

Nuclear Weapons Databook

Volume II U.S. Nuclear Warhead Production

by

Thomas B. Cochran, William M. Arkin, Robert S. Norris,
and Milton M. Hoenig

A book by the
Natural Resources Defense Council, Inc.

BALLINGER PUBLISHING COMPANY
Cambridge, Massachusetts
A Subsidiary of Harper & Row, Publishers, Inc.



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International Standard Book Number: 0-88730-124-X (CL)
0-88730-125-8 (PB)

Library of Congress Catalog Card Number: 82-24376

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

(Revised for vol. 2)

Cochran, Thomas B.
Nuclear weapons databook.

"A book by the Natural Resources Defense Council, Inc."

Includes bibliographical references and indexes.

Contents: v. 1. U.S. nuclear forces and capabilities—v. 2. U.S. nuclear warhead production.

1. Nuclear weapons. I. Arkin, William M. II. Natural Resources Defense Council. I. Title.

U264.C6 1984 355.8'25119 82-24376

ISBN 0-88410-172-X (v. 1)

ISBN 0-88410-173-8 (pbk. : v. 1)

ISBN 0-88730-124-X (v. 2)

ISBN 0-88730-125-8 (pbk. : v. 2)

Table D.3
**Amount of Highly Enriched Uranium (>90% U-235) Supplied to
 Civilian Power Reactors Through Fiscal Year 1964**

Reactor	Power (Mw _t)	Startup	Shut Down	Enrichment (%)	Uranium-235 Requirement Through 1964 (kg)	Total U-235 Requirement (kg)	Reprocessor
Shippingport	236	1957	1982	92	680 ^a	1020 ^a	INEL ^{2a}
Indian Point 1	615	1962	1980	93	1100 ^b	1100	West Valley ^c
Elk River	58	1962	1968	93	344 ^h	344 ^h	Italy, but large amount stored at SRP ⁱ
Pathfinder	190	1963	1967	93	50 ^d	100 ^d	INEL ^e
Peach Bottom	115	1966	1974	93	220 ^f	440 ^f	Stored at INEL ^g
TOTAL					2,390	3,000	

- ^a The first core used four seeds containing 345 kg of U-235 and the second core used two seeds each containing 338 kg of U-235; M.T. Simnad, *Fuel Element Experience in Nuclear Power Reactors*, An AEC Monograph, Gordon and Breach Science Publishers, 1971, p. 211, and F. Duncan and J.M. Holl, "Shippingport: The Nation's First Atomic Power Station," History Division Department of Energy, undated, appeared in HASC, NNPP-1993. The second seed of the second core was not fabricated before the end of FY 1964; Duncan, *op. cit.* The seeds from the first core were most likely reprocessed at INEL. It is unclear what happened to the seeds in the second core, although it can be expected that they will (or have been) reprocessed at INEL.
- ^b Only the first core of Indian Point 1 used HEU fuel; M.T. Simnad, *Fuel Element*, pp. 286-289.
- ^c Almost all of the spent HEU fuel was reprocessed at West Valley in 1968; G. Rochlin, et al., "West Valley: Remnant of the AEC," *Bulletin of the Atomic Scientists* (January 1978): table 2.
- ^d Two cores were fabricated for the Pathfinder reactor, although the second core was not fabricated until a few years after FY 1964; JCAE, FY 1965 AEC; JCAE, FY 1967 AEC. Each core contained 50 kg of U-235; M.T. Simnad, *Fuel Element*, pp. 405-6.

- ^e Not all of the HEU fuel from the Pathfinder reactor has been reprocessed. About 50 kg of slightly irradiated fuel is currently stored at INEL: DOE, Spent Fuel, RW-0006, September 1984.
- ^f Two cores were fabricated for the Peach Bottom reactor: H.L. Brey and H.G. Olson, "Fort St. Vrain Experience," *Nuclear Energy* 22, 2 (April 1983): 120. Each core contained about 220 kg of U-235; M.T. Simnad, *Fuel Element*, p. 116. Because the second core was inserted after 1968, it is assumed that only one core was fabricated by the end of FY 64; "Operating History of U.S. Nuclear Power Reactors," Appendix 4, JCAE, FY 1970 AEC, Part 2, p. 1581.
- ^g At the end of 1983 Peach Bottom spent fuel containing about 330 kg of HEU, of which about 220 kg is U-235, is stored at INEL: DOE, Spent Fuel.
- ^h One core was inserted into the Elk River reactor and another was being fabricated in March 1984; JCAE, FY 1985 AEC, p. 781. Each core contained 172 kg of U-235; M.T. Simnad, *Fuel Element*, p. 378.
- ⁱ At the end of 1983 about 190 kg of 83 percent enriched uranium spent fuel from the Elk River reactor were stored at SRP; DOE Spent Fuel. In the 1970s a small amount of Elk River fuel was reprocessed at the ITREC facility in Italy; S. Cao *et al.*, Italian Experience with Pilot Reprocessing Plants, IAEA-CN-36/304, May 1977.

Source: David Albright, private communication.

tributed significantly to the estimate of oralloy production made here.

Rocket Propulsion Reactors

Under Project Rover, a joint NASA-AEC program to develop a nuclear propulsion reactor for space travel, there were seven nuclear rocket reactor experiments conducted between 1960 and 1965. These reactors had power levels ranging between 100 Mw_t and 1070 Mw_t. The combined power of all seven was 4820 Mw_t. Two additional experiments were conducted after 1965 (1400 Mw_t (1967) and 4200 Mw_t (1968)). DOE ultimately recovered 2.819 MT U-235 at the ICPP from fuel used in Project Rover.²⁴

Exports for Foreign Civilian Reactors

Through 1964 the United States exported 1.9 MT of HEU to foreign research reactors, containing 1.6 MT of U-235.²⁵ During this same period only 97 kg of uranium

containing 80 kg U-235 were returned to the United States.²⁶

Consumption in Nuclear Weapons Tests²⁷

The United States conducted 374 nuclear tests through 1964 plus three joint U.S.-UK tests (see Appendix B). These tests correspond to about 1.4 percent of the current nuclear weapons stockpile of about 26,000 warheads. Thus the total HEU expended in tests conducted prior to the end of 1964 was about 10 MT (about 20 kg HEU per warhead).

Weapon Grade Uranium Inventory in 1964

The inventory of weapon grade uranium (93.5% U-235) at the end of FY 1964, when oralloy production ceased, can now be estimated by subtracting the uranium used in other activities from the purchases before FY 1965. According to Table D.7 a stockpile of some 657 MT (93.5 percent U-235) was available for weapons at the

²⁴ ICPP, private communication to David Albright, 1985. See also *Nuclear Fuel*, (27 August 1984): 13. Earlier it was reported that there were 2800 kg of unprocessed Rover fuel; SASC FY 1979 DOE, p. 66.

Jonald R. Hodel, Secretary of Energy, *Yearly Export Totals and Summary of Totals: Exports of Low Enriched Uranium, High Enriched Uranium, Uranium-233, Plutonium, and Heavy Water, January 1, 1954, Through February 28, 1983*, Enclosures 1 and 2 in a letter to Representative Richard Ottinger, 10 May 1983.

²⁶ DOE, "NMM&S Report U.S. Origin Imports," (computer printout) enclosure in letter from Robert A. O'Brien, Jr. to Thomas B. Cochran, 13 December 1984.

²⁷ Perhaps a dozen nuclear weapons were lost in accidents. See "U.S. Nuclear Weapons Accidents: Danger in Our Midst," *The Defense Monitor*, Volume X, Number 6, 1981.