concentrations.

REACTOR PHYSICS

Boiling Protection with ZTM Against Poison Flush

Analytical study of the effect of PCCF column flush at full reactor power with the zone temperature monitor set to trip at 130 C, has shown that the maximum outlet coolant temperature would not exceed 141 C. This is less than the saturation temperature at any of the reactors.

In-Core Flux Monitor Tests

The in-core chambers tested at KW Reactor under PT-IP-440-F were discharged during the June 1 outage. Arrangements were made to examine the chambers in the 300 Area facilities.

RADIOLOGICAL ENGINEERING

Radiation Control Experience

The following table summarizes the radiation exposure experience for critical IPD classifications through 22 weeks of the 1965 badge year:

Classification	Total Dose	No. of Employees	Average Dose/ Employee	Extrapolated Year End Average	No. of Employees Over 3R Extrapolated Exposure
Radiation Monitors	80585 mR	56	1439 mR	3467 mR	47
Processing Operators	241325	195	1238	2982	106
Pipefitters	53070	66	804	1937	3
Millwrights	51620	60	860	2072	8

DECLASSIFIED

Six Radiation Occurrences were reported during the period. Two involved nasal contamination to employees. One involved skin contamination to an employee during discharge area work. The others involved: (1) radioactive sources improperly stored, (2) spread of contamination to ground and buildings caused by wind action on empty retention tanks, and (3) removal of a contaminated coupling for a graphite overbore machine to an uncontrolled area.

Radiation Occurrences

	Distribution by Reactor and Component							
	B	C	D	F	H	KE	KW	Totals
Processing			1				1	2
Maintenance				1				1
Facilities Engineering			2					2
Outside IPD			1					1
	0	0	4	1	0	0	1	6

Effluent Activity Data

The table below shows the average concentrations of five radionuclides from effluent samples in May 1965. All units are 10^{-12} curies per milliliter.

Reactor	As-76	P-32	Zn-65	Cr-51	Np-239
B	175	15.9	23	380	160
C	225	18.6	24	850	260
D	111	10.1	22	270	105
F	138	23.3	15	330	170
KE	44	8.9	10	130	55
KW	146	9.7	11	170	125

The half-reactor test at F Reactor using unflocculated coolant was discontinued on May 4, 1965. The H Reactor was shut down for deactivation on April 21, 1965. There were no other significant changes made in the treatment of reactor coolant during the month.

Dose Rate Telemetering

The dose rate telemetering prototype will undergo final acceptance testing by the General Electric Company off-site inspector during the week of June 21, 1965, and will be shipped immediately if accepted by the inspector.

DECLASSIFIED

Pocket Radiation Alarm Devices

The modified Chalk River pocket dose alarm is undergoing change to improve the sound output of the instrument. The fabrication of the final prototypes of the pocket dose rate alarm device has been delayed by the long delivery time on some components.

Confinement Tests

A preliminary test with foam to prove its deposition characteristics has been carried out. A foam generator mounted on a truck was connected to a 120 foot long tube 3 feet in diameter. The tube was raised to an elevation of 100 feet up the side of the meteorology tower and foam was generated into it. The foam fell to the ground within 50 yards of the tower with a wind of eight to ten miles per hour.

DECLASSIFIED

PROCESS TECHNOLOGY

PROCESS STANDARDS

HW-27155 Rev. 1, Process Standards - Water Plant

One revised standard was issued during the report period. This was:

Process Standard 190-C-010 - "Emergency Evacuation of Personnel"

The standard was updated to provide current terminology for emergency practices.

HW-79800, "Nuclear Safety Specifications"

One revised specification was issued during the report period. This was:

Specification C-010 - "Processing Various Enrichments and/or Physical States of Uranium"

The specification was revised to include data for handling fully enriched uranium.

PROCESS CHANGE AUTHORIZATIONS

Four Process Change Authorizations were issued during the report period. These were:

PCA #5-28 - "Confinement System, Halogen Monitor - B Reactor"

Authorization was given to bypass the Halogen monitor for repair purposes for a period of 22 hours. The authorization was valid only while all process tubes remained capped.

PCA #5-29 - "O_2 Limitation at Startup - F Reactor"

Authorization was granted to permit up to 4 per cent O_2 in the reactor at startup, provided the O_2 content of the reactor atmosphere met Process Standard requirements prior to exceeding a power level of 50 mw.

The authorization provided additional time for purging the reactor without sacrifice of operating time and was not expected to have any adverse effects.

PCA #5-30 - "Gas Atmosphere Control - K Reactors"

The process change extended the provisions of PCA #5-19. PCA #5-19 provided interim specifications for Gas Atmosphere Control. The extension was authorized to provide additional time for review of a proposed revised standard.

DECLASSIFIED

PCA #5-31 - "Graphite Temperature Limits - KE Reactor"

Authorization was given to operate with graphite temperature up to 20 C above the normal limit for approximately three days. The reactor was approximately 90 cmk below predicted reactivity values and it was considered infeasible to reduce the startup graphite temperature to normal limits without significant risk of reactor shutdown.

MEMORANDUM OF PROCESS STANDARDS RELAXATIONS

Two memorandums were issued during the report period. These were:

Memo. #5-4M - "Zone Temperature Monitor - D Reactor"

The memorandum superseded Memo. #5-2M and rescheduled installation and safety circuit testing of the ZTM for D Reactor.

Memo. #5-5M - "Reduced Last-Ditch Emergency Pumping - H Area"

The memorandum authorized dactivation of the steam-driven export pump under the conditions specified in the memorandum.

AUDITING

One engineer audited conformance to Process Standards on all Processing Operations' shifts by making 16 inspections at each reactor during the report period.

FUEL FAILURE EXPERIENCE

Production Fuel

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failure (kw)	Exposure MWD/T	Type Failure
6/17/65	3077-C	KC-322-A	I&E E (0.94%)	1526	815	SH
6/23/65	3380-KE	KG-204-N	I&E ES (0.94%)	1858	562	SM

Target Fuel

Failure Date	Tube Number	Lot Number	Type of Material	Tube Power at Failure (kw)	Per Cent of Goal	Type Failure
6/23/65	0358-C	TC-1250	Solid Thoria	85	106	EM
6/26/65	4168-KW	TK-9240	Solid Thoria	206	92	EM

DECLASSIFIED

Legend

I&E E - This is the symbol for internally and externally cooled production reactor fuel elements with uranium cores enriched in U-235. The fuel is irradiated in ribbed process tubes. The weight per cent U-235 in the core material is stated.

I&E ES - This is the symbol for internally and externally cooled production reactor fuel elements which have projections welded to the fuel element jacket. The fuel is irradiated in ribless process tubes. The uranium cores are enriched in U-235 and the weight per cent U-235 in the core material is stated.

First Character

S	Side	Failure occurred on the side of the fuel element.
E	End	Failure occurred at the end of the fuel element.

Second Character

H	Hot-Spot	Failure caused by accelerated high temperature corrosion attack.
M	Defect	Failure caused by a defect in fuel fabrication.

DECLASSIFIED

OPERATIONAL PHYSICS OPERATION

PILE PHYSICS PLANT ASSISTANCE

All production reactors operated at "bulk" or administrative limits during the report period. Flattening efficiency, as measured by ECT, was maintained at a level commensurate with the reactor loadings. Startup performance, measured by nonequilibrium losses, compared favorably with the average for the previous year. F Reactor was shut down on June 25 and deactivation initiated.

As of June 25, the nonstandard loadings were as follows:

core thoria:	KW (half remaining)
fringe thoria:	B, C, D, KE, KW
enriched-depleted:	B, KE

The remaining core thoria at KW is expected to be discharged in late June or early July.

SUMMARY OF OPERATIONAL DATA OF PHYSICS INTEREST
FOR THE MONTH OF JUNE, 1965

Reactor	B	C	D	F	KE	KW
ECT in June (1)	1420	1465	1540	1540	2145	2060
12-Month Average ECT	1415	1515	1445	1505	2370	2235
Equil. Scram Time (2)	22	22	18	20	22	30
Recording Time:						
From:	5-19	5-15	5-19	5-20	5-20	5-20
To:	6-20	6-18	6-21	6-22	6-22	6-22

(1) Effective Central Tubes: This value is defined as pile power level divided by the average power of the ten most productive tubes in the reactor.

(2) This is defined as the maximum time in minutes which could elapse between scram and half-up and still permit a successful scram recovery using hot startup procedures. Equilibrium scram recoveries are not attempted at any of the reactors, and hot startup procedures are no longer authorized.

B Reactor - J. R. Langton

Total control requirements related to the enriched-depleted block now result in extension of "minimum" time and reduced turnaround levels. As the exposure in the block increases further, nonequilibrium losses will increase somewhat; no effect on flattening efficiency is expected. Continuity of operation at B Reactor was somewhat below average during the report period. Nonequilibrium losses and ECT remained near the 12-month average. The limit to operating level during the report interval was bulk outlet water temperature.

DECLASSIFIED

C Reactor - J. R. Heald

Ruptures in enriched material were limiting to operating continuity during the report period. In addition, during the outage of May 16, a large volume of water was introduced into the moderator in conjunction with rupture removal operations. The subsequent startup and approach to equilibrium were made continuously as the stack was dried out. Although an appreciable flux distortion was caused by the water during the early stages of the approach to equilibrium, the transition to normal operation was made without undue difficulty.

D Reactor - R. L. Miller

D Reactor operated continuously during the report period subsequent to May 31. Nonequilibrium losses for May 31 startup were low and ensuing ECT values were high. A "block" discharge scheme is again being used; the current block being scheduled for discharge in late July. The only nonstandard material remaining in D Reactor is the fringe thoria load.

F Reactor - G. C. Masche

F Reactor was operated continuously from May 20 to June 19, during which time the ECT was maintained above the 12-month average. A tendency to cycle, caused by the rather high exposure of the fuel, was reduced by increases in the helium content of the reactor atmosphere. Final shutdown of the reactor was made on June 25.

KE Reactor - G. D. Baston

KE Reactor was operated continuously from May 25, when half of the core thoria loading was discharged, to June 23, at which time the remaining core thoria and compensating enrichment were removed. During this period, the ECT was maintained at a high level, considering the number of nonstandard charges in the reactor. Subsequent to the June 23 outage, the only large loadings of nonstandard material in KE Reactor will be the fringe thoria and the enriched-depleted (E-D) block.

After the startup of May 25, a period of low reactivity was experienced, during which high graphite temperatures were maintained in order to provide sufficient operating reactivity. Subsequent analysis of reactivity data obtained during this period indicate that increases in pile atmospheric nitrogen concentrations in excess of roughly 40 per cent produce a net negative reactivity effect due to the greater importance of the gas absorption cross section contribution relative to the graphite temperature increase. It is therefore expected that future occurrences of this sort may be handled without temporary relaxation of graphite temperature limits.

DECLASSIFIED

KW Reactor - R. A. Dieterich

During the outage of May 31 the half core thoria loading at KW was discharged. The rest of the core thoria will be discharged in late June or early July. Subsequent operation of the reactor during the report period was continuous with the ECT value slightly below expectations due to localized areas of enriched material remaining after the discharge of the thoria; this was not of significant consequence as tube powers were not limiting.

PROCESS PHYSICS STUDIES

Reactivity and Control Studies

Total control curves for E-D loads in the KE and B Reactors were extended for covering the range from 1400 - 2500 MWD/T. Minimum outage length is approximately one hour greater at the higher exposure, bringing the total to about four hours longer than without the E-D load. Even at the higher exposure, however, the number of splines needed for fulfilling supplementary control requirements does not exceed that needed for optimum startup and operating efficiency.

Analysis of the physics tests conducted during H Reactor deactivation is continuing. A document is being prepared which will make the data available for reference purposes in the near future.

Production-Related Studies

Core loadings of the large-scale U-233 production program (E-Q) will be completed with the discharge of the final half-core from KW Reactor in early July. During the same outage recharging of the thoria in the fringes of the five continuing reactors is scheduled to start.

The depleted uranium loadings (E-D) for the production of high Pu-240 in partial cores at the B and KE Reactors continued to operate satisfactorily. The ratio of supporting E-columns to D-columns is slightly over 1.5 to 1 at both reactors. Goal exposure during the report period was in the range of 1550 and 1800 MWD/T at the B and KE reactors respectively. Provided the performance of the depleted uranium elements continues to be rupture-free, their exposures will be extended to approach 2500 MWD/T.

Reactor Fundamentals Studies

The third programmed learning text for operating personnel on Reactor Physics Concepts was published during the report period as Book III - Variations in Pile Reactivity. The rough draft of the final book of the series, Control of the Pile Reaction, was completed and forwarded to the Reactor Personnel Certification group for publication and distribution.

DECLASSIFIED

TESTING

PLANT ASSISTANCE - IPD

Corrosion Testing Facilities

TF-18 - Operating conditions are 130 C, flow 60 gpm, 2.5 ppm sodium dichromate. Objective is to condition the system and establish operational stability.

TF-20 - Testing was continued to: 1) evaluate the effects of surface treatment on zirconium hydride formation in low temperature systems; and 2) determine the cause of resistance temperature detector corrosion and the effect of various coatings to prevent corrosion. The operating conditions are 120 C, 9.5 gpm and pH 6.6.

Irradiated Process Tube Measurements

Wall Thickness Gauge (eddy-current type - WTG)

Reactor	No. of Tubes Measured	Report No.	RL-REA
KE	12	15	2140
B	17	16	2181
D	134	17	2187
Total	163		

Ex-Reactor Visual, Weight and Micrometer Measurements

Reactor	No. of Tubes Measured	Tube Samples Measured	Reason Examined
B	3	132	2 - internal leakers 1 - rupture leaker
F	1	36	internal leaker
H	2	88	corrosion studies

Critical Reactor Component Examination

Front-Face Flexible Connector Examination - 108-B Building

Reactor	No. of Connectors	Reason Examined
B	1	Leaker

Pressure Monitor System Programs

No in-board Bourdon coil examinations were conducted during the report period.

DECLASSIFIED

Gauges receiving failure analysis	18	
Gauges received from Central Maintenance	540	
-gauges accepted	511	
-acceptance rate		(94.6%)
-acceptance rate previous month		(91.8%)

Nine hundred sixty-three Model 156 type pressure monitor gauges have been processed for KW Reactor and 767 Model 154 type pressure monitor gauges with Model 156 type dial stops have been processed for KE Reactor to date.

Borescoping Activities - In-reactor tubes and channels were examined with the borescope as follows:

Reactor	Channel or Tube	Motion Picture Record	Purpose*
KW	RS-1	No	1
KW	HCR #2	No	2
KE	HCR #19	No	2
C	VSR #17	Yes	2

* 1 - Routine maintenance support
2 - VSR-HCR channel problem

Spline Traverses - Front-to-rear flux distribution data were taken as follows:

Reactor	No. of Tubes
C	14
KE	10

TESTING AND IRRADIATION SERVICES - OTHER DEPARTMENTS, CONTRACTORS

Irradiations - Non-Loop - Routine sample irradiations were handled as follows:

Reactor	Test Hole	Facility	Request Number	No. of Samples	Material-Purpose
KW KE	2A 2D	Quickie	HAPO 172	5	Basalt (activation analysis)
C	B	Bare Channel	HAPO 177	18	Graphite (irradiation damage)
KW KE	2A 2D	Quickie	HAPO 184	37	Washington Designated Program
KW	4C	Snout	HAPO 243	3	Tensile specimens (fast neutron damage study)
KW KE	2A 2D	Quickie	HAPO 254	8	Effluent water (activation analysis)
KW KE	2A 2D	Quickie	HAPO 271	5	Various (isotope production)
KW	2B	Snout	HAPO 273	1	Wave guide (flux measuring device evaluation)

DECLASSIFIED

Reactor,	Test Hole	Facility	Request Number	No. of Samples	Material-Purpose
D		PCCF	HAPO 302	2	Zeolites (H_3 impurity investigation
KW	3865	General Purpose	HAPO 304	1	Uranium (uranium swelling program)
KW	2B	Snout	HAPO 306	2	Uranium (fission product confinement study)
KW	2A	Quickie	HAPO 321	2	Bioassay samples (activation analysis)
C	Y	Neutron Beam	HAPO 325	480	Boron concrete slabs (N storage basin beam concentration check)
KW	3674	General Purpose	HAPO 322	2	Thoria (heat treatment variation)
KW	2B	Snout	HAPO 327		$MoUO_2$ (NASA fuel plate evaluation)
C		Process Tube	ORNL 184	34	Be_3N_2 (Carbon-14 production)
KW	3674	General Purpose	HAPO 223	5	Cobalt (cobalt calibration study)
KW	2D	General Purpose	NAA 118	1	$MoUO_2$ (fuel plate evaluation)
		*Gamma	HAPO 320	15	RTD's (radiation damage)

*Gamma irradiation facility located in Building 105-KE storage basin

Ex-Reactor Pressurized Water Loops

TF-1 - The test to determine the stress cracking corrosion of stainless steel, spiral-wound, asbestos-filled gaskets was completed. Operating conditions were 300 C, 1650 psig, and pH 9.8 ± 0.2 adjusted with ammonium hydroxide.

TF-3 - Testing continued to provide long-term corrosion data at N Reactor alternate primary coolant water conditions. Operating conditions are 293 C, 1350 psig, and pH 10.0 adjusted with lithium hydroxide.

TF-7 - Corrosion and equipment testing continued. Operating conditions are 277 C, 1125 psig, and pH 10.0 adjusted with ammonium hydroxide. The test sections contain the following material:

1. PRTR fuel element for fretting corrosion.
2. Two dummy fuel elements, two NIN1 fuel elements and coupons for ALK-15 crevice corrosion tests.
3. A metallic spiral-wound, asbestos-filled gasket for caustic corrosion cracking.
4. Special NPR type inner fuel elements for fretting corrosion.
5. One KSE3 fuel element for uniform corrosion testing.
6. Two coupon holders for film buildup studies.
7. One Zr-2 specimen for caustic attack testing.

Legend

NIN1 - N Reactor, inner tube, natural, first model
KSE3 - KER Loops, single tube, enriched, third model

[redacted] Manager, Research and Engineering

DECLASSIFIED

DATE FILMED

10/12/94

END