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IN MICROFICHE
PRODUCTS.**

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HW--60143

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By Authority of

per Doc May 1973

By K. B. B. 11/21/91

By PM Eick 11-21-91

DEFINITIVE PROCESS DESIGN

REDOX MULTI-PURPOSE DISSOLVER INSTALLATION

Received by OSTI

By

L. D. Gustafson

JAN 0 1 1972

EXTRACTION DESIGN AND DEVELOPMENT
FACILITIES ENGINEERING

GENERAL ELECTRIC COMPANY - HANFORD ATOMIC PRODUCTS OPERATION

May 6, 1959

SPECIAL RE-REVIEW

FINAL DETERMINATION

DECLASSIFICATION CONFIRMED

BY *J. P. Desmar* DATE *3-5-82*

BY *J. E. B. B. B.* DATE *3-5-82*

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4. Issue No. 134 - July 28, 1958, AEC Serious Accident Report.
5. HW-59252 REV 1., "Budget Study Report - FY-1961 - Redox NPR Fuel Reprocessing," L. D. Gustafson, May 5, 1959.

C. Drawings

1. SK-2-7229, Redox Multipurpose Dissolver Engineering Flow Diagram.
2. SK-2-7181, Removable Charging Rack.
3. SK-2-7230, Multipurpose Redox Dissolver Installation 'B' Cell.
4. SK-2-7231, Redox Multipurpose Dissolver.
5. SK-2-7232, Modifications to Down-Draft Dissolver Tower.
6. SK-2-7233, Proposed NPR Fuel Element Cannisters.
7. SK-2-7234, NPR Fuel Element Charging Rack.

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HW-60143
Page 8

APPENDIX A

PROJECT COST ESTIMATE SUMMARY

Installation and Erection Cost

I. Construction Operation	
II. G. E. Plant Forces	\$ 158,500
III. Fixed Price Contractor	
IV. Supervision of Construction(Title III)	5,700
V. Project Start-Up	
VI. Contingency	25,100
VII. Escalation (3% of Direct Labor)	<u>1,200</u>
Sub-Total	\$ 190,500
VIII. General Overhead (5 % of sub-total)	<u>9,500</u>
Total Installation and Erection Cost	200,000
<u>Management Services</u>	8,000
<u>Design Services (Title I & II)</u>	<u>27,000</u>
TOTAL PROJECT COST	<u><u>\$ 235,000</u></u>

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SCOPE

DATE	REVISION
10-1-58	1
10-1-58	2
10-1-58	3

REMOVABLE CHAIRS
1. BACK 1

NO.	DESCRIPTION	QTY	UNIT
1	REMOVABLE CHAIRS	1	EA
2	BACK 1	1	EA
3	...	...	...

GENERAL NOTES

1. ALL MATERIALS TO BE AS PER L. SPEC.

HT-60145
Page 10

GENERAL NOTES

1. NO SET CONSTRUCTION - E.S.A
2. WHEN POSITIONED IN DOSSOLVER, INCE
MUST BE CAPABLE OF SUPPORTING A
WIRE FULL ELEMENT CANNISTERS
3. 2000 LBS EACH

CONCEPTUAL

HW-60/43

PAGE 15

NAME	WONG, CHOW SIU CHING
DOB	1952-07-01
SEX	M
ETHNICITY	CHINESE
RELIGION	B
EDUCATION	HS GRAD
EMPLOYMENT	UNEMPLOYED
RESIDENCE	100-10 100-10 100-10
TELEPHONE	100-10 100-10 100-10
VEHICLE	100-10 100-10 100-10
REMARKS	100-10 100-10 100-10

REDOX MUEL11/10K-POS	DN350LEVER
W 2024	W 2100
5K-2-7234	

NPR FUEL ELEMENT
CHARGING RACK

**U. S. Atomic Energy Commission
Nuclear and Atomic Properties Division
2000 General Electric Building
Rockville, Maryland**

100

•

PLAN

DEF 1

Section 11-1

ΕΛΕΥΘΕΡΙΟΝ

SECTION 8-B

SECTION C-C

SCOPE

HW-60143
Pas 12

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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HW-60143
Page 2

**DEFINITIVE PROCESS DESIGN
REDOX MULTI-PURPOSE DISSOLVER INSTALLATION**

I. INTRODUCTION

Redox is currently processing E-Metal while all natural uranium is being processed in Purex. Because the existing Redox dissolving facilities are limited by batch size controls necessary for nuclear safety, the current E-Metal commitment requires nearly all of the available Redox dissolving capacity. This does not leave Redox with any appreciable back-up capacity for Purex production, or any appreciable reserve capacity for increases in E-Metal commitments. The introduction of Non-Production Fuels (NPF) and NPR fuels to Redox will require eventual E-Metal dissolution capacity matching the solvent extraction capacity of the Redox Plant (Reference 1).

II. PURPOSE

This document provides the required definitive scope design for dissolver equipment capable of nuclear safe processing by geometry of E-Metal and certain other fuels enriched to a maximum of one per cent U-235 equivalent. Using only a single dissolver installation of this design, it will be possible to process the current E-Metal monthly commitment in less than two weeks (five-day week). The proposed dissolver system is to incorporate design flexibility required to permit conversion to Zirflex processing of NPR fuels.

III. SUMMARY

One new dissolver vessel with modified down-draft tower, approximately 28 new jumpers, and miscellaneous service-side modifications are proposed for installation in the Redox Plant. This equipment as installed will be nuclear safe by geometry for the processing of E-Metal or natural uranium. With minor modifications necessary for the Zirflex process, it will also be adaptable to processing of NPR and certain other fuels up to an equivalent enrichment of one per cent U-235 with nuclear safety by geometry.

The total project cost for this installation, not including future adaptation to NPR processing, is estimated to be \$235,000 and the physical completion date approximately eight months after authorization.

IV. DESCRIPTION OF WORK

There will be four primary phases of work required to complete the proposed project for this dissolver installation:

Reference 1 - HW-58961, "Integration of Non-Production Fuel Reprocessing at Hanford by W. K. MacCready, January 23, 1959.

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.

A. Final Design

1. Final Design of the annular-type dissolver will be prepared with drawing SK-2-7231 as the basis. Parts of the design work prepared in conjunction with the E-Metal dissolver proposed by Project CG-772 (References 2 and 3) will be applicable. This dissolver design is to be compatible to charging of E-Metal or natural uranium fuels using a charging rack as shown by SK-2-7181, and to charging NPR fuels using a carrier and charging rack design similar to that shown by SK-2-7233 and SK-2-7234.
2. Final design covering the needed revisions to the down-draft dissolver tower for Zirflex processing of NPR fuels will be prepared with drawing SK-2-7232 as the basis.
3. Jumper designs and service-side design modifications will be prepared using drawings SK-2-7229 and SK-2-7230 as the initial basis. Approximately 20 per cent of the jumper design is for an off-gas silver reactor by-pass system. This by-pass system is required to relieve the hazardous conditions associated with ammonia in the silver reactor (Reference 4). The detail design of dissolver vessel and tower nozzle locations must precede jumper design. Final design of the additional jumpers required for Zirflex processing of NPR fuels will not be prepared by this project; however, the jumpers designed for this project must permit the future installation of these additional jumpers.

B. Fabrication

1. One new dissolver is to be fabricated with charging rack and other necessary accessories as shown by SK-2-2231 and SK-2-7181. The NPR charging rack, SK-2-7234, will not be supplied by this project. The dissolver vessel shall be fabricated per specification HWS-5796, Rev. 3.
2. Modify an existing spare down-draft dissolver tower as shown on SK-2-7232.
3. Fabricate those jumpers required for processing of E-Metal or natural uranium as shown on SK-2-7230. The additional jumpers required for Zirflex processing of NPR fuels are not to be provided by this project. All cell jumpers shall be fabricated per specification HWS-5786, Rev. 1.

-
- Reference 2 - HW-52843, "Definitive Process Design "E" Metal Dissolving Equipment Redox," by W. A. Graf, September 30, 1957.
- Reference 3 - HW-55356, "Project Proposal, Revision 1, E-Metal Dissolvers - Redox, (Project CG-772), by D. A. Snyder, March 19, 1958.
- Reference 4 - Issue No. 134 - July 28, 1958, A.E.C. Serious Accident Report.

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HW-60143
Page 4

C. Cell Preparation

Dissolver Cell B will be prepared for installation of the new dissolver and tower. This will require removal and burial or salvage of the existing dissolver, tower and associated jumpers. Dissolver Cell A, B or C may be used for this installation; however, Cell B has been selected for illustrative purposes in this report. Minor changes necessary for an A or C Cell installation would have no significant affect upon the cost of the project.

D. Installation

The new dissolver, tower and associated jumpers will be installed in Cell B. The necessary re-arrangements and additions to the service-side area will be made while the old cell equipment is being removed and replaced. Only those service-side modifications necessary for the processing of E-Metal and natural uranium will be performed by this project; see drawing SK-2-7229 and SK-2-7230.

V. DESCRIPTION OF EQUIPMENT

A. The Dissolver Vessel

The dissolver vessel design as illustrated by the scope drawings of this document is similar to the annular type dissolver designed earlier for E-Metal. The outer solution annulus has been reduced in size and the metal annulus modified for better utilization with NPR fuel reprocessing.

This dissolver is designed for a 12-ton crib capacity with conventional Hanford-type fuel elements of either irradiated natural uranium or E-Metal. It is designed for nuclear safe processing by geometry of fuels enriched to a maximum of one per cent U-235 equivalent. Using a fuel carrier similar to that shown by SK-2-7233, this dissolver will have an estimated NPR fuel capacity of 6.5 to 8.0 tons depending upon final NPR fuel element design. It will also be capable of processing certain other fuel elements, contingent upon enrichment, cladding material and physical dimensions.

Vessel geometry has been altered to permit improved operating performance with Zirflex processing of NPR or other zirconium-clad fuel elements. Specific vessel data of operating significance are:

<u>Description</u>	<u>Liquid Capacity, Gallons</u>	<u>Liquid Height Above Tank Bottom, Inches</u>
Minimum Operating Level (Top of Coil - No heel)	700	44
Normal Operating Level (Liquid covers standard natural or E-Metal charge)	1050	72
Maximum Operating Level	1400	87
Operating Overflow	2020	111

The vapor freeboard above the maximum liquid operating level is about three feet.

The vessel coil is to provide the heating and cooling services required during the various stages of the process cycle. A total heat transfer area of 150 square feet is provided for this service with the coil submerged at minimum operating level.

A charging chute cover is provided with the incorporation of a water seal to reduce dissolver air leakage. This water seal is designed to seal from plus six inches to minus twelve inches of water. The charging chute cover must be designed to remain in place by gravity at plus six inches of water internal pressure. Since some air is required for proper process operation, a bleed valve system is installed with the valve operable from the operating panel. A seal pot is installed on the overflow line to limit air leakage and is not for pressure control. The seal on this overflow pot is not to break before the cover seal. This cover-water seal system is unchanged from that presented in Reference 2.

The earlier E-Metal definitive process design (Reference 2) presented the need for a neutron moderator and absorber placed in the hollow central portion under the tank. As presently conceived, this unit will be a hollow concrete cylinder with a cadmium outer layer enclosed in a stainless steel sandwich. This concrete cylinder is shown on the dissolver scope drawing, SK-2-7231.

The dissolving equipment should be designed per specification HW-5796, Rev. 3 and fabricated of 304-L stainless steel. All internal permanent piping in contact with process solutions should be schedule 80 pipe.

B. Dissolver Tower

An existing spare down-draft dissolver tower is to be modified as shown by the tower modification drawing, SK-2-7232. These modifications will permit future additions for Zirflex processing of NPR fuels. A two-inch stub line is to be added to the off-gas outlet line to allow a future air bleed required for dilution of Zirflex off-gases. A condensate side outlet is provided for future use in purging ammonia during the Zirflex dechlorinating step. The dissolver tower is to have a remotely replaceable type of flange gasket.

VI. COST AND TIMING

A new dissolver is needed at the Redox Plant as soon as possible to replace a failed unit needed for routine service. The flexibility and versatility of the annular design proposed for installation by this report would permit application of the new dissolver to NPR fuel processing in the future while alleviating a safety and production handicap during the interim E-Metal processing periods.

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HW-60143
Page 6

<u>Schedule</u>	<u>Time After Authorization</u> (Months)	
	<u>Start</u>	<u>Finish</u>
Detail Design	0	5
Procurement and Fabrication	1	6
Physical Performance	1	8
Beneficial Use	-	7

As shown by the above schedule, the multi-purpose dissolver installation could be ready for beneficial use seven months after project authorization. Assuming project authorization by July 1, 1959 the installation would then be ready for operation February 1, 1960.

The over-all project cost estimate as shown by Appendix A is \$235,000.

VII. REMARKS

This multi-purpose dissolver installation has been designed to optimize as best possible at this time, an annular type dissolver that will provide a satisfactory E-Metal processing rate with the added flexibility required to permit future conversion to Zirflex processing of NPR fuels as currently conceived.

Future conversion to NPR processing will not affect the processing of E-Metal in this system; since, it will only be necessary to change dissolver charging racks between NPR and E-Metal batches. The present concepts call for separate campaigns for the processing of E-Metal, NPR and other reactor fuels (Reference 1). When NPR fuel reprocessing begins, additional dissolving facilities supplementing this multi-purpose installation will be necessary (Reference 5).

VIII. APPENDIX

A. Cost Estimate

B. References

1. HW-58961, "Integration of Non-Production Fuel Reprocessing at Hanford," by W.K. MacCready, January 23, 1959.
2. HW-52845, "Definitive Process Design "E" Metal Dissolving Equipment Redox," by W. A. Graf, September 30, 1957.
3. HW-55356, "Project Proposal, Revision 1, E-Metal Dissolvers - Redox, (Project CG-772)," by D. A. Snyder, March 19, 1958.

Reference 5 - HW-59252 REV 1, "Budget Study Report - FY-1961 - Redox NPR Fuel Reprocessing," L. D. Gustafson, May 5, 1959.

HW-60143
PAGE 14

DESCRIPTION

GENERAL NOTES

1. ALL ALUMINIUM CONSTRUCTION
2. EACH UNIT NOT TO EXCEED 50 LBS
3. CARRYING CAPACITY 1 TON

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CONCEPTUAL

SK-2-7233

APPROVALS

SCALE: 1/2" = 1'

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

DATE: 12-1-52

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DATE: 12-1-52

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DATE: 12-1-52

DATE: 12-1-52

U. S. ATOMIC ENERGY COMMISSION
MANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

FEEDBACK VPR FUEL
ELEMENT CANISTERS

SK-2-7233

NONE

CLASSIFIED BY 1106 DATE 4-22-52

END

DATE
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