6 ~~5~~

Iodine-131 in Irradiated Fuel at Time of Processing From December 1944 Through December 1947

**C. M. Heeb
L. G. Morgan**

March 1991

Prepared for the Technical Steering Panel

DISCLAIMER

This report was prepared under the direction of the HANFORD ENVIRONMENTAL DOSE RECONSTRUCTION PROJECT Technical Steering Panel by Battelle Memorial Institute's Pacific Northwest Laboratories operating the Pacific Northwest Laboratory for the U.S. Department of Energy (DOE). While funding for the work was provided by DOE, the work is *not* under DOE direction or control. The views and opinions of the authors expressed in this document do not necessarily reflect those of the United States Government or any agency thereof. 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 U.S. Government or any agency thereof, nor by Battelle Memorial Institute.

Printed in the United States of America

Available to DOE and DOE contractors from the
Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831;
prices available from (615) 576-8401. FTS 626-8401.

Available to the public from the National Technical Information Service,
U.S. Department of Commerce, 5285 Port Royal Rd., Springfield, VA 22161.

IODINE-131 IN IRRADIATED FUEL AT TIME
OF PROCESSING FROM DECEMBER 1944
THROUGH DECEMBER 1947

Hanford Environmental Dose
Reconstruction Project

C. M. Heeb
L. G. Morgan

March 1991

Prepared for
the Technical Steering Panel

Pacific Northwest Laboratory
Richland, Washington 99352

**IODINE-131 IN IRRADIATED FUEL AT TIME OF
PROCESSING FROM DECEMBER 1944 THROUGH
DECEMBER 1947**

March 1991

This document has been reviewed
and approved by the Technical Steering Panel.

A handwritten signature in black ink, appearing to read "John E. Till", is written over a horizontal line.

John E. Till, Chairman
Technical Steering Panel
Hanford Environmental
Dose Reconstruction Project

March 9, 1991
Date

FOREWORD

The appendix to this document is a record of TSP comments and Battelle's responses to those comments; the TSP has reviewed and approved Battelle's responses. Comment numbers appear in the left margin next to the paragraphs in which the corresponding comments were addressed. The text and table contained in this document were rewritten since the previous draft; the revisions reflect responses to TSP comments, as well as changes to correct errors or for further clarification.

QUANTITIES OF IODINE-131 RELEASED TO THE ATMOSPHERE
FROM HANFORD SITE OPERATIONS IN 1944-1947

1 The purpose of this document is to provide a record of the iodine-131 releases that were used as source terms in calculating the Phase I air pathway doses.

2. 1 The following table provides estimates of monthly iodine-131 releases to the atmosphere from the irradiated fuel processing plants for the time period December 1944 (the first month of dissolution of irradiated fuel from the Hanford Site) through December 1947. The estimated values of iodine-131 contained in the irradiated fuel at the time of processing were calculated using the best available information. Details of the calculations, including the assumptions required to obtain the values and the inherent uncertainties in the values, will be addressed in a Phase II HEDR report. The quantity of iodine-131 released to the atmosphere is obtained by multiplying the calculated iodine-131 content of the fuel being dissolved by a release fraction. The actual release fraction value is uncertain. The release fractions assumed for iodine-131 were based on values that are expected to bound the actual release of iodine-131.

1 The Phase I dose estimates from iodine-131 were based on a most probable release factor of 75% with an upward uncertainty bound of 85% and a lower uncertainty bound of 50%. The values shown in the table were input to the Phase I Modular Dose Calculation Model, which provided the air pathway doses.

EARLY HANFORD IODINE-131 RELEASES AT 3 ASSUMED RELEASE FACTORS

7			<u>Curies at 3 Release Factors</u>			<u>Percentage of</u>	
	<u>Year</u>	<u>Month</u>	<u>50%</u> <u>Release</u>	<u>75%</u> <u>Release</u>	<u>85%</u> <u>Release</u>	<u>Total Release</u> <u>Annual</u>	<u>Cumulative</u>
5	1944	December	1.1 +03	1.6 +03	1.8 +03	0.4	0.4
	1945	January	6.8 +02	1.0 +03	1.1 +03	0.2	0.6
	1945	February	8.4 +02	1.3 +03	1.4 +03	0.3	0.9
	1945	March	1.1 +03	1.7 +03	1.9 +03	0.4	1.4
	1945	April	1.4 +04	2.0 +04	2.3 +04	5.0	6.4
	1945	May	3.8 +04	5.7 +04	6.5 +04	14.1	20.5
	1945	June	2.0 +04	3.0 +04	3.4 +04	7.3	27.8
	1945	July	1.7 +04	2.6 +04	2.9 +04	6.4	34.2
	1945	August	2.4 +04	3.6 +04	4.1 +04	8.9	43.1
	1945	September	2.9 +04	4.4 +04	5.0 +04	10.9	54.0
	1945	October	3.1 +04	4.7 +04	5.3 +04	11.6	65.5
	1945	November	1.3 +04	2.0 +04	2.2 +04	4.8	70.4
	1945	December	2.2 +04	3.3 +04	3.7 +04	8.1	78.5
	1946	January	6.3 +03	9.5 +03	1.1 +04	2.3	80.9
	1946	February	2.7 +03	4.1 +03	4.7 +03	1.0	81.9
	1946	March	2.5 +03	3.8 +03	4.3 +03	0.9	82.8
	1946	April	5.4 +03	8.1 +03	9.2 +03	2.0	84.8
	1946	May	5.2 +03	7.8 +03	8.8 +03	1.9	86.7
	1946	June	2.4 +03	3.7 +03	4.2 +03	0.9	87.6
	1946	July	2.6 +03	3.9 +03	4.5 +03	1.0	88.6
	1946	August	4.6 +03	6.9 +03	7.8 +03	1.7	90.3
	1946	September	3.6 +03	5.3 +03	6.1 +03	1.3	91.6
	1946	October	2.6 +03	3.9 +03	4.4 +03	1.0	92.6
	1946	November	2.8 +03	4.2 +03	4.7 +03	1.0	93.6
	1946	December	3.1 +03	4.6 +03	5.3 +03	1.1	94.8
	1947	January	3.5 +03	5.2 +03	5.9 +03	1.3	96.0
	1947	February	1.6 +03	2.3 +03	2.7 +03	0.6	96.6
	1947	March	2.0 +03	3.0 +03	3.4 +03	0.7	97.4
	1947	April	2.0 +03	3.0 +03	3.4 +03	0.7	98.1
	1947	May	1.9 +03	2.9 +03	3.3 +03	0.7	98.8
	1947	June	7.2 +02	1.1 +03	1.2 +03	0.3	99.1
	1947	July	8.9 +02	1.3 +03	1.5 +03	0.3	99.4
	1947	August	5.5 +02	8.3 +02	9.4 +02	0.2	99.6
	1947	September	4.9 +02	7.3 +02	8.3 +02	0.2	99.8
	1947	October	2.1 +02	3.1 +02	3.5 +02	0.1	99.9
	1947	November	1.7 +02	2.5 +02	2.9 +02	0.1	99.9
	1947	December	1.8 +02	2.7 +02	3.1 +02	0.1	100.0
			2.7 +05	4.1 +05	4.6 +05	100	

APPENDIX

SUMMARY OF TSP COMMENTS AND BATTELLE RESPONSES

SUMMARY OF TSP COMMENTS AND BATTELLE RESPONSES

Document Number PNL-7253 HDRDocument Title I-131 in Irradiated Fuel at Time of Processing from
December 1944 through December 1947

Comment Number	Commenter	Page, Paragraph	Comment Summary	Resolution
1.	Genevieve S. Roessler		Reference the "separate documentation." Also, some comment should be made as to how this fits into the total scheme of the project.	First and last new paragraphs address how this fits into the Phase I framework. The second paragraph references a Phase II report in place of "subsequent HDR reports." It is currently planned to provide a basis for the Phase I iodine-131 numbers as part of Task 0302 - Iodine Closure.
2.	GSR	Page 1, line 3	"actual irradiated fuel ..."--actual implies that something occurred that was not actual.	"Actual" was removed.
3.	GSR	Page 2	Put totals at the bottom of each of the three release columns.	Totals are now provided.
4.	John E. Till		A fourth column should be added to indicate uncertainties in the source term estimates.	NA - The three columns at 50%, 75%, and 85% release are intended to reflect an uncertainty range. The last paragraph addresses this.
5.	JET		Can we justify the number of significant digits in the table? We should decide our level of accuracy and reflect such in the number of significant digits.	Revised table to two significant figures in scientific notation. Note: XX + 3 implies two significant figures, whereas X,X00 would imply four significant figures even though it would be easier to read.
NA - no	action.			

SUMMARY OF TSP COMMENTS AND BATTELLE RESPONSES

Document Number PNL-7253 HEDRDocument Title I-131 in Irradiated Fuel at Time of Processing from
December 1944 through December 1947

Comment Number	Commenter	Page, Paragraph	Comment Summary	Resolution
6.	Bernard Shleien		Incorporate the distribution of power levels recommended by Dr. Robkin, and include comparative data between Anderson's results and 5-plus months of original notebook information.	NA - The method recommended by Dr. Robkin will be included in Task 0302 - Iodine Closure.
7.	K. J. Kopecky		■ recommend that two (and perhaps four) columns be added to the table to give percentage releases for each month and cumulative percentages.	The last two columns were added as requested. There is no basis for the "best available information about ¹³¹ I releases" at hand for calculating two more columns.
8.	Robkin		The iodine release should be based on the average iodine inventory in the discharged fuel, which is larger than that based on the core average power.	NA - Will address this issue in Phase II Task 0302 - Iodine Closure.
9.	Robkin		What year did air sparging begin? If 1944-1947 is before air sparging, applying the assumed range of iodine releases of 50% to 85% with a mean value of 75% to this Phase ■ period is conservative.	NA - Air sparging began in 1951.
NA - no	action.			

DISTRIBUTION

No. of
Copies

No. of
Copies

OFFSITE

18 Technical Steering Panel

D. S. Barth
University of Nevada
4505 Maryland Parkway
Las Vegas, NV 89154

W. A. Bishop
2503 Wedgewood Court SE
Olympia, WA 98501

M. L. Blazek
Oregon Department of Energy
625 Marion Street N.E.
Salem, OR 97310

G. G. Caldwell
Director
Tulsa City-County Health Dept
4616 East 15th Street
Tulsa, OK 74112

S. N. Davis
Dept. of Hydrology & Water
Resources
Bldg. 11
University of Arizona
Tucson, AZ 85721

N. J. Germond
224 Iron Mountain Blvd.
Lake Oswego, OR 97034

P. C. Klingeman
Civil Engineering Dept.
Oregon State University
Corvallis, OR 97331-2302

K. J. Kopecky
Fred Hutchinson Cancer
Research Center
1124 Columbia Street
Seattle, WA 98104

R. L. Morrill
Dept. of Geography
DP-10
University of Washington
Seattle, WA 98195

A. H. Murphy
c/o Climate Analyses Center
National Weather Service, NOAA
W/NMC51, WAB Room 604
Washington, DC 20233

V. Nguyen
EWA Inc.
133 1st Ave. N.
Minneapolis, MN 55401

D. W. Price
Agricultural Economics
Hulbert Hall Room 211
Washington State University
Pullman, WA 99164-6210

M. A. Robkin
Radiological Sciences SB-75
University of Washington
Seattle, WA 98195

G. S. Roessler
Rt. 1, Box 139H
Elysian, MN 56028

No. of
Copies

B. Shleien
2421 Homestead Drive
Silver Springs, MD 20902

A. P. Slickpoo, Sr.
P. O. Box 331
809 Nez Perce Lane
Kamiah, ID 83536

J. E. Till
Rt. 2 Box 122
Neeses, SC 29107

D. E. Walker, Jr.
P.O. Box 4147
Boulder, CO 80306

2 DOE Office of Scientific and
Technical Information
Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

10 J. S. Stohr
Office of Nuclear Waste Mgmt.
Department of Ecology
99 South Sound Center
Mail Stop PV-11
Olympia, WA 98504

No. of
Copies

ONSITE

DOE Richland Operations

R. F. Brich, SED A5-55

24 Pacific Northwest Laboratory

W. A. Glass K1-40
S. P. Gydesen P8-55
C. M. Heeb (5) K6-42
A. H. McMakin K6-86
L. G. Morgan K2-35
W. L. Templeton K1-30
Project Office Files (5) K6-89
Public Reading Room (5) A1-65
Publishing Coordination K1-11
Records Center K3-70
Technical Library (2) P8-55