

[REDACTED]

UNCLASSIFIED

NAA-SR-Memo-737

REACTORS-POWER (M-3679, 18th Ed.)

This document consists of 10 pages.

No. 114 of 178 copies, Series TB.

UNITED STATES ATOMIC ENERGY COMMISSION

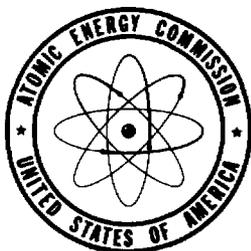
REVISED REACTOR FUEL AND FUEL
PROCESSING COSTS—JULY 1953

By
C. W. Wheelock

DEPARTMENT	
1ST REVISION DATE	4-3-97
AUTHORITY	✓
NAME	Jerry E. Keyser
2ND REVISION DATE	4-8-97
AUTHORITY	
NAME	Jed Davis

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED
DATE 10-15-98 BY SP-6
JED DAVIS

MASTER



July 10, 1953

North American Aviation, Inc.
Downey, California

This document is
PUBLICLY RELEASEABLE

Jerry E. Keyser
Authorizing Official
Date 3-5-98

[REDACTED]

[REDACTED]

[REDACTED]

Technical Information Service Extension, Oak Ridge, Tenn.

AEC RESEARCH AND DEVELOPMENT REPORT

UNCLASSIFIED

[REDACTED]

UNCLASSIFIED

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.

This report has been reproduced directly from the best available copy.

Printed in USA. Charge 25 cents. Available from the Technical Information Service Extension, P. O. Box 1001, Oak Ridge, Tennessee. Please direct to the same address inquiries covering the procurement of classified AEC reports.

UNCLASSIFIED

[REDACTED]

AEC, Oak Ridge, Tenn.

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.

Classification cancelled (or changed to) *letter 4/17/73*
by authority of *Frank Stewart, Dir. Plan. Wash DC*

UNCLASSIFIED

July 10, 1953

DTE, date *6/4/73*

REVISED REACTOR FUEL AND FUEL PROCESSING COSTS - July, 1953

by
C. W. Wheelock

As a result of the recent "Chicago Evaluation Treaty", aimed toward consistency among the various groups doing power reactor evaluation work, the following adjustments in the uranium fuel costs presented in NAA-SR-Memo-575, appear necessary.

	NAA-SR-Memo-575	NAA-SR-Memo-737
1. Fixed charge rate on capital investment.	16%	15%
2. Fixed charge on SF materials.	10%	12%
3. Uranium ore cost.	\$20 per lb.	\$15 per lb.
4. Diffusion plant separative work.	\$58 per unit	\$50 per unit
5. Diffusion plant waste concentration.	Optimum for given ore cost.	0.25% U ²³⁵
6. Uranium conversion costs.	NAA-SR-Memo-575	See enclosed table

MASTER

All uranium processing costs except those for chemical separations are the values suggested at the Chicago meeting. The period of time for which S.F. material charges were assessed for each stage of processing was determined from the processing data upon which NAA-SR-Memo-575 was based. The chemical separations cost was determined in a manner similar to that of NAA-SR-Memo-575 except that the plant capacity was changed from 2400 to 1800 tons per year, which increases the unit cost for recovering irradiated uranium as well as that for

4 UNCLASSIFIED

processing plutonium. The new value for plutonium processing is

$$C_{\text{Pu Processing}} = \frac{4803}{G} (\$/\text{gm Pu})$$

where G = plutonium concentration in the irradiated metal (grams per metric ton).

The attached curves provide values for uranium fuels in three forms (UF_6 , Rods, and Irradiated Metal) for varying U^{235} content. Three different uranium ore costs (10, 15, and 20 dollars per pound U_3O_8) have been assumed and the respective curves drawn for each with 12 percent S.F. material charges.

The value of enriched UF_6 , as in NAA-SR-Memo-575, was determined by diffusion plant costs, and this value applied in the following equations to find the value of Rods and Irradiated Metal of the same enrichment.

$$\text{Value of irradiated metal} = C_o = \frac{C_{\text{UF}_6} (1 - 0.2064 r) - 7.77}{1 + 0.2064 r}$$

$$\text{Value of Rods} = C_R = \frac{C_{\text{UF}_6} (1 + 0.02877 r) + 3.98}{1 - 0.02877 r}$$

$$\text{Cost of cladding (Hanford type slug)} = C_{\text{cladding}} = \frac{\frac{10.27}{L^2} + 0.2082 r C_R}{1 - 0.1041 r}$$

where

C_{UF_6} = value of UF_6 of the desired enrichment

D = uranium slug diameter (inches)

r = S.F. material fixed charge rate (expressed as a decimal).

UNCLASSIFIED

TABLE I

URANIUM VALUES AND PROCESSING COSTS

	<u>Time for Processing (days)</u>	<u>Processing Charge (\$/kg)</u>	<u>12% Fixed Charge on Natural Uranium (\$/kg)</u>	<u>Value of Natural Uranium (\$/kg)</u>
Irradiated slugs leaving reactor			(1)	(1) 20.49 33.21 45.93
Conversion to UNH	(2) 65	5.02	0.49 0.77 1.05	
UNH or U ₃ O ₈				26.00 39.00 52.00
Conversion to UO ₃	45.7	1.60	0.41 0.60 0.80	
UO ₃				28.01 41.20 54.40
Conversion to UF ₆	40.4	1.15	0.38 0.56 0.73	
UF ₆				29.54 42.91 56.28
Conversion to UF ₄	8.3	0.95	0.08 0.12 0.15	
UF ₄				30.57 43.98 57.38
Conversion to Ingots	6.0	1.48	0.06 0.09 0.12	
Ingots				32.11 45.55 58.98
Conversion to Rods	6.6	1.55	0.07 0.10 0.13	
Rods				33.73 47.20 60.66
Conversion to Machined Slugs	76	2.45	0.92 1.27	
Conversion to clad slugs		3.10	1.61	
Clad slugs				40.20 54.02 67.82

UNCLASSIFIED

(1) The three different values shown in these columns are for 10, 15, and 20 dollar/pound uranium ore. (concentrated U₃O₈).

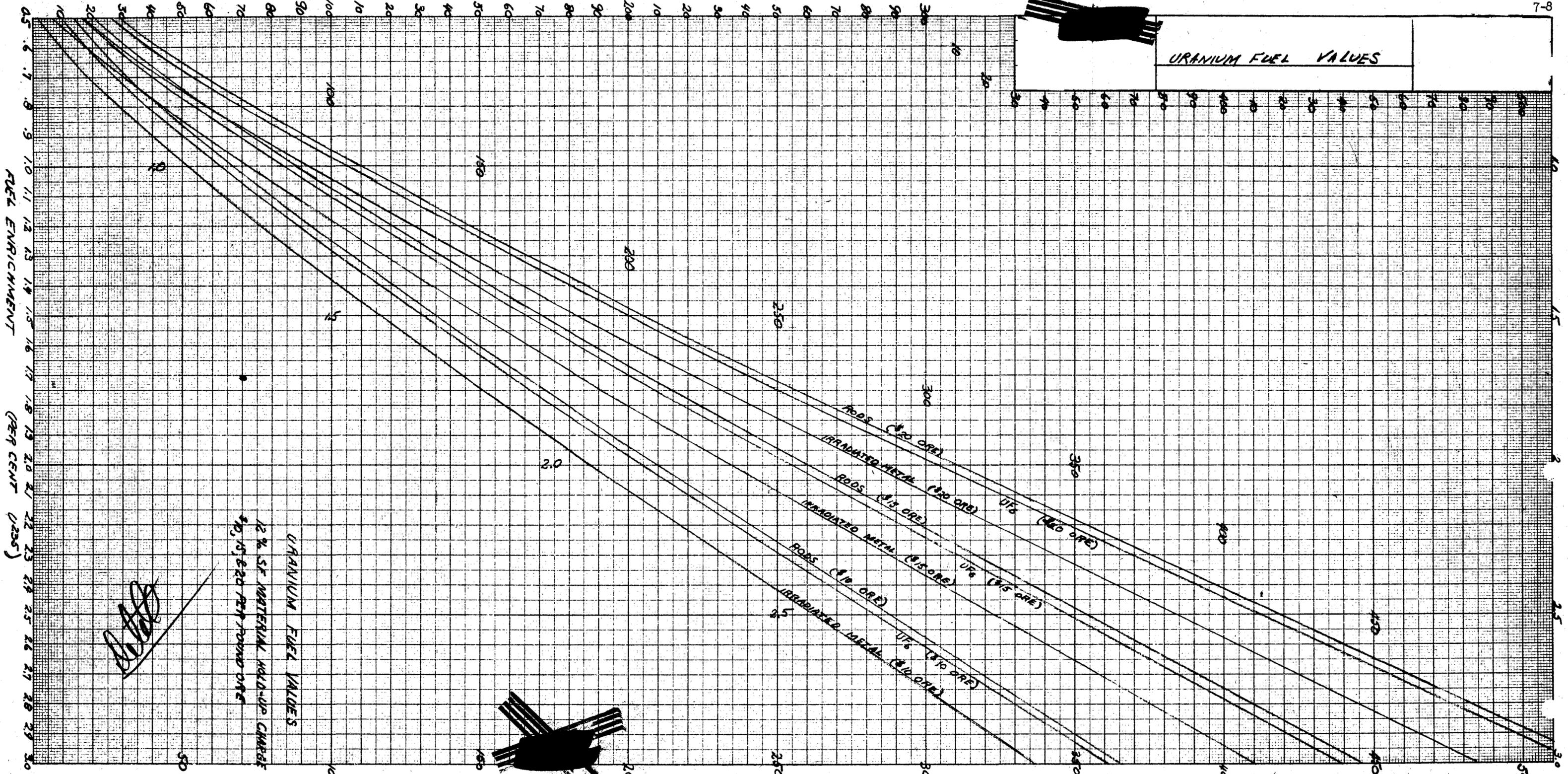
(2) In the charge for chemical separations, 60 days was allowed for radioactive decay and 5 days for processing through the Redox plant.



UNCLASSIFIED

UNCLASSIFIED

FUEL VALUE (DOLLARS PER KILOGRAM)



FUEL ENRICHMENT (PER CENT U²³⁵)

URANIUM FUEL VALUES

UNCLASSIFIED

UNCLASSIFIED

REACTORS-POWER, M-3679 (18th Edition)

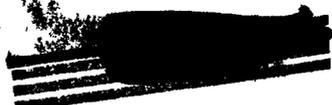
NAA-SR-Memo-737

Series TB

Copy No.Standard Distribution

1	AF Plant Representative, Burbank
2	AF Plant Representative, Marietta
3	AF Plant Representative, Seattle
4	AF Plant Representative, Wood-Ridge
5	ANP Project Office, Fort Worth
6	Albuquerque Operations Office
7	Alco Products, Inc.
8-19	Argonne National Laboratory
20	Armed Forces Special Weapons Project, Sandia
21	Armed Forces Special Weapons Project, Washington
22	Army Chemical Center
23	Assistant Secretary of the Air Force, R&D
24-27	Atomic Energy Commission, Washington
28	Battelle Memorial Institute
29-34	Bettis Plant (WAPD)
35-37	Brookhaven National Laboratory
38	Bureau of Ships
39	Chicago Operations Office
40	Chicago Patent Group
41	Chief of Naval Research
42	Combustion Engineering, Inc. (CERD)
43	Continental Army Command
44-47	duPont Company, Aiken
48	duPont Company, Wilmington
49	Duquesne Light Company
50	Engineer Research and Development Laboratories
51-52	General Electric Company (ANPD)
53-60	General Electric Company, Richland
61	Hanford Operations Office
62	Headquarters, Air Force Special Weapons Center
63	Iowa State College
64-67	Knolls Atomic Power Laboratory
68-71	Los Alamos Scientific Laboratory
72	Mound Laboratory
73	National Advisory Committee for Aeronautics, Cleveland
74	National Advisory Committee for Aeronautics, Washington
75-76	Naval Research Laboratory
77-78	New York Operations Office
79	North American Aviation, Inc.
80	Nuclear Development Corporation of America
81	Nuclear Metals, Inc.
82	Office of the Chief of Naval Operations (OP-361)
83	Office of the Quartermaster General
84	Patent Branch, Washington

UNCLASSIFIED



REACTORS-POWER, M-3679 (18th Edition) (Continued)

NAA-SR-Memo-737

Series TB

Copy No.

Standard Distribution

85-91	Phillips Petroleum Company (NRTS)
92	Pratt and Whitney Aircraft Division (Fox Project)
93	Public Health Service
94	San Francisco Operations Office
95	Special Devices Center
96	Sylvania Electric Products, Inc.
97-100	Union Carbide Nuclear Company (ORNL)
101	USAF Project RAND
102	U. S. Naval Ordnance Laboratory
103	U. S. Naval Postgraduate School
104	University of California Radiation Laboratory, Berkeley
105	University of California Radiation Laboratory, Livermore
106	Vitro Engineering Division
107	Vitro Laboratories
108-113	Wright Air Development Center (WCOSI-3)
114-178	Technical Information Service Extension (For Official AEC Use)

UNCLASSIFIED

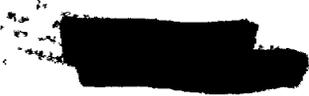


11-11-68

11-11-68

11-11-68

11-11-68

 UNCLASSIFIED

UNCLASSIFIED

 AT