23

Sta #10

OCT - 6 1994

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 150175

2. To: (Receiving Organization) Engineering Development & Disposal Systems	3. From: (Originating Organization) Facility & Equipment Engineering	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: TWRS	6. Cog. Engr.: R. C. Brown	7. Purchase Order No.: N/A
8. Originator Remarks: Please review and approve the supporting document entitled, "Compilation of Summary Statistics for Radiation Worker Exposure for the 200 Areas: 1978-1993," WHC-SD-WM-TI-635, Rev. 0.		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: N/A
		12. Major Assm. Dwg. No.: N/A
11. Receiver Remarks:		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 6/15/94

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Impact Level	Reason for Trans- mittal	Origi- nator Dispo- sition	Receiv- er Dispo- sition
1.	WHC-SD-WM-TI-635		0	Compilation of Summary Statistics for Rad Worker	N/A	1	4	4

16. KEY					
Impact Level (F)		Reason for Transmittal (G)			Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)		1. Approval	4. Review	1. Approved	4. Reviewed no/comment
		2. Release	5. Post-Review	2. Approved w/comment	5. Reviewed w/comment
		3. Information	6. Dist. (Receipt Acknow. Required)	3. Disapproved w/comment	6. Receipt acknowledged

(G)	(H)	17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)								(G)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog.Eng. R. C. Brown	<i>R. C. Brown</i>	8/19/94	613/44	RLB					
1	1	Cog. Mgr. J. G. Propson	<i>J. G. Propson</i>	9/7/94							
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		Safety									
		Env.									
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18. Signature of EDT Originator <i>R. C. Brown</i> 8/19/94	19. Authorized Representative for Receiving Organization <i>J. G. Propson</i> 9/7/94	20. Cognizant/Project Engineer's Manager <i>John Propson</i> 9/7/94	21. DOE APPROVAL (if required) Ltr. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
--	--	---	--

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RELEASE AUTHORIZATION

Document Number: WHC-SD-WM-TI-635, Rev. 0

Document Title: Compilation of Summary Statistics for Radiation
Worker Exposure for the 200 Areas: 1978-1993

Release Date: 10/5/94

* * * * *

This document was reviewed following the
procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

* * * * *

WHC Information Release Administration Specialist:

CHRISTINE WILLINGHAM

(Signature)

10/5/94

(Date)

SUPPORTING DOCUMENT		1. Total Pages 28 85
2. Title Compilation of Summary Statistics for Radiation Worker Exposures for the 200 Areas: 1978 Through 1993		3. Number WHC-SD-WM-TI-635
		4. Rev No. 0
5. Key Words Average exposure, radiation worker, 200 Areas		6. Author Name: R. C. Brown <i>R. C. Brown</i> Signature Organization/Charge Code 7E850/E08372
7. Abstract This document provides estimates of average annual radiation worker exposures for the 200 Areas of the Hanford Site for various facilities. The period of exposures extends from calendar year 1978 through 1993. These estimates were extracted from annual dosimetry reports.		
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9. Impact Level N/A		

**APPROVED FOR
PUBLIC RELEASE**

WJ
10-5-94

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**COMPILATION OF SUMMARY STATISTICS FOR
RADIATION WORKER EXPOSURES FOR
THE 200 AREAS: 1978 THROUGH 1993**

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide estimates of average annual radiation worker exposures for various facilities at the Hanford Site for use in design of facilities and planning operational activities.* The period of the exposures extends from calendar year 1978 through 1993. These estimates, extracted from annual dosimetry reports, are useful for comparison of design options for new radioactive waste processing facilities. Tentative design features and resulting estimates of personnel exposures to radiation can be compared with historical exposures from previous Hanford Site facility operations. This comparison allows design personnel to rate design options based on anticipated exposures of personnel to radiation.

1.2 SCOPE

The estimates of radiation worker exposure provided in this document are to 200 Area activities and to 100 Area activities from 1987 through 1993. Estimates are provided for the following classes of personnel:

- Average exposure for all 200 Area radiation workers from 1978 through 1993
- Average radiation worker exposure at four specific 200 Area facilities from 1982 through 1993:
 - Plutonium-Uranium Extraction (PUREX)
 - Plutonium Finishing Plant (PFP)
 - Tank Farms
 - B Plant and Waste Encapsulation and Storage (WESF)
- Average radiation worker exposure at the 100 Area from 1987 through 1993.

These estimates contain the average annual radiation worker exposure, the number of personnel on which the average is based, and the cumulative personnel exposure. Corrections to provide more realistic estimates of the

*NOTE: These compiled statistics do not represent a total comprehensive statement for Hanford Site occupational radiation exposure. Refer to official annual U.S. Department of Energy reports for comprehensive occupational radiation exposure statistics.

number of full-time radiation workers and the resulting increase in the average radiation worker exposure as compared with results reported in dosimetry reports are suggested and discussed.

Appendix A includes, in tabular form, the data abstracted from the appropriate dosimetry reports from which the various estimates are calculated. Appendix B includes an independent estimate of facility dosimetry totals for 3 years. Appendix C provides a comparison of the independent estimate in Appendix B with the corresponding values from Appendix A. Resolution of the discrepancies as reported in Appendix C will be provided.

1.3 BACKGROUND

Formal, retrievable dosimetry reports have been issued annually since 1982 (Decker 1983, 1984, and 1985; Decker and Wirth 1986 and 1987; Wirth 1988; Decker and Newcomb 1988; Decker et al. 1990; WHC 1990, 1991, 1992, and 1993) and perhaps earlier. Average radiation worker exposures, the number of personnel, and the cumulative exposure have been reported for as early as calendar year 1978. These reports contain a great deal of information, but not in identical formats from year to year. Thus, there are some difficulties in obtaining identical groupings of radiation workers from one year to the next.

Radiation worker exposure summaries are broken down into subcategories by organizations. Some reports will collect the appropriate subcategories together to report facility totals; others will only report subcategories listed as organization codes, which are based on the management control system. Unless one is familiar with the organization codes that are affiliated with particular facilities and change from year to year, it is difficult to estimate totals from specific facilities.

The data contained in this report attempt to provide reasonable estimates of facility-specific annual radiation worker exposures. Certain segments of facility personnel may not be accounted for, but the average for those groups that are counted should be representative of radiation workers at that particular facility.

There appears to be a need to take a retrospective look at performance with regard to radiation worker exposures in the design of new facilities to process radioactive wastes. This document will provide a ready reference of average radiation worker exposures for some facilities that have operated in the 200 Area of the Hanford Site plus some 100 Area activities since 1987.

2.0 METHOD

2.1 DATA SOURCES FOR PERSONNEL EXPOSURE

Exposure summaries from Rockwell Hanford Operations were used from 1982 to 1986 (Decker 1983, 1984, and 1985; Decker and Wirth 1986 and 1987). After consolidation of contractors in 1987, dose summaries and health and safety

performance reports were used (Wirth 1988; Decker and Newcomb 1988; Decker et al. 1990; WHC 1990, 1991, 1992, and 1993). To the degree feasible, data for all radiation workers and for radiation workers from PUREX, PFP, Tank Farms, B Plant/WESF, and 100 Area (since 1987) were extracted from the above reports. Data of interest included number of personnel, cumulative exposure, and the average exposure, which can be calculated from the first two quantities.

2.2 ASSUMPTIONS

Four assumptions are invoked to provide better and/or complete estimates of radiation worker exposures. These assumptions are stated and discussed in Sections 2.2.1 through 2.2.4.

2.2.1 Definition of Radiation Worker

For purposes of this discussion, radiation workers are defined as those personnel with monthly exchange frequencies for their thermoluminescent dosimeters (TLD). Personnel with quarterly and annual TLD badge change frequencies are not considered to be radiation workers.

2.2.2 Estimation of Full-Time Radiation Workers

The manner in which the number of personnel classified as radiation workers is reported in the referenced documents overestimates the number of full-time equivalent personnel engaged in these activities. The referenced reports contain the total number of personnel for whom a monthly exchange frequency TLD badge was issued during the calendar year in question irrespective of the length of time that the TLD was issued to that person. This number does not take into consideration those personnel who only worked a portion of a year with a monthly TLD exchange frequency.

Dosimetry personnel estimate that from 10% to 20% of the total number of personnel reported as radiation workers were in the category of working for something less than a full year. To provide a better estimate of the number of radiation workers, the following assumption is invoked:

Assumption: 15% of the total number of personnel reported as radiation workers were radiation workers for less than a full calendar year. On average, these personnel were radiation workers for 6 months out of the year; therefore, the number of full-time radiation workers would be reduced by one-half of the 15% (7.5%) or 92.5% of the number stated. The average radiation worker exposure would be increased by a factor equal to the reciprocal of 0.925, 1.081. The total cumulative personnel exposure in units of person-rem would remain unchanged.

2.2.3 Correction for N Reactor Radiation Workers

Before 1987, the Rockwell Hanford Operations exposure summaries did not contain contributions from personnel involved with N Reactor operations.

These exposure summaries were reported by the operating contractor, UNC Nuclear Industries. Beginning with the 1988 report by T. M. Wirth, 100 N Reactor operations personnel were included in the Westinghouse Hanford Company reports. These additions have to be removed to compare 200 Area activities from before and after consolidation.

During the 1987 and 1988 shutdown activities at N Reactor, high personnel exposures were received during shutdown operations. To remove this artifact from the post-1987 separations area average exposures, the contributions from N Reactor-related activities were subtracted from the number of personnel and the cumulative personnel exposure for the data from 1987 through 1993.

Because the 100 Area personnel dosimetry statistics have to be extracted from the total statistics to estimate the 200 Area values, the 100 Area results will be reported as well.

2.2.4 Estimation of Facility Staffing Numbers

Inconsistencies in reporting formats for safety and health performance reports resulted in incomplete or missing numbers of personnel for specific facilities. Because there were usually values reported for the same facility in the year preceding and the year following the time period with a missing value, averages of the before and after values were used. Whenever this situation occurred, a note is inserted in the data tabulation to indicate the discrepancy. Again, the uncertainty of this effect on average annual radiation worker exposure estimates is judged to be acceptable. Internal dosimetry reports also were used to estimate the number of personnel at the facilities of interest.

2.3 Data Verification

The volume of data that has to be transcribed from the appropriate dosimetry reports is high, and the opportunity to introduce errors into these data is high. To provide a means for data verification, the following protocol was adopted:

An independent estimator will abstract and record data from three calendar years: 1982, 1984, and 1988. These data will be for the four 200 Area facilities in question: PUREX, PFP, Tank Farms, and B Plant. In addition, the 100 Area totals will be recorded for the 1988 report. This recording will be accomplished independently from that provided by the author of this document; i.e., the independent estimator will not have seen the tabulations provided by the author until the estimator's efforts are completed. Then a facility-by-facility comparison will be provided to examine any differences between the two comparable listings.

The independent estimator is Douglas V. Vo, an engineer from the Waste Transfer Projects group. His tabulations are included in Appendix B. Appendix C contains the facility-by-facility comparison of the results from Appendixes A and B. The resolution of any significant discrepancies is addressed in Appendix C.

3.0 RESULTS

Table 1 provides a summary of radiation worker exposure statistics for 1978 through 1993. These data are extracted from the pertinent reports with no corrections for full-time equivalent employees or 100 N Reactor personnel after 1987.

Table 1. Summary Radiation Worker Dose Equivalent Statistics Reported for Hanford Site Personnel, 1978 Through 1993.

Year	Number of personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1978	787	364	463
1979	888	438	493
1980	822	365	444
1981	893	294	330
1982	920	355	386
1983	1,145	346	302
1984	1,253	441	352
1985	1,262	452	358
1986	1,265	415	328
1987 ^a	2,255	1,194	530
1988 ^a	1,788	383	214
1989 ^a	1,731	357	207
1990 ^a	1,524	149	98
1991 ^a	1,424 ^b	123	86
1992 ^a	1,190 ^b	99	83
1993 ^a	1,176	77	65

^aIncludes N Reactor personnel from 1987 through 1993.

^bEstimated from totals on the whole body distribution data for monthly exchange frequency dosimeters for these years.

The estimated effects of N Reactor are provided in Table 2. This information will be used as described in Section 2.2.3 to provide a basis for reporting 200 Area radiation worker estimated exposures during these years.

The number of personnel in a given year does not take into consideration those personnel who only worked a portion of the year with a monthly exchange frequency TLD. As indicated in Section 2.2.2, a correction factor of 0.925 was applied to the number of workers and a factor of 1.081 was applied to the average annual radiation exposure provided in Table 1. In addition, the cumulative exposure and the number of radiation workers from N Reactor for 1987 through 1993 have been subtracted from the equivalent values in Table 1. These data are provided in Table 3.

Further breakdowns of facility-specific personnel average dose equivalents are available from the cited exposure reports for 1982 through 1993. Because of differences in formats of the various annual reports, some construction of facility-specific values is required. The values reported should be considered as estimates of the average exposure received by personnel in the specified facilities. The facilities for which these averages are reported are PUREX, PFP, Tank Farms, B Plant, and the 100 Area (after 1987). These data are provided in Tables 4 through 8. Table 4 also notes the operating history at PUREX.

Average radiation worker annual exposures from Tables 3 through 8 are plotted in Figures 1 through 6. Figure 1 is a plot of the annual average exposure (estimated) for 200 Area workers. Figure 2 is a plot of the estimated average 200 Area and PUREX radiation worker annual dose equivalent. Superimposed on Figure 2 is a histogram showing the operating periods at PUREX. Figures 3 through 6 are plots of the 200 Area radiation worker exposure (estimated) from PUREX, PFP, Tank Farms, B Plant/WESF, and the 100 Area (after 1987).

Table 2. Estimated 100 Area Contributions (Including N Reactor) for 1987 Through 1993.

Year	Estimated number of N Reactor personnel	Estimated cumulative exposure (person-rem)	Estimated annual average exposure at N Reactor (mrem)
1987	887	857	966
1988	776	193	249
1989	469	229	489
1990	328	62	189
1991	221	17	77
1992	211	20	95
1993	231	14	61

Table 3. Corrected Summary Radiation Worker Dose Equivalent Estimated Statistics for Hanford Site Separations Area Personnel, 1978 Through 1993.

Year	Corrected number of FTE personnel	Cumulative exposure (person-rem)	Corrected average exposure (mrem)
1978	728	364	501
1979	821	438	533
1980	761	365	480
1981	826	294	357
1982	851	355	417
1983	1,059	346	326
1984	1,159	441	381
1985	1,167	452	387
1986	1,170	415	355
1987	1,265	337	266
1988	936	190	203
1989	1,167	128	110
1990	1,106	87	79
1991	1,113	106	95
1992	906	79	87
1993	874	63	72

*Corrected for number of full-time radiation workers and for the effects of N Reactor personnel from 1987 through 1993 (see Table 2).

FTE = Full-time equivalent

Table 4. Estimated Annual Dose Equivalent for
Radiation Workers at the Plutonium-Uranium
Extraction Plant, 1982 Through 1993.

Year	Number of FTE personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1982 ^a	217	44	203
1983 ^a	310	39	126
1984 ^a	341	55	161
1985 ^a	316	84	266
1986 ^a	299	67	224
1987 ^{a,b}	312	47	151
1988 ^a	394	27	69
1989	370	7	19
1990	204	7	34
1991	296	3	10
1992	253	2	8
1993	139	0.5	4

^aContains estimate for number and cumulative exposure of radiation protection monitoring personnel assigned to the Plutonium-Uranium Extraction (PUREX) Plant.

^bContains an estimate of the number and cumulative exposure of analytical laboratory personnel assigned to PUREX.

NOTE: PUREX was in operation from September 30, 1983, through December 7, 1988, when a shutdown occurred. For final cleanout of PUREX, the head end was operated from December 17, 1989, through January 6, 1990, and the solvent extraction process was operated from January 10 through March 12, 1990.

FTE = Full-time equivalent

Table 5. Estimated Annual Dose Equivalent
for Radiation Workers at the Plutonium
Finishing Plant, 1982 Through 1993.

Year	Number of FTE personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1982 ^a	187	102	545
1983 ^a	254	125	492
1984 ^a	286	198	692
1985 ^a	255	220	863
1986 ^a	281	259	922
1987 ^{a,b}	294	142	483
1988 ^a	345	144	417
1989	426	95	223
1990	586	62	106
1991	467	52	111
1992	431	52	121
1993	459	36	78

^aEstimates for number and cumulative exposure
of radiation protection monitoring personnel
assigned to the Plutonium Finishing Plant.

^bContains an estimate of the number and
cumulative exposure of analytical laboratory
personnel assigned to the Plutonium Finishing
Plant.

FTE = Full-time equivalent

Table 6. Estimated Annual Dose Equivalent for
Radiation Workers in Tank Farms,
1982 Through 1993.

Year	Number of FTE personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1982*	178	98	551
1983*	194	81	418
1984*	204	75	368
1985*	216	56	259
1986*	205	30	146
1987*	216	42	194
1988*	216	17	79
1989	185	10	54
1990	195	14	72
1991	407	15	37
1992	377	10	27
1993	305	10	33

*Contains an estimate of the number and
cumulative exposure of radiation protection
monitoring personnel assigned to Tank Farms.

FTE = Full-time equivalent

Table 7. Estimated Annual Dose Equivalent in
B Plant and Waste Encapsulation and
Storage Facility.

Year	Number of FTE personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1982*	135	65	481
1983*	156	53	340
1984*	142	42	296
1985*	124	24	194
1986*	108	17	157
1987*	120	22	183
1988*	138	7	51
1989	132	5	38
1990	137	5	37
1991	186	3	16
1992	144	1	7
1993	126	5	40

*Contains an estimate of the number and
cumulative exposure of radiation protection
monitoring personnel assigned to B Plant.

FTE = Full-time equivalent

Table 8. Estimated Annual Dose Equivalent in the 100 Area (Including N Reactor).

Year	Number of FTE personnel	Cumulative exposure (person-rem)	Average exposure (mrem)
1987*	820	857	1,045
1988*	718	193	269
1989	434	229	528
1990	303	62	205
1991	204	17	83
1992	195	20	95
1993	214	14	65

*Contains an estimate of the number and cumulative exposure of radiation protection monitoring personnel assigned to 100 Area facilities.

FTE = Full-time equivalent

4.0 DISCUSSION OF RESULTS

Figures 1 through 6 indicate the performance of estimated average radiation worker exposures in the 200 Area and at the 100 Area since 1987. The overall trend is downward, although upward trends occur. There may be correlations with operations conducted in the respective facilities that would explain year-to-year variations in facility-specific radiation worker average exposures.

For all workers, the estimated average annual exposure has decreased from some 500 mrem in 1978 to 70 in 1993, a factor of seven reduction. There has also been a sixfold reduction in cumulative exposure to this population from 364 person-rem in 1978 to 63 person-rem in 1993.

The verification of data, Appendixes B and C, indicates the difficulties that arise in abstracting pertinent data from the dosimetry reports. This is especially true for personnel such as the author and the independent verifier who do not work with these data on a continuing basis.

While there may be discrepancies between numbers of personnel and their cumulative exposures, the average annual exposures appear to be more robust. The average is the result of a division of the cumulative exposure by the number of personnel. The usual discrepancy is to over- or underestimate both of these parameters (numerator and denominator). The resulting average, however, is usually near the "true" average value.

Figure 1. Average Annual Radiation Worker Exposure (Estimated) for Hanford Site Workers (200 Area Exclusive of 100 N Reactor Personnel).

Figure 2. Comparison of Average Annual Radiation Worker Exposures (Estimated) for all Hanford Site Workers (200 Area) with Plutonium-Uranium Extraction Plant Workers and Periods of Operation Shown.

Comparison of PUREX with 200 Area

Figure 3. Comparison of Average Radiation Worker Exposures (Estimated) for all Hanford Site Workers (200 Area) with Plutonium Finishing Plant Workers.

Comparison of PFP with 200 Area

(Annual average rad worker exposure)

Figure 4. Comparison of Average Radiation Worker Exposures (Estimated) for all Hanford Site Workers (200 Area) with Tank Farm Workers.

Figure 5. Comparison of Average Radiation Worker Exposures (Estimated) for all Hanford Site Workers (200 Area) with B Plant Workers.

Figure 6. Comparison of Average Radiation Worker Exposures (Estimated) for all Hanford Site Workers (200 Area) with 100 Area Workers after 1987.

Some credit for observed reduction in annual average radiation worker exposure belongs with the as low as reasonably achievable activities of the various facilities onsite. Improvements in operations to reduce personnel exposure also have been effective.

5.0 RECOMMENDATION

The information contained in this document needs to be updated on an annual basis. By adding the most recent annual dosimetry data this report will remain current. An added benefit is that the personnel responsible for compiling dosimetry data will be familiar with the reported results. This familiarity, including access to the past calendar year dosimetry database, is invaluable in obtaining accurate facility-specific data.

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7.0 GLOSSARY

ABBREVIATIONS AND ACRONYMS

FTE	full-time equivalent
PFP	Plutonium Finishing Plant
PUREX	Plutonium-Uranium Extraction
TLD	thermoluminescent dosimeter
WESF	Waste Encapsulation and Storage

APPENDIX A

TABULATIONS EXTRACTED FROM DOSIMETRY REPORTS

APPENDIX A

TABULATIONS EXTRACTED FROM DOSIMETRY REPORTS

Tables A-1 through A-12 contain the item-by-item listing from the dosimetry reports for each facility of interest for 1982 through 1993. The intent of listing these data is twofold.

1. Anyone checking dosimetry results for a particular facility will be able to ascertain exactly which data were used.
2. The independent verification (Appendix B) can be compared with these listings.

Listings under Group Designators are those listed in the cited reference. No attempt has been made to define acronyms.

Footnotes are provided at the end of each table to indicate the source of data, any assumptions invoked, and other pertinent information.

Table A-1. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1982.¹ (sheet 1 of 2)

Group designator	Number of personnel	Cumulative exposure (person- mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Analytical Laboratory	24	2,390	100	12530
Operations	125	16,590	133	46700
Plant Maintenance	46	5,810	126	48540
Radiation Monitoring ²	40	19,440	486	72340
Totals for PUREX	235	44,230	188	--
Plutonium Finishing Plant (PFP)				
Z Plant Analytical Laboratory	14	5,100	364	12520
Plutonium Operations	84	50,820	605	46600
Z Plant Maintenance	42	13,700	326	48510
Nuclear Materials Control	12	7,750	646	58500
Radiation Monitoring ³	50	24,300	486	72340
Totals for PFP	202	101,670	503	--
Tank Farms				
Surveillance & Operations	154	80,190	521	46300
Maintenance	18	8,050	447	48560
Radiation Monitoring ⁴	20	9,720	486	72340
Totals for Tank Farms	192	97,960	510	--

Table A-1. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1982.¹ (sheet 2 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Fission Products Operations	100	47,190	472	46200
Waste Production & Encapsulation Maintenance	36	12,760	354	48550
Radiation Monitoring ⁵	10	4,860	486	72340
Totals for B Plant	146	64,810	444	--
Totals for above facilities	775	308,670	398	--

¹W. A. Decker, 1983, *1982 Rockwell Exposure Summary*, RHO-HS-SR-82-14, Rockwell Hanford Operations, Richland, Washington.

²The number of Radiation Monitoring personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiation Monitoring personnel exposure of 486 mrem.

³The number of Radiation Monitoring personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Radiation Monitoring personnel exposure of 486 mrem.

⁴The number of Radiation Monitoring personnel at Tank Farms is estimated to be 20; the cumulative exposure is therefore 20 times the average Radiation Monitoring personnel exposure of 486 mrem.

⁵The number of Radiation Monitoring personnel at B Plant is estimated to be 10; the cumulative exposure is therefore 10 times the average Radiation Monitoring personnel exposure of 486 mrem.

Table A-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1983.¹ (sheet 1 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Quality Engineering and Control	5	1,040	208	12360
Analytical Laboratory	73	4,150	57	12530
Operations	150	9,440	63	46700
Maintenance	67	4,170	62	48540
Radiation Monitoring ²	40	19,880	497	72340
Totals for PUREX	335	38,680	115	--
Plutonium Finishing Plant (PFP)				
Z Plant Analytical Laboratory	45	5,170	115	12520
Plutonium Operations Production Control	7	3,240	463	44600
Plutonium Operations	104	71,760	690	46600
Z Plant Maintenance	59	12,370	210	48510
Nuclear Materials Control	10	7,500	750	58500
Radiation Monitoring ³	50	24,850	497	72340
Totals for PFP	275	124,890	454	--
Tank Farms				
Surveillance and Operations	150	55,110	367	46300
Maintenance	24	7,850	327	48560
Radiation Monitoring ⁴	36	17,890	497	72340
Totals for Tank Farms	210	80,850	385	--

Table A-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1983.¹ (sheet 2 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Fission Products Operations	103	34,880	339	46200
Maintenance	46	8,010	174	48550
Radiation Monitoring ⁵	20	9,940	497	72340
Totals for B Plant	169	52,830	313	--
Totals for above facilities	989	297,250	301	--

¹W. A. Decker, 1984, *1983 Rockwell Exposure Summary*, RHO-HS-SR-83-14, Rockwell Hanford Operations, Richland, Washington.

²The number of Radiation Monitoring personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiation Monitoring personnel exposure of 497 mrem.

³The number of Radiation Monitoring personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Radiation Monitoring personnel exposure of 497 mrem.

⁴The number of Radiation Monitoring personnel at Tank Farms is estimated to be 36; the cumulative exposure is therefore 36 times the average Radiation Monitoring personnel exposure of 497 mrem.

⁵The number of Radiation Monitoring personnel at B Plant is estimated to be 20; the cumulative exposure is therefore 20 times the average Radiation Monitoring personnel exposure of 497 mrem.

Table A-3. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984.¹ (sheet 1 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Quality Engineering and Control	8	190	24	12300
Analytical Laboratory	65	9,850	152	12530
Operations	163	20,180	124	46700
Plant Maintenance Group	93	6,900	74	48540
Radiation Monitoring ²	40	18,080	452	72300
Totals for PUREX	369	55,200	150	--
Plutonium Finishing Plant (PFP)				
Z Plant Analytical Laboratory	40	8,280	207	12520
Plutonium Operations Production Control	11	3,800	345	44600
Plutonium Operations	129	140,030	1,086	46600
Z Plant Maintenance Group	68	16,700	246	48510
Nuclear Materials Control	11	6,270	570	58500
Radiation Monitoring ³	50	22,600	452	72300
Totals for PFP	309	197,680	640	--
Adjusted totals for PFP (see Appendix C)	322	200,935	624	--

Table A-3. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984.¹ (sheet 2 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
Surveillance and Operations	147	49,370	336	46300
Maintenance	33	7,480	227	48560
Radiation Monitoring ⁴	40	18,080	452	72300
Totals for Tank Farms	220	74,930	341	--
Adjusted totals for Tank Farms (see Appendix C)	259	74,920	289	--
B Plant				
Fission Products Operations	89	23,820	268	46200
Maintenance Group	40	6,700	168	48550
Radiation Monitoring ⁵	25	11,300	452	72300
Totals for B Plant	154	41,820	272	--
Totals for above facilities	1,052	369,630	351	--
Adjusted totals (see Appendix C)	1,104	372,875	338	--

¹W. A. Decker, 1985, *Rockwell Hanford Operations Exposure Summary for 1984*, RHO-HS-SR-84-14, Rockwell Hanford Operations, Richland, Washington.

²The number of Radiation Monitoring personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiation Monitoring personnel exposure of 452 mrem.

³The number of Radiation Monitoring personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Radiation Monitoring personnel exposure of 452 mrem.

⁴The number of Radiation Monitoring personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiation Monitoring personnel exposure of 452 mrem.

⁵The number of Radiation Monitoring personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Radiation Monitoring personnel exposure of 452 mrem.

Table A-4. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1985.¹ (sheet 1 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
QE and Control	11	150	14	12300
Analytical Lab	67	22,510	336	12530
Radiological Protection ²	40	16,200	405	12600
Production Control	2	10	5	37200
Maintenance	73	10,200	140	37300
Processing	96	13,080	136	37400
Production Support	22	1,370	62	37500
Oxide and UO ₃ ³	31	20,010	645	37600
Totals for PUREX	342	83,530	244	--
Plutonium Finishing Plant (PFP)				
Analytical Laboratory	42	6,110	145	12520
Radiological Protection ⁴	50	20,250	405	12600
Plutonium Operations Production Control	6	850	142	36200
Z Plant Maintenance	50	35,590	712	36300
Plutonium Processing and Product Handling	98	144,910	1,479	36400/36600
Z Plant Facility Services	24	2,480	103	36500
Nuclear Materials Control	6	9,570	1,595	58500
Totals for PFP	276	219,760	796	--

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Table A-4. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1985.¹ (sheet 2 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
Radiological Protection ⁵	40	16,200	405	12600
Maintenance	25	12,900	516	35300
Services	89	19,210	216	35400
Processing Operations	79	7,880	100	35500
Totals for Tank Farms	233	56,190	241	--
B Plant				
Radiological Protection ⁶	25	10,120	405	12600
Maintenance	27	4,340	161	34300
Fission Products Production	52	9,060	174	34400
Waste Encapsulation Processing	30	180	6	34500
Totals for B Plant	134	23,700	177	--
Totals for above facilities	985	383,180	389	--

¹W. A. Decker and T. M. Wirth, 1986, *Rockwell Hanford Operations Exposure Summary for 1985*, RHO-HS-SR-85-14, Rockwell Hanford Operations, Richland, Washington.

²The number of Radiological Protection personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiological Protection personnel exposure of 405 mrem.

³These personnel spend time in PUREX and UO₃; however, the majority of cumulative exposure is received in PUREX (i.e., the UO₃ component of exposure is insignificant).

⁴The number of Radiological Protection personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Radiological Protection personnel exposure of 405 mrem.

⁵The number of Radiological Protection personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Radiological Protection personnel exposure of 405 mrem.

⁶The number of Radiological Protection personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Radiological Protection personnel exposure of 405 mrem.

Table A-5. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1986.¹ (sheet 1 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Analytical Lab	57	13,160	231	12530
East Radiological Protection ²	40	10,320	258	12610
Production Control	3	20	7	47200
Maintenance	75	10,780	144	47300
Processing	127	30,020	236	47400
Services and UO ₃ Operations ³	21	2,770	132	47500
Totals for PUREX	323	67,070	208	--
Plutonium Finishing Plant (PFP)				
Analytical Laboratory	44	8,530	194	12520
West Radiological Protection ⁴	50	22,150	443	12620
Plutonium Production	7	7,200	1,029	46200
Maintenance	67	39,510	590	46300
Plutonium Nitrate/Metal Production	85	131,290	1,545	46400
Facility Services	22	6,670	303	46500
Product Handling	23	31,520	1,370	46600
Nuclear Materials Control	6	11,650	1,942	58500
Totals for PFP	304	258,520	850	--

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Table A-5. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1986.¹ (sheet 2 of 2)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
East/West Radiological Protection ⁵	40	14,060	352	12610/12620
Maintenance	46	4,270	93	35300
Services	71	10,460	147	35400
Processing Operations	65	1,410	22	35500
Totals for Tank Farms	222	30,200	136	--
B Plant				
East Radiological Protection ⁶	25	6,450	258	12610
Maintenance	32	3,650	114	34300
Fission Products Production	44	5,910	134	34400
Waste Encapsulation Processing	16	740	46	34500
Totals for B Plant	117	16,750	143	--
Totals for above facilities	966	372,540	386	--

¹W. A. Decker and T. M. Wirth, 1987, *Rockwell Hanford Operations Exposure Summary for 1986*, RHO-HS-SR-86-14, Rockwell Hanford Operations, Richland, Washington.

²The number of East Radiological Protection personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average East Radiological Protection personnel exposure of 258 mrem.

³These personnel spend time in PUREX and UO₃; however, the majority of cumulative exposure is received in PUREX (i.e., the UO₃ component of exposure is insignificant).

⁴The number of West Radiological Protection personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average West Radiological Protection personnel exposure of 443 mrem.

⁵The number of East/West Radiological Protection personnel at Tank Farms is estimated to be 40 (20 of each); the cumulative exposure is therefore 20 times the average East Radiological Protection personnel exposure of 258 mrem and 20 times the average West Radiological Protection personnel exposure of 443 mrem.

⁶The number of East Radiological Protection personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average East Radiological Protection personnel exposure of 258 mrem.

Table A-6. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1987.¹ (sheet 1 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
Defense Reactor Operations	2	1,210	605	W11100
Defense Reactor Operations (<i>sic</i>)	276	250,030	906	W11200
Defense Reactor Fuel Supply	23	19,930	867	W11300
Defense Reactor Engineering	83	118,520	1,428	W11500
Production Reactor Projects	6	6,770	1,128	W24400
Quality Assurance	43	34,110	793	W32100
Operation (<i>sic</i>) Health Physics ²	100	52,600	526	W33100
Services	7	2,860	409	W33600
N Plant Maintenance	329	346,590	1,053	W51100
Maintenance Engineering Services	1	1,270	1,270	W51200
Maintenance Integration and Material	17	22,620	1,331	W51400
Totals for N Reactor	887	856,510	966	--
Plutonium-Uranium Extraction (PUREX)				
Operations	155	15,880	102	W12100
Chemical Processing Technical ³	57	5,360	94	W12200
Chemical Plants Quality Assurance	7	110	16	W32300
Operation (<i>sic</i>) Health Physics ⁴	40	21,040	526	W33100
Maintenance	78	4,330	56	W52100
Totals for PUREX	337	46,720	139	--

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Table A-6. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1987.¹ (sheet 2 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Chemical Processing Technical ⁵	44	4,140	94	W12200
Plutonium Finishing Plant	140	81,320	581	W12300
Operation (sic) Health Physics ⁶	50	26,300	526	W33100
Safeguards	10	12,010	1,201	W34200
Maintenance	66	16,200	245	W52200
Safeguards and Security Maintenance and Standards Laboratory	8	1,940	243	W55500
Totals for PFP	318	141,910	446	--
Tank Farms				
Surveillance and Operation	161	19,110	119	W13200
Operation (sic) Health Physics ⁷	40	21,040	526	W33100
Maintenance	33	1,920	58	W52400
Totals for Tank Farms	234	42,070	180	--

Table A-6. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1987.¹ (sheet 3 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Operations	68	5,970	88	W13100
Operation (sic) Health Physics ⁸	25	13,150	526	W33100
Maintenance	37	2,820	76	W52300
Totals for B Plant	130	21,940	169	--
Totals for above facilities	1,906	1,109,150	582	--

¹T. M. Wirth, 1988, *Westinghouse Hanford Company 1987 Skin Contamination and Dose Summary*, WHC-IP-0345, Westinghouse Hanford Company, Richland, Washington.

²The number of Operational Health Physics personnel at N Reactor is estimated to be 100; the cumulative exposure is therefore 100 times the average Operational Health Physics personnel exposure of 526 mrem.

³The number of Chemical Processing Technical (Analytical Laboratory) personnel at PUREX is assumed to be 57; the cumulative exposure is therefore 57 times the average Chemical Processing Technical personnel exposure of 94 mrem.

⁴The number of Operational Health Physics personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Operational Health Physics personnel average exposure of 526 mrem.

⁵The number of Chemical Processing Technical (Analytical Laboratory) personnel at PFP is assumed to be 44; the cumulative exposure is therefore 44 times the average Chemical Processing Technical personnel exposure of 94 mrem.

⁶The number of Operational Health Physics personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Operational Health Physics personnel exposure of 526 mrem.

⁷The number of Operational Health Physics personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Operational Health Physics personnel exposure of 526 mrem.

⁸The number of Operational Health Physics personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Operational Health Physics personnel exposure of 526 mrem.

Table A-7. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988.¹ (sheet 1 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
Defense Reactor Operations Assessment	3	70	23	W11100
Defense Reactor Operations	289	47,860	166	W11200
Defense Reactor Engineering	39	4,670	120	W11500
Defense Reactor Projects	5	210	42	W24400
Quality Assurance	26	5,480	211	W32100
Health Physics ²	100	14,900	149	W33100
Plant Maintenance Group	297	117,190	395	W51100
Maintenance Engineering Services	3	60	20	W51200
Maintenance Integration and Material Services	14	2,470	176	W51400
Totals for N Reactor	776	192,910	249	--
Plutonium-Uranium Extraction (PUREX)				
Purex (<i>sic</i>)	187	10,750	57	W12100
Chemical Processing Systems Engineering	68	7,420	109	W12700
Chemical Plants Quality Assurance	7	290	41	W32300
Health Physics ³	40	5,960	149	W33100
PUREX-UO ₃ Maintenance	124	2,250	18	W52100
Totals for PUREX	426	26,670	63	--

Table A-7. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988.¹ (sheet 2 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Plutonium Finishing Plant (<i>sic</i>)	165	97,630	592	W12300
PFP Engineering	52	12,180	234	W12800
Health Physics ⁴	50	7,450	149	W33100
Safeguards	10	8,530	853	W34200
Maintenance	87	17,070	196	W5220 (<i>sic</i>) probably W52200
Safeguards and Security Maintenance and Standards Laboratory	9	700	78	W55500
Totals for PFP	373	143,560	385	--
Tank Farms				
Surveillance and Operation	160	9,960	62	W13200
Health Physics ⁵	40	5,960	149	W33100
Maintenance	34	1,320	39	W52400
Totals for Tank Farms	234	17,240	74	--

Table A-7. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988.¹ (sheet 3 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Operations	63	1,820	29	W13100
Health Physics ⁶	25	3,720	149	W33100
Maintenance	61	1,310	21	W52300
Totals for B Plant	149	6,850	46	--
Totals for above facilities	1,958	387,230	198	--

¹W. A. Decker and J. L. Newcomb, 1988, *Westinghouse Hanford Company 1988 Skin Contamination and Dose Summary*, WHC-IP-0582, Westinghouse Hanford Company, Richland, Washington.

²The number of Operational Health Physics personnel at N Reactor is estimated to be 100; the cumulative exposure is therefore 100 times the average Operational Health Physics personnel exposure of 149 mrem.

³The number of Health Physics personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Health Physics personnel average exposure of 149 mrem.

⁴The number of Health Physics personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Health Physics personnel exposure of 149 mrem.

⁵The number of Health Physics personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Health Physics personnel exposure of 149 mrem.

⁶The number of Health Physics personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Health Physics personnel exposure of 149 mrem.

Table A-8. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1989.¹ (sheet 1 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
Defense Reactor Operations Assessment	11	9,450	859	W11100
Reactor Plant Operations	171	135,880	795	W11210
Reactor/Production/Work Control	1	0	0	W11230
Defense Reactor Programs	1	0	0	W11400
Defense Reactor Engineering	23	3,240	141	W11500
100 Area & Site Surveillance Health Physics	94	35,830	381	W33150
Plant Maintenance Group	163	44,820	275	W51100
Maintenance Integration Material Support	5	100	20	W51400
Totals for N Reactor	469	229,320	489	--
Plutonium-Uranium Extraction (PUREX)				
Planning	9	50	6	W12110
PUREX/UO ₃ Process Operations	122	2,550	21	W12120
Technical Administration	4	10	3	W12140
Technical Support	78	1,310	17	W12150
Health Physics	57	910	16	W33130
Chemical Processing Quality Assurance	10	120	12	W38200
PUREX-UO ₃ Maintenance	120	1,580	13	W52100
Totals for PUREX	400	6,530	16	--

Table A-8. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1989.¹ (sheet 2 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Plutonium Finishing Plant (<i>sic</i>)	6	1,360	227	W12300
PFP Production Control	3	60	20	W12310
Plutonium Nitrate Production	11	1,410	128	W12320
Plutonium Operations	107	43,211	404	W12330
Facility Services (PFP)	29	1,260	43	W12340
Product Handling	31	8,030	259	W12350
Plutonium Operations Training	26	1,040	40	W12370
Operator Trainees	16	0	0	W12610
Process Chemistry & Engineering Lab	19	1,850	97	W12710
Engineering Laboratory	46	2,520	55	W12820
Process Control	8	1,180	148	W12840
Health Physics	58	12,480	215	W33170
Safeguards	8	8,960	1,120	W34200
Maintenance	78	10,520	135	W52200
S&S Maintenance (SSM) & Standard Lab	14	880	63	W55500
Totals for PFP	460	94,761	206	--

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Table A-8. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1989.¹ (sheet 3 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
Production Control	2	20	10	W13210
Single-Shell Tanks	1	10	10	W13220
Operations	126	6,790	54	W13230
Waste Management Health Physics ²	40	2,160	54	W33140
Maintenance	31	1,110	36	W52400
Totals for Tank Farms	200	10,090	50	--
B Plant				
Processing	65	2,140	33	W13130
Evaluation & Compliance	2	40	20	W13150
Waste Management Health Physics ³	25	1,350	54	W33140
Maintenance	51	1,160	23	W52300
Totals for B Plant	143	4,690	33	--
Totals for above facilities	1,672	345,391	207	--

¹W. A. Decker, T. L. Aldridge, and J. L. Newcomb, 1990, *Westinghouse Hanford Company Radiological Protection Dose Summary and ALARA Goal Report, Calendar Year 1989*, WHC-SP-0588, Westinghouse Hanford Company, Richland, Washington.

²The number of Health Physics personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Waste Management Health Physics personnel exposure of 54 mrem.

³The number of Health Physics personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Waste Management Health Physics personnel exposure of 54 mrem.

Table A-9. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1990.¹ (sheet 1 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
N Reactor	1	10	10	W11000
Fuels & K/D Ops	53	10,230	193	W11220
Haz & Rad Waste Control	12	280	23	W11250
N Plant Shift Operations	77	15,600	203	W11270
Program Support	4	40	10	W11400
N Reactor Engineering	21	980	47	W11500
100 Area & Site Surveillance Health Physics	108	12,200	113	W33150
Maintenance	33	50	2	W52910
K Maintenance	19	220	12	W52920
Totals for N Reactor	328	39,610	121	--
Plutonium-Uranium Extraction (PUREX)				
Process Operations	23	450	20	W17200
Process Operations Support	1	0	0	W17210
Processing	97	1,500	15	W17220
UO ₃ Plant Operations	9	150	17	W17300
Analytical Lab	41	830	20	W17530
Health Physics	41	1,001	24	W33130
Maintenance	9	120	13	W52100
Totals for PUREX	221	4,051	18	--

Table A-9. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1990.¹ (sheet 2 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Plutonium Finishing Plant (<i>sic</i>)	0	10	0	W15000
Production Control	6	110	18	W15200
Work Control	1	140	140	W15230
Plutonium Operations	89	12,380	139	W15300
Operations Support	4	140	35	W15310
PRF	15	580	39	W15320
RMC	15	2,710	181	W15330
Processing	61	4,950	81	W15340
Facility Services	25	380	15	W15350
Power and Ventilation	21	890	42	W15360
Product/Solid Waste Handling	20	2,510	126	W15400
Group Support	4	440	110	W15410
Solid Waste Operations	17	320	19	W15420
Remediation Unit	3	0	0	W15430
Plant Engineering	49	400	8	W15510
Process Control	4	20	5	W15530
Engineering Laboratory	45	1,340	30	W15560
Pu Operations Training	1	0	0	W15600
Certification Training	46	5,730	125	W15610

Table A-9. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1990.¹ (sheet 3 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP) (cont)				
Process Support Labs	9	980	109	W16230
Health Physics	61	9,340	153	W33170
Safeguards	7	7,250	1,036	W34200
Maintenance	1	0	0	W52200
Field Support	3	0	0	W52210
RMC Outage	11	1,570	143	W52220
Facility/Lab Maintenance	66	5,640	85	W52230
Main Shift Support	39	2,480	64	W52260
S&S Maintenance & Standard Lab	11	2,110	192	W55500
Totals for PFP	634	62,420	98	--
Tank Farms				
Waste Management Health Physics ²	40	2,880	72	W33140
Waste Management and Site Support Quality Assurance ³	7	770	110	W38100
Maintenance	1	0	0	W52400
Maintenance Shift Support	2	170	85	W52410
Process Maintenance	10	460	46	W52420
Service Maintenance	15	170	11	W52430
Tank Farms	136	6,260	46	W86120
Totals for Tank Farms	211	10,710	51	--

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Table A-9. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1990.¹ (sheet 4 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Waste Management Health Physics ⁴	25	1,800	72	W33140
Waste Management and Site Support Quality Assurance ⁵	2	220	110	W38100
Maintenance	3	30	10	W52300
Mechanical Maintenance	14	270	19	W52310
Instrument Maintenance	14	80	6	W52320
Maintenance (<i>sic</i>)	10	280	28	W52330
Electrical Maintenance	10	270	27	W52340
Waste Vitrification Division	70	1,850	26	W85000
Totals for B Plant	148	4,800	32	--
Totals for above facilities	1,542	121,591	79	--

¹W. A. Decker, 1991, *Westinghouse Hanford Company Occupational Health and Safety - Radiation Dose Summary and ALARA Goal Report, Calendar Year 1990*, WHC-SP-0671, Westinghouse Hanford Company, Richland, Washington.

²The number of Waste Management Health Physics personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Waste Management Health Physics personnel exposure of 72 mrem.

³The number of Waste Management and Site Support Quality Assurance personnel at Tank Farms is estimated to be 7; the cumulative exposure is therefore 7 times the average Waste Management and Site Support Quality Assurance personnel exposure of 110 mrem.

⁴The number of Waste Management Health Physics personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 40 times the average Waste Management Health Physics personnel exposure of 72 mrem.

⁵The number of Waste Management and Site Support Quality Assurance personnel at B Plant is estimated to be 2; the cumulative exposure is therefore 2 times the average Waste Management and Site Support Quality Assurance personnel exposure of 110 mrem.

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Table A-10. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1991. (sheet 1 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
N/A ²	1	0	0	W110/
N/A	1	0	0	W11100
N/A	1	0	0	W11110
N/A	1	10	10	W11130
N/A	1	0	0	W11230
N/A	11	0	0	W11250
N/A	58	2,700	47	W11270
N/A	0	0	0	W113/
N/A	2	0	0	W11420
N/A	8	0	0	W11520
N/A	13	170	13	W11530
N/A	4	250	63	W11540
N/A	4	0	0	W11550
N/A	7	630	90	W14122
N/A	44	4,230	96	W33910
N/A	6	120	20	W38510
N/A	37	9,200	249	W11220
N/A	8	1,350	169	W14121
N/A	14	500	36	W14123
Totals for N Reactor	221	19,160	87	--
Reported in dosimetry report	N/A	17,180	N/A	--

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Table A-10. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1991.¹ (sheet 2 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
N/A	3	10	3	W14310
N/A	15	50	3	W14311
N/A	13	213	16	W14312
N/A	7	10	1	W14313
N/A	10	501	50	W14321
N/A	13	70	5	W14322
N/A	6	130	22	W14323
N/A	8	60	8	W14324
N/A	1	0	0	W14325
N/A	6	0	0	W14330
N/A	15	32	2	W14331
N/A	177	2,901	16	W17/
N/A	46	290	6	W33930
Totals for PUREX	320	4,267	13	--
Reported in dosimetry report	N/A	3,290	N/A	--
Plutonium Finishing Plant (PFP)				
N/A	0	0	0	W14200
N/A	11	50	5	W14210
N/A	14	2,040	146	W14221
N/A	23	1,600	70	W14222
N/A	16	810	51	W14223
N/A	15	310	21	W14224
N/A	3	100	33	W14230
N/A	11	1,253	114	W14231
N/A	17	1,370	81	W14232
N/A	2	360	180	W14233

Table A-10. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1991.¹ (sheet 3 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP) (cont)				
N/A	1	30	30	W14235
N/A	326	33,226	102	W15/
N/A	4	10	3	W27230
N/A	60	9,500	158	W33920
N/A	2	0	0	W38530
Totals for PFP	505	50,659	100	--
Reported in dosimetry report	N/A	51,740	N/A	--
Tank Farms				
N/A	1	0	0	W32000
N/A	79	390	5	W33400
N/A	21	1,000	48	W33410
N/A	15	630	42	W33420
N/A	11	630	57	W33430
N/A	4	180	45	W33450
N/A	3	220	73	W33460
N/A	4	340	85	W33470
N/A	5	200	40	W33480
N/A	21	1,510	72	W52543
N/A	222	9,260	42	W76/
N/A	2	0	0	W77/
N/A	52	490	9	W78/
Totals for Tank Farms	440	14,850	34	--
Reported in dosimetry report	N/A	15,330	N/A	--

Table A-10. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1991.¹ (sheet 4 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
N/A	22	980	45	W33550
N/A	13	460	35	W52371
N/A	12	70	6	W52372
N/A	10	100	10	W52373
N/A	11	180	16	W52374
N/A	2	0	0	W85110
N/A	60	930	16	W85130
N/A	52	560	11	W85131
N/A	16	430	27	W85132
N/A	1	20	20	W85133
N/A	1	0	0	W85134
N/A	1	10	10	W85153
Totals for B Plant	201	3,740	19	--
Reported in dosimetry report	N/A	3,290	N/A	--
Totals for above facilities	1,687	92,676	55	--

¹W. A. Decker, 1991, *Westinghouse Hanford Company Occupational Health and Safety - Radiation Dose Summary and ALARA Goal Report, Calendar Year 1990*, WHC-SP-0671, Westinghouse Hanford Company, Richland, Washington.

²N/A indicates descriptive Group Designator was not available.

Table A-11. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1992.¹ (sheet 1 of 5)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
N/A ²	0	0	0	W110/
N/A	9	20	2	W111/
N/A	31	2,270	73	W11270
N/A	2	0	0	W11520
N/A	17	360	21	W11530
N/A	4	70	18	W11540
N/A	7	30	4	W11550
N/A	16	380	0	W14111
N/A	9	320	36	W14112
N/A	7	520	74	W14122
N/A	48	4,180	87	W33910
N/A	3	20	7	W38510
N/A	38	7,870	207	W117/
N/A	7	1,740	249	W14121
N/A	13	500	38	W14123
Totals for N Reactor	211	18,280	87	--
Reported in dosimetry report	N/A	19,800	N/A	--

Table A-11. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1992.¹ (sheet 2 of 5)

Group designator	Number of personnel	Cumulative exposure (person- mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
N/A	3	0	0	W14310
N/A	14	10	1	W14311
N/A	9	80	9	W14312
N/A	1	0	0	W14320
N/A	8	360	45	W14321
N/A	10	10	1	W14322
N/A	4	30	8	W14323
N/A	7	20	3	W14324
N/A	12	50	4	W14325
N/A	8	70	9	W14326
N/A	10	0	0	W14327
N/A	1	0	0	W14330
N/A	18	10	1	W14331
N/A	121	2,130	18	W17/
N/A	1	0	0	W23610
N/A	47	699	15	W33930
Totals for PUREX	274	3,469	13	--
Reported in dosimetry report	N/A	1,700	N/A	--
Plutonium Finishing Plant (PFP)				
N/A	7	490	70	W14200
N/A	7	40	6	W14210
N/A	21	4,210	200	W14221
N/A	20	1,540	77	W14222
N/A	21	1,310	62	W14223
N/A	22	1,150	52	W14224

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Table A-11. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1992.¹ (sheet 3 of 5)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP) (cont)				
N/A	6	290	48	W14225
N/A	2	30	15	W14230
N/A	19	1,185	62	W14231
N/A	8	40	5	W14233
N/A	271	28,646	106	W15/
N/A	62	8,600	139	W33920
Totals for PFP	466	47,531	102	--
Reported in dosimetry report	N/A	52,500	N/A	--
Tank Farms				
N/A	7	30	4	W33310
N/A	19	350	18	W33311
N/A	15	640	43	W33312
N/A	26	630	24	W33313
N/A	4	0	0	W33320
N/A	12	280	23	W33321
N/A	11	190	17	W33322
N/A	10	90	9	W33323
N/A	12	90	8	W33324
N/A	16	650	41	W52543
N/A	80	890	11	W7C120
N/A	16	100	6	W7C121
N/A	11	230	21	W7C130
N/A	15	250	17	W7C131
N/A	10	1,200	120	W7C132
N/A	10	320	32	W7C133

Table A-11. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1992.¹ (sheet 4 of 5)

Group designator	Number of personnel	Cumulative exposure (person- mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms (cont)				
N/A	10	0	0	W7C140
N/A	58	1,690	29	W7C150
N/A	7	30	4	W7C151
N/A	1	0	0	W7C213
N/A	1	0	0	W7C221
N/A	1	0	0	W7C245
N/A	1	20	20	W7C260
N/A	10	0	0	W7C311
N/A	2	0	0	W7C314
N/A	2	0	0	W7C332
N/A	1	0	0	W7C341
N/A	2	0	0	W7C342
N/A	14	200	14	W7C343
N/A	8	110	14	W7C344
N/A	4	10	3	W7C345
N/A	4	40	10	W7C346
N/A	2	20	10	W7C347
N/A	4	50	13	W7C348
N/A	2	90	45	W7C349
Totals for Tank Farms	408	8,200	20	--
Reported in dosimetry report	N/A	10,200	N/A	--

Table A-11. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1992.¹ (sheet 5 of 5)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
N/A	20	600	30	W33330
N/A	14	90	6	W33331
N/A	5	20	4	W33332
N/A	13	80	6	W7C351
N/A	12	40	3	W7C352
N/A	7	40	6	W7C353
N/A	10	20	2	W7C354
N/A	2	0	0	W7E130
N/A	50	640	13	W7E131
N/A	8	30	4	W7E132
N/A	15	10	1	W7E133
Totals for B Plant	156	1,570	10	--
Reported in dosimetry report	N/A	1,000	N/A	--
Totals for above facilities	1,515	79,050	52	--

¹W. A. Decker, *Westinghouse Hanford Company ALARA Summary, 1992*, Westinghouse Hanford Company, Richland, Washington. Contact W. A. Decker (372-2881) for a copy of this report.

²N/A indicates descriptive Group Designator was not available.

Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1993.¹ (sheet 1 of 6)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
N/A ²	47	8,030	171	W117/
N/A	3	30	10	WC14120
N/A	12	610	51	WC14121
N/A	7	260	37	WC14122
N/A	14	340	24	WC14123
N/A	24	520	22	WC11270
N/A	3	0	0	WC11520
N/A	20	250	13	WC11530
N/A	5	0	0	WC11540
N/A	9	150	17	WC14100
N/A	2	0	0	WC14110
N/A	11	80	7	WC14111
N/A	10	50	5	WC14112
N/A	39	1,380	35	WC33910
N/A	25	1,970	79	WC33911
N/A	2	40	20	WC38560
N/A	2	0	0	WC52110
N/A	1	0	0	WC52120
N/A	10	0	0	WC52130
Totals for N Reactor	246	13,710	56	--
Reported in dosimetry report	231	13,810	60	--

Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1993.¹ (sheet 2 of 6)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
N/A	1	0	0	WC14310
N/A	11	0	0	WC14311
N/A	10	0	0	WC14312
N/A	1	0	0	WC14320
N/A	6	0	0	WC14321
N/A	7	30	4	WC14322
N/A	2	70	35	WC14323
N/A	6	60	10	WC14324
N/A	12	80	7	WC14326
N/A	11	0	0	WC14327
N/A	1	0	0	WC14330
N/A	1	0	0	WC14360
N/A	1	0	0	WC14380
N/A	127	300	2	WC17/
N/A	4	0	0	WC33931
N/A	3	0	0	WC38510
Totals for PUREX	204	540	3	--
Reported in dosimetry report	150	480	3	--

Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1993.¹ (sheet 3 of 6)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
N/A	14	130	9	WC14200
N/A	5	70	14	WC14210
N/A	16	3,870	242	WC14221
N/A	19	1,120	59	WC14222
N/A	9	700	78	WC14223
N/A	8	1,080	135	WC14224
N/A	9	560	62	WC14225
N/A	1	0	0	WC14230
N/A	21	3,370	160	WC14231
N/A	17	11,880	699	WC14232
N/A	10	0	0	WC14233
N/A	253	47,622	188	WC15/
N/A	50	2,414	48	WC33920
N/A	8	60	8	WC33921
N/A	39	2,586	66	WC33922
N/A	6	510	85	WC33923
N/A	4	390	98	WC33924
N/A	4	350	88	WC33925
N/A	8	404	51	WC33926
N/A	6	3,250	542	WC51220
N/A	1	40	40	WC51221
Totals for PFP	508	80,406	158	--
Reported in dosimetry report	496	36,136	73	--

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Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1993.¹ (sheet 4 of 6)

Group designator	Number of personnel	Cumulative exposure (person- mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
N/A	1	0	0	WC33310
N/A	18	780	43	WC33311
N/A	17	370	22	WC33312
N/A	26	960	37	WC33313
N/A	4	140	35	WC33314
N/A	2	0	0	WC33320
N/A	7	0	0	WC33321
N/A	9	100	11	WC33322
N/A	6	70	12	WC33323
N/A	4	0	0	WC33324
N/A	15	780	52	WC52230
N/A	17	1,230	72	WC52240
N/A	3	0	0	W7C020
N/A	59	810	14	W7C120
N/A	15	270	18	W7C121
N/A	11	640	58	W7C130
N/A	12	940	78	W7C131
N/A	21	1,840	88	W7C132
N/A	8	430	54	W7C133
N/A	71	1,400	20	W7C150
N/A	25	160	6	W7C151
N/A	1	0	0	W7C159
N/A	1	0	0	W7C213
N/A	2	0	0	W7C221

Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During
Calendar Year 1993.¹ (sheet 5 of 6)

Group designator	Number of personnel	Cumulative exposure (person- mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms (cont)				
N/A	1	0	0	W7C223
N/A	2	10	5	W7C245
N/A	1	0	0	W7C260
N/A	1	0	0	W7C311
N/A	1	0	0	W7C342
N/A	6	230	38	W7C343
N/A	2	30	15	W7C344
N/A	5	30	6	W7C345
N/A	1	0	0	W7C346
N/A	2	110	55	W7C347
N/A	2	130	65	W7C348
N/A	2	10	5	W7C349
Totals for Tank Farms	381	11,470	30	--
Reported in dosimetry report	330	10,070	31	--

Table A-12. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1993.¹ (sheet 6 of 6)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
N/A	8	0	0	WC14500
N/A	17	70	4	WC14510
N/A	12	50	4	WC14520
N/A	4	10	3	WC14530
N/A	9	520	58	WC14540
N/A	2	0	0	WC14550
N/A	71	3,620	51	WC16/
N/A	38	328	9	WC33932
Totals for B Plant	161	4,598	29	--
Reported in dosimetry report	136	4,570	34	--
Totals for above facilities	1,500	110,724	74	--

¹W. A. Decker, *Westinghouse Hanford Company ALARA Summary, 1993*, Westinghouse Hanford Company Richland Washington. Contact W. A. Decker (372-2881) for a copy of this report.

²N/A indicates descriptive Group Designator was not available.

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APPENDIX B

**INDEPENDENT VERIFICATION OF DOSIMETRY REPORT DATA
FOR CALENDAR YEARS 1982, 1984, AND 1988**

BY D. V. VO

APPENDIX B

**INDEPENDENT VERIFICATION OF DOSIMETRY REPORT DATA
FOR CALENDAR YEARS 1982, 1984, AND 1988**

To provide verification of the data used in this document, an independent transcriber was used: Mr. Douglas V. Vo, Waste Transfer Projects group. Mr. Vo was provided with the appropriate dosimetry reports for the designated years and asked to list the pertinent data for each of the facilities of interest: Plutonium-Uranium Extraction, Plutonium Finishing Plant, Tank Farms, B Plant, and 100 Area for the 1988 tabulation. The years selected were 1982, 1984, and 1988.

This verification was done with no knowledge of the author's efforts (Appendix A) for any of these years. Wherever assumptions were necessary as to the number of personnel at a particular facility (i.e., Plutonium-Uranium Extraction), the same number as employed by the author in Appendix A was provided to Mr. Vo. The results of Mr. Vo's tabulations are provided in Tables B-1 through B-3.

The signature block, below, attests to the veracity of this effort.

INDEPENDENT TRANSCRIBER: _____

Douglas V. Vo

DATE: _____

Table B-1. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1982¹ as Recorded Independently by D. V. Vo. (sheet 1 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Analytical	24	2,390	100	12530
Processing	94	13,850	147	46710
Service & UO ₃ Operation	28	2,740	98	46720
Plant Maintenance	46	5,810	126	48540
Health, Safety & Environment ²	40	18,960	474	72340
Totals for PUREX	232	43,750	189	--
Plutonium Finishing Plant (PFP)				
Z Plant Analytical	14	5,100	364	12520
Z Plant Maintenance	42	13,700	326	48510
Production Handling Operations	37	40,390	1,092	46610
Facilities Services	26	4,550	175	46630
Decontamination & Decommissioning	21	5,880	280	46640
Research Engineering	23	4,560	198	65000
Nuclear Materials Control	12	7,756	646	58500
Health, Safety & Environment ³	50	23,700	474	72000
Totals for PFP	225	105,636	469	--

Table B-1. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1982¹ as Recorded Independently by D. V. Vo. (sheet 2 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
Services	78	56,840	729	46310
Processing Operations	76	23,350	307	46320
Maintenance	18	8,050	447	48560
Analytical Labs (222-S)	50	12,210	244	12510
Fabrication Service	3	100	33	47000
Health, Safety & Environment ⁴	24	11,376	474	72000
Totals for Tank Farms	249	111,926	450	--

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Table B-1. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1982¹ as Recorded Independently by D. V. Vo. (sheet 3 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Waste Encapsulation Processing	39	10,270	263	46230
Waste Production & Encapsulation Maintenance	36	12,760	354	48550
Applied Technology	18	3,320	184	12540
Lab Service	5	2,440	488	12550
Fission Products	60	36,860	614	46220
Health, Safety & Environment ⁵	10	4,740	474	72000
Totals for B Plant	168	70,390	419	--
Totals for above facilities	874	331,702	380	--

¹W. A. Decker, 1983, 1982 Rockwell Exposure Summary, RHO-HS-SR-82-14, Rockwell Hanford Operations, Richland, Washington.

²The number of Health, Safety & Environment personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Health, Safety & Environment personnel exposure of 474 mrem.

³The number of Health, Safety & Environment personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Health, Safety & Environment personnel exposure of 474 mrem.

⁴The number of Health, Safety & Environment personnel at Tank Farms is estimated to be 24; the cumulative exposure is therefore 24 times the average Health, Safety & Environment personnel exposure of 474 mrem.

⁵The number of Health, Safety & Environment personnel at B Plant is estimated to be 10; the cumulative exposure is therefore 10 times the average Health, Safety & Environment personnel exposure of 474 mrem.

Table B-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984¹ as Recorded Independently by D. V. Vo. (sheet 1 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium-Uranium Extraction (PUREX)				
Analytical Laboratory	65	9,850	152	12530
Op Processing	128	10,030	78	46710
Service & UO ₃ Operation	34	1,200	35	46720
Oxide Processing	53	8,990	170	46730
Maintenance	93	6,900	74	48540
Health, Safety & Environment ²	40	18,080	452	72000
Chemical Processing Engineering	13	5,190	399	65400
Maintenance and Transportation	1	95	95	59000
Totals for PUREX	427	60,335	141	--

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Table B-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984¹ as Recorded Independently by D. V. Vo. (sheet 2 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Analytical	40	8,280	207	12520
Fission Products & Production Control	8	50	6	44200
Op Production Control	11	3,800	345	44600
Fission Products Processing	60	19,050	318	46220
Operations	129	140,030	1,086	46600
Maintenance	68	16,700	246	48510
Research and Engineering	27	8,360	310	65000
Nuclear Materials Control	11	6,270	570	58500
Health, Safety & Environment ³	50	22,600	452	72000
Process Engineering	12	3,160	263	65900
Maintenance and Transportation	1	95	95	59000
Totals for PFP	417	228,395	548	--

Table B-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984¹ as Recorded Independently by D. V. Vo. (sheet 3 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Tank Farms				
Production Control	14	260	19	44300
Services	93	36,940	397	46310
Processing Operations	91	12,410	136	46320
Maintenance	33	7,480	227	48560
Health, Safety & Environment ⁴	40	18,080	452	72000
Waste Management System Engineering	2	10	5	65600
Fabrication Services	20	1,810	91	47000
Totals for Tank Farms	293	76,990	263	--

Table B-2. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1984¹ as Recorded Independently by D. V. Vo. (sheet 4 of 4)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Waste Encapsulation Processing	33	4,770	145	46230
Maintenance	40	6,700	168	48550
Health, Safety & Environment ⁵	25	11,300	452	72000
Totals for B Plant	98	22,770	232	--
Totals for above facilities	1,235	388,490	315	--

¹W. A. Decker, 1985, *Rockwell Hanford Operations Exposure Summary for 1984*, RHO-HS-SR-84-14, Rockwell Hanford Operations Richland Washington.

²The number of Health, Safety & Environment personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Health, Safety & Environment personnel exposure of 452 mrem.

³The number of Health, Safety & Environment personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Health, Safety & Environment personnel exposure of 452 mrem.

⁴The number of Health, Safety & Environment personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Health, Safety & Environment personnel exposure of 452 mrem.

⁵The number of Health, Safety & Environment personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Health, Safety & Environment personnel exposure of 452 mrem.

Table B-3. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988¹ as Recorded Independently by D. V. Vo. (sheet 1 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
N Reactor				
Defense Reactor Operations Assessment	3	70	23	W11100
Defense Reactor Operations	289	47,860	166	W11200
Defense Reactor Engineering	39	4,670	120	W11500
Quality Assurance	26	5,480	211	W32100
Health Physics ²	100	14,900	149	W33100
Reactor Safety	2	50	25	W33400
Plant Maintenance Group	297	117,190	395	W51100
Maintenance Engineering Services	3	60	20	W51200
Maintenance Integration & Material Service	14	2,470	176	W51400
Totals for N Reactor	773	192,750	249	--
PUREX				
Chemical Processing - PUREX	187	10,750	57	W12100
Chemical Processing Systems Engineering	68	7,420	109	W12700
Chemical Plants Quality Assurance	7	290	41	W32300
Health Physics ³	40	5,960	149	W33100
PUREX-UO ₃ Maintenance	124	2,250	18	W52100
Totals for PUREX	426	26,670	63	--

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Table B-3. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988¹ as Recorded Independently by D. V. Vo. (sheet 2 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
Plutonium Finishing Plant (PFP)				
Chemical Process Division	165	97,630	592	W12300
Engineering	52	12,180	234	W12800
Health Physics ⁴	50	7,450	149	W33100
Maintenance	87	17,070	196	W52200
Totals for PFP	354	134,330	379	--
Tank Farms				
Surveillance & Operation	160	9,960	62	W13200
Health Physics ⁵	40	5,960	149	W33100
Maintenance	34	1,320	39	W52400
Totals for Tank Farms	234	17,240	74	--

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Table B-3. Dosimetry Tabulations for Monthly Badged Personnel During Calendar Year 1988¹ as Recorded Independently by D. V. Vo. (sheet 3 of 3)

Group designator	Number of personnel	Cumulative exposure (person-mrem)	Average personnel exposure (mrem)	Organization code
B Plant				
Defense Waste Management - B Plant	63	1,820	29	W13100
Defense Waste Engineering	3	0	0	W13300
Health Physics ⁶	25	3,725	149	W33100
Nuclear Facilities Safety	1	0	0	W33700
Maintenance	61	1,310	21	W52300
Totals for B Plant	153	6,855	45	--
Totals for above facilities	1,940	377,845	195	--

¹W. A. Decker and J. L. Newcomb, 1989, *Westinghouse Hanford Company 1988 Skin Contamination and Dose Summary*, WHC-IP-0582, Westinghouse Hanford Company, Richland, Washington.

²The number of Health Physics personnel at N Reactor is estimated to be 100; the cumulative exposure is therefore 100 times the average Health Physics personnel exposure of 149 mrem.

³The number of Health Physics personnel at PUREX is estimated to be 40; the cumulative exposure is therefore 40 times the average Health Physics personnel exposure of 149 mrem.

⁴The number of Health Physics personnel at PFP is estimated to be 50; the cumulative exposure is therefore 50 times the average Health Physics personnel exposure of 149 mrem.

⁵The number of Health Physics personnel at Tank Farms is estimated to be 40; the cumulative exposure is therefore 40 times the average Health Physics personnel exposure of 149 mrem.

⁶The number of Health Physics personnel at B Plant is estimated to be 25; the cumulative exposure is therefore 25 times the average Health Physics personnel exposure of 149 mrem.

APPENDIX C

COMPARISON OF DOSIMETRY DATA ANALYSIS EFFORTS

APPENDIX C

COMPARISON OF DOSIMETRY DATA ANALYSIS EFFORTS

C1.0 DESCRIPTION

Tables C-1 through C-3 contain a facility-by-facility comparison of the author's data analysis as compared with the independent effort of Mr. Douglas V. Vo for the years 1982, 1984, and 1988.

The independently determined data (Appendix B) will be used as the standard to compare the author's comparable data (Appendix A). Each element of the data will be compared and a percentage deviation computed; i.e., number of personnel, cumulative exposure, and average facility personnel exposure. Those values for which the magnitude of the deviation exceeds 5% will be re-evaluated against the original dosimetry reports. Resolution will consist of selecting the most appropriate value and the reason for that selection. That value (or values) will be used in the respective tables and/or calculations contained in the body of this report. Appropriate notations will be provided in the data as tabulated in Appendix A. The data affected by resolution will be adjusted and used for this report.

Deviations that are <5% will be considered as not materially different, and the author's data will be used.

C2.0 RESOLUTION OF DISCREPANCIES

C2.1 PLUTONIUM FINISHING PLANT (PFP) - 1982

The major discrepancy is one of 23 Research & Engineering personnel (Organization Code 65000) included in Appendix B. Even though some of these personnel may have been assigned to PFP activities, others would have been assigned to other facilities; i.e., Plutonium-Uranium Extraction (PUREX), Tank Farms, and B Plant. Therefore, for lack of definitive knowledge, these personnel will not be included in the PFP personnel count, and the agreement between Appendix A and Appendix B would be acceptable. The author's values (Appendix A) will be used for this item. Deletion of these personnel will bring the average personnel exposures into agreement also.

C2.2 TANK FARMS - 1982

The major discrepancy is one of including 50 Analytical Labs (222-S) personnel in the Tank Farms personnel totals in Appendix B. These personnel are located in the 222-S facility. Only some fraction of these personnel would work on Tank Farm analyses. Resolution consists of not including these personnel in the Tank Farms personnel and cumulative exposure totals.

Table C-1. Comparison of Dosimetry Transcription Efforts for
Calendar Year 1982.

Item	Independent transcriber value (Appendix B)	Author's value (Appendix A)	Deviation* (%)	Exceed limit
Facility: Plutonium-Uranium Extraction Plant				
Number of personnel	232	235	+1.29	No
Cumulative exposure (person-mrem)	43,750	44,230	+1.10	No
Average personnel exposure (mrem)	189	188	-0.53	No
Facility: Plutonium Finishing Plant				
Number of personnel	225	202	-10.22	Yes
Cumulative exposure (person-mrem)	105,636	101,670	-3.75	No
Average personnel exposure (mrem)	469	503	-7.25	Yes
Facility: Tank Farms				
Number of personnel	249	192	-22.89	Yes
Cumulative exposure (person-mrem)	111,926	97,960	-12.48	Yes
Average personnel exposure (mrem)	450	510	-13.33	Yes
Facility: B Plant				
Number of personnel	168	146	-13.10	Yes
Cumulative exposure (person-mrem)	70,390	64,810	-7.93	Yes
Average personnel exposure (mrem)	419	444	+5.97	Yes
Totals for above facilities				
Number of personnel	874	775	-11.33	Yes
Cumulative exposure (person-mrem)	331,702	308,670	-6.94	Yes
Average personnel exposure (mrem)	380	398	+4.74	No

*Deviation is calculated as $100 \times (V_{\text{App A}} - V_{\text{App B}}) / (V_{\text{App B}})$.

Table C-2. Comparison of Dosimetry Transcription Efforts for
Calendar Year 1984.

Item	Independent transcriber value (Appendix B)	Author's value (Appendix A)	Deviation* (%)	Exceed limit
Facility: Plutonium-Uranium Extraction Plant				
Number of personnel	427	369	-13.58	Yes
Cumulative exposure (person-mrem)	60,335	55,200	-8.51	Yes
Average personnel exposure (mrem)	141	150	6.38	Yes
Facility: Plutonium Finishing Plant				
Number of personnel	417	309	-25.90	Yes
Cumulative exposure (person-mrem)	228,395	197,680	-13.45	Yes
Average personnel exposure (mrem)	548	640	16.79	Yes
Facility: Tank Farms				
Number of personnel	293	220	-24.91	Yes
Cumulative exposure (person-mrem)	76,990	74,930	-2.68	No
Average personnel exposure (mrem)	263	341	29.66	Yes
Facility: B Plant				
Number of personnel	98	154	57.14	Yes
Cumulative exposure (person-mrem)	22,770	41,820	-83.66	Yes
Average personnel exposure (mrem)	232	272	+17.24	Yes
Totals for above facilities				
Number of personnel	1,235	1,052	-14.82	Yes
Cumulative exposure (person-mrem)	388,490	369,630	-4.85	No
Average personnel exposure (mrem)	315	351	11.43	Yes

*Deviation is calculated as $100 \times (V_{\text{App A}} - V_{\text{App B}}) / (V_{\text{App B}})$.

Table C-3. Comparison of Dosimetry Transcription Efforts for
Calendar Year 1988. (sheet 1 of 2)

Item	Independent transcriber value (Appendix B)	Author's value (Appendix A)	Deviation* (%)	Exceed limit
Facility: N Reactor				
Number of personnel	773	776	0.39	No
Cumulative exposure (person-mrem)	192,750	192,910	0.08	No
Average personnel exposure (mrem)	249	249	0.00	No
Facility: Plutonium-Uranium Extraction Plant				
Number of personnel	426	426	0.00	No
Cumulative exposure (person-mrem)	26,670	26,670	0.00	No
Average personnel exposure (mrem)	63	63	0.00	No
Facility: Plutonium Finishing Plant				
Number of personnel	354	373	5.37	Yes
Cumulative exposure (person-mrem)	134,330	143,560	6.87	Yes
Average personnel exposure (mrem)	379	385	1.58	No
Facility: Tank Farms				
Number of personnel	234	234	0.00	No
Cumulative exposure (person-mrem)	17,240	17,240	0.00	No
Average personnel exposure (mrem)	74	74	0.00	No
Facility: B Plant				
Number of personnel	153	149	-2.61	No
Cumulative exposure (person-mrem)	6,855	6,850	-0.07	No
Average personnel exposure (mrem)	45	46	+2.22	No

Table C-3. Comparison of Dosimetry Transcription Efforts for
Calendar Year 1988. (sheet 2 of 2)

Item	Independent transcriber value (Appendix B)	Author's value (Appendix A)	Deviation* (%)	Exceed limit
Totals for above facilities				
Number of personnel	1,940	1,958	0.93	No
Cumulative exposure (person-mrem)	377,845	387,230	2.48	No
Average personnel exposure (mrem)	195	198	1.54	No

*Deviation is calculated as $100 \times (V_{\text{App A}} - V_{\text{App B}}) / (V_{\text{App B}})$.

Removing these components in Appendix B will bring these values into a range of no material difference when compared with similar values in Appendix A. The values in Appendix A will be used for this item.

C2.3 B PLANT - 1982

The major discrepancy is that of including 18 Applied Technology (Organization Code 12540) personnel and 5 Lab Service (Organization Code 12550) personnel. These organizations are in the Analytical Laboratories and would have no direct B Plant functions; therefore, these personnel and the cumulative exposure should not be included in the B Plant totals. When these components are removed there is agreement between the pertinent values in Appendixes A and B. Resolution consists of removing these two components from Appendix B. The values in Appendix A will be used for this item.

C2.4 TOTALS FOR 1982

The resolutions noted in Sections C2.1 through C2.3 will cause the totals for 1982 in Appendixes A and B to be in agreement.

C2.5 PUREX - 1984

Two major discrepancies appear to exist in Appendix A; (1) 53 personnel from Oxide Processing (Organization Code 46730) were not included, and (2) 13 personnel from Chemical Processing Engineering (Organization Code 65400) were not included. Resolution consists of using the values reported in Appendix B. The adjusted values will be incorporated into Appendix A.

C2.6 PFP - 1984

Each appendix contains discrepancies. Appendix B contains listings for Fission Products & Production Control (Organization Code 44200), Fission Products Processing (Organization Code 46220), and Research and Engineering (Organization Code 65000). The first and second of these listings is associated with B Plant and should not be included in the PFP tabulation; the third listing cannot be assigned exclusively to PFP because responsibilities for all processing facilities are encompassed by this organization. Appendix A does not include Process Engineering (Organization Code 65900) or Maintenance and Transportation (Organization Code 59000). Resolution consists of adding Process Engineering and Maintenance and Transportation to the totals in Appendix A. These changes will provide the necessary adjustments to cause each of the totals to be within 5% of one another. The adjusted values will be incorporated into Appendix A.

C2.7 TANK FARMS - 1984

There are two discrepancies in Appendix A; (1) Tank Farm Services (Organization Code 46310) and Tank Farm Processing Operations (Organization Code 46320) should be used instead of Surveillance and Operations (Organization Code 46300), and (2) Waste Management System Engineering (Organization Code 65600) should be included. In Appendix B, Production Control personnel (Organization Code 44300) should not be included because they use quarterly frequency dosimeters (i.e., they are not defined as radiation workers), and Fabrication Services (Organization Code 47000) should not be included with Tank Farms. Resolution consists of adopting these changes to bring each of the reported values within 5% of one another.

C2.8 B PLANT - 1984

Appendix B does not contain all of Fission Products Operations (Organization Code 46200). Resolution consists of including Organization Code 46200 in place of Waste Encapsulation Processing (Organization Code 46230). With this change, Appendixes A and B are in agreement. The values in Appendix A will be used for this item.

C2.9 TOTALS FOR 1984

Incorporation of the adjustments described in Sections C2.5 through C2.8 brings the totals into agreement.

C2.10 PFP - 1988

Appendix B does not contain Safeguards (Organization Code W34200) and Safeguards and Security Maintenance and Standards Laboratory (Organization Code W55500). Resolution consists of including the values associated with these entities into Appendix B, which will then be in agreement with Appendix A. The values in Appendix A will be used for this item.

C3.0 CONCLUSIONS

Section C2.0 demonstrates the kinds of difficulties encountered in abstracting the appropriate data entries from the dosimetry reports. Errors of omission, incorporation of nonradiation worker entries, and incorporation of organizations that do not belong with the facility in question are a few of the problems noted.

The comparisons between two independent determination as demonstrated here indicates that even with the differences detected, agreement of the average annual personnel exposure at any one of the given facilities will be within 10% of one another. When discrepancies are resolved, the resulting differences from the original reported values are usually <10%.

Based on this experience, there is reasonable confidence that the average facility annual exposures are within $\pm 10\%$ of the true value.