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PRODUCTION OF
ZIRCONIUM-NIOBIUM-95 AND SCANDIUM-46 AT HANFORD

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October 18, 1963

T. R. Clark, Manager
 Contract Administration
 Contract and Accounting Operation

PRODUCTION OF
ZIRCONIUM-NIOBIUM-95 AND SCANDIUM-46 AT HANFORD

Reference: Letter, T. R. Clark to J. H. Warren, "Request for Study - Zirconium - Niobium-95 and Scandium-46", dated October 3, 1963.

In response to your request of October 3, we have made a preliminary feasibility study of the equipment and program needs for the production of zirconium-niobium-95 and scandium-46 at Hanford. Appropriate extrapolation of existing technology indicates that either material could be produced at Hanford at the capacities and quality desired.

Zirconium-niobium-95 production program at Hanford would appear most practical as an integrated effort in the waste extraction-isotope packaging complex planned for B-Plant. Zirconium-niobium-95 could conceivably be recovered from Purex acid waste by adsorption on silica gel and then eluted and calcined to the desired product specifications, possibly using a radiant heat spray calciner. If an integrated B-Plant program were authorized in

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the third quarter of FY 1964, megacurie amounts of zirconium-niobium-95 could be made available in the Spring of 1967. Capital cost in addition to planned B-Plant expenditures would be approximately \$1,200,000, assuming cell renovation, service installation and process equipment needs generally similar to that now planned for waste management and isotope packaging operations. Throughput capacities for the system could range from 1 to 25 megacuries per month with little change in capital costs. Operating costs and equivalent uranium throughput rates are summarized for three production cases as follows:

ZR-NB-95 COST SCHEDULES AND PROCESSING RATES

	<u>1 Mc/mc.</u>	<u>10 Mc/mc.</u>	<u>25 Mc/mc.</u>
Fund Cost (1)	\$ 24,000	\$230,000	\$532,000
Depreciation (2)	<u>80,000</u>	<u>83,000</u>	<u>86,000</u>
Annual Cost	\$104,000	\$313,000	\$618,000
<u>Unit Cost/Curie</u>			
Fund Cost	\$ 0.0020	\$ 0.0019	\$ 0.0018
Depreciation Cost	<u>0.0067</u>	<u>0.0007</u>	<u>0.0003</u>
Total Cost/Curie	\$0.0087	\$ 0.0026	\$ 0.0021
<u>Process Rates</u>			
Tons/Yr. (3)	250	2500	6300

- Notes: (1) Includes full general plant overhauls together with direct and apportioned costs of B-Plant complex.
- (2) Includes amortization of new facilities on a 20 year basis plus apportioned amounts for common usage of existing facilities.
- (3) The 25 Mc/mc. case approximates combined production rate of all Hanford reactors excluding the NPR. Assumes exposures of 600 MWD/T and power levels of 10 MW/T.

Early definition of program needs would be of prime importance to proper integration of a ZrNb-95 program into the B-Plant waste extraction-isotope packaging complex. Current isotope packaging plans do not include ZrNb-95 so that the limited space available in B-Plant should be reserved for Zr-Nb-95

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promptly to avoid larger capital investments and possibly higher operating costs. In addition, prompt initiation of laboratory development would be required to assure production-scale operations in 1967. The development program would involve cold, tracer and full-level pilot plant demonstration runs in laboratory facilities such as the FRPP. During hot pilot plant testing, limited amounts of packaged ZrNb-95 oxides could be made available for product characterization, customer evaluation or proof-of-principal demonstration units.

Scandium-46 could be produced at Hanford by irradiating scandium oxide. The raw material is costly (roughly \$2/gm) and may be limited in its availability. Assuming target fabrication and disassembly by the customer, Scandium-46 could be produced by service irradiation at Hanford for approximately \$0.02 per curie, including feed materials, U²³⁵ burncut charges and total allocated reactor operating costs. The use of overbored channels in the reactors would reduce irradiation costs approximately 25 percent at capital costs of \$24,000 and \$240,000 for 1 and 10 megacurie per month production cases, respectively. Recycle of decayed scandium for reirradiation would reduce the net cost about a factor of 2. Approximately .01 percent of the annual capabilities of a small Hanford reactor would be required per megacurie of Sc-46. A scandium irradiation program could be initiated as soon as the appropriate target elements could be made available.

We would appreciate prompt definition of program needs and priorities to assure timely development of the requisite technology and proper integration into the current B-Plant waste extraction and isotope packaging scope design effort.

Manager - Production
Chemical Processing Department

JH Warren:BFJ:jap

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