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

DECLASSIFIED

HW-58740

DATE

January 20, 1959

GENERAL ELECTRIC

RD ATOM PRODUCTS OPERATION - RICHLAND, WASHINGTON

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED
DATE 08-14-2010 BY 60322 UCBAW

VARIABLE GOAL EQUATIONS FOR ENRICHED AND
NATURAL I & E MATERIAL AT THE C AND K REACT.

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. R. Elomstrand

ISSUING FILE

CIRCULATING COPY
RECEIVED 1000 AREA

JAN 26 1959

RETURN TO

THIS DOCUMENT IS NOT BE UNAUTHORIZED OR WHEN AN UNAUTHORIZED PERSON HAS INFORMATION TO WHEN HE USE, IT MUST BE KEPT IN AN APPROVED LOCKED DEPOSITORY. IT IS NOT TO BE LOANED OR WHILE IT IS YOUR RESPONSIBILITY AND UNTIL YOU OBTAINED A WRITTEN RECORD FROM CLASSIFIED FILES, IT IS YOUR RESPONSIBILITY TO KEEP IT AND ITS CONTENTS WITHIN THE LIMITS OF THIS PROGRAM AND FROM ANY UNAUTHORIZED PERSON. ITS TRANSMITTAL TO ANY STORAGE OR PLACE OF RECORD IS PROHIBITED. IT IS NOT TO BE DUPLICATED, IF ADDITIONAL COPIES ARE REQUIRED, OBTAIN THEM FROM THE RELATION ISSUING THE ALL PERSONS READING THIS DOCUMENT ARE REQUESTED TO SIGN IN THE SPACE PROVIDED BELOW.

[illegible]

THIS DOCUMENT IS PUBLICLY
AVAILABLE

DECLASSIFIED

04/20/1994

DECLASSIFIED

HW-5874C

[REDACTED]

PRELIMINARY REPORT - This report was prepared only for use within General E Electric Company in the course of work under Atomic Energy Commission Contract W-31-109-Eng-52. Any views or opinions expressed in the report are those of the authors only.

COPY 1 OF 1, SERIAL MA

This document consists of 6 pages.

This document classified by:

H. S. Spencer

1. T Prudich
2. JT Baker
3. RS Bell
4. JL Benson
5. RR Bloomstrand
6. CE Bowers
7. RW Bown
8. RO Brugge
9. RD Carter
10. RL Dickeman
11. FC Franklin
12. GC Fullmer
13. SM Graves
14. OH Greager
15. LT Hagie
16. RE Hall
17. EE Leitz
18. CG Lewis
19. AR Maguire
20. JHM Miller
21. JF Music
22. CA Priode
23. RW Reid
24. HG Spencer
25. P Thompson
26. EC Wood
27. 300 Files
28. Record Center

January 20, 1959

Classification Cancelled and Changed to

DECLASSIFIED

By Authority of C. G. P. R. 2.

By *D. S. Kewis, 12-1-59*

By *Johnnie M. Nally, 1-1-60*

Verified By *W. L. Hanson, 4-1-60*

T. Prudich - Manager
Production Forecasting & Scheduling
Production Operation
IRRADIATION PROCESSING DEPARTMENT

VARIABLE GOAL EQUATIONS FOR
ENRICHED AND NATURAL I & E MATERIAL
AT THE G & K REACTORS

- Reference: (1) HW-57937, "Goal Exposures for I & E Enriched Material at the G and K Reactors", 10-28-58 (Secret).
(2) HW-58282, "K Reactor Natural I & E Goal Exposure", 11-26-58, (Secret).
(3) Letter, HG Spencer to T Prudich, 1-6-59.

We have previously transmitted interim recommendations of goal exposure plans for enriched I & E material at the G and K Reactors (1) and for natural I & E material at the K Reactors (2,3). We indicated in the references that corrections for changes in inlet temperature would be forthcoming. The purpose of this letter is to transmit revised goal exposure equations.

DECLASSIFIED

04/20/1994

DECLASSIFIED HW-58740

T. Prudich

-2-

1-20-59

The equations embody the effects of inlet temperature, as well as power, on the optimum exposure. They were prepared from the output data of an optimization equation, which we have previously discussed, that includes terms for the major variables that affect reactor production rates including: rupture losses, charge-discharge, tube replacement, reactivity and total-control considerations, and other miscellaneous losses. Loss per rupture was taken to be 24 and 19 hours at the C and K Reactors, respectively.

In formulating these recommendations, we have added 50 MWD/T to the goal exposures calculated to be optimum. The adder serves to probe metal performance levels, a function which we believe to be both prudent and necessary at this time.

The exposure equation is as follows:

$$(1) M = \sqrt{a} (T)^b (F)^c P^d k$$

Where M = tube exposure (MWD/Ton or MWD/Ton of E-Metal)
T = inlet temperature °C
F = tube flow rate (gpm)
P = tube power (MW)
a, b, c, k = constants of appropriate sign

The values of the constants for the various types of material at the subject reactors are shown in Table I. Because the equations are simply linear fits to output data from the optimization equation, their application is restricted to specified ranges.

We recommend the following methods for determining tube power (P), tube flow rate (F), and inlet temperature (T) for use in equation (1):

- (1) Tube power for tube with factor 1.00 = $\frac{\text{Average equilibrium power level for preceding 20 or more operating days}}{\text{Average number of active tubes}}$
- (2) Inlet temperature = Average inlet temperature for same time period as in (1), above.
- (3) Average tube flow rates for the various types of charges can be determined from most recent (or otherwise appropriate) IBM records.

The interim exposure plans (1, 2, 3) and the goals calculated from equation (1) are graphically illustrated on Figures 1 and 2, attached. For the cases shown, i.e. at 10 inlet, it is seen that the interim recommendations for the enriched material are lower than the results of equation (1). The interim goal for I & E natural at the K Reactors is approximately equal to that calculated by equation (1).

DECLASSIFIED

DECLASSIFIED

TABLE I

Reactor	Type Metal And Loading	Constants for Equation (1)					Range of Applicable Conditions			Maximum Exposure*
		a	b	c	k		P	F	T	
					w/o mixer	w/mixer				
KE & KW	38 piece I & E Natural 1.474 x .375	-5.2	± 8.4	-1075	±1438	1473	Up to 1400	52-64	Normal Var. (5-20)	860 (560 minimum**)
	46 piece I & E Enriched 1.454 x .375	-8.4	±12.0	-1803	±1995	—	Up to 1400	60-70	"	1500 min
C	32 piece I & E Natural 1.460 x .375	-7.2	±14.5	-1700	±1735	—	Up to 1200	45-55	"	1000
	34 piece I & E Enriched 1.454 x .375	-9.4	±14.2	-1869	±1916	—	Up to 1200	49-59	"	1500

* Maximum exposure (MWD/Ton) to which tubes should be irradiated, regardless of exposure calculated from equation (1).

** Minimum exposure (MWD/Ton) to which tubes should normally be irradiated. This "floor" value results primarily from total control-considerations.

DECLASSIFIED

04/20/1994

DECLASSIFIED

HW-58740

-4-

Significant changes in exposure should be timed such that existing reactivity cycles are damped and control problems minimized, insofar as is practicable. We recommend that the Operational Physics Operation be consulted in these matters. As in the past, we will periodically review irradiation experience and recommend any desirable changes in the goal plans.

R.R. Blomstrand

R. R. Blomstrand
Process Analysis Operation
Research And Engineering Operation
IRRADIATION PROCESSING DEPARTMENT

APPROVED:

J. E. Music

J. E. Music - Manager
Process Technology Operation
Research And Engineering Operation
IRRADIATION PROCESSING DEPARTMENT

RRB:ga

DECLASSIFIED

T. Pundlich

- 5 -

100-5074-1

1-20-59

C REACTOR

FIGURE 11

DECLASSIFIED

Tube Power (kw)

FIGURE 1

DATE

FILMED

10/18/94

END