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**Eleventh Annual Report of  
Radiation Exposures for DOE & DOE  
Contractor Employees**

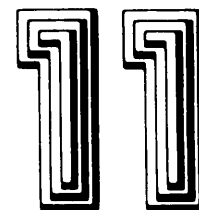
**1978**



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**U.S. Department of Energy**  
Assistant Secretary for Environment  
Office of Environmental Compliance and Overview  
Operational and Environmental Safety Division





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## PREFACE

In 1968, the U.S. Atomic Energy Commission (AEC) established a program for reporting certain occupational radiation exposure\* information to a central radiation records repository maintained at the Union Carbide Computing Technology Center, Oak Ridge, Tennessee. Annual summaries (WASH-1350-R1 through WASH-1350-R6) were reported for the years 1968-1973 and included data on AEC contractor employees as well as employees of companies in the private sector licensed by the AEC.

In January 1975, the operational functions of the AEC, including the maintenance of records on the occupational radiation exposure of contractor employees, were transferred to the Energy Research and Development Administration (ERDA) and the AEC's regulatory functions, including the reporting of information on the occupational radiation exposure of licensees, were transferred to the Nuclear Regulatory Commission (NRC). Previous AEC licensees then reported to NRC while the contractors reported to ERDA. Radiation exposure data for AEC/ERDA and AEC/ERDA contractor employees for 1974 and 1975 were reported in ERDA 76/119 and ERDA 77-29. The 1976 data for ERDA and ERDA contractor employees were reported in DOE/EV-0011/9.

On October 1, 1977, the Department of Energy (DOE) was formed and assumed the responsibilities of ERDA. DOE and DOE contractor radiation exposure data for 1977 are presented in DOE/EV-0066/10. This report contains the 1978 radiation exposure data for DOE and DOE contractors.

Previous reports for AEC/ERDA, AEC/ERDA contractor employees may be seen at the DOE Public Documents Room, 1000 Independence Avenue, SW, Washington, D.C. 20585.

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\*The word "exposure" is herein synonymous with "dose equivalent".





## STANDARDS FOR RADIATION PROTECTION

DOE (ERDA) Manual Chapter 0524, Standards for Radition Protection, is applicable to DOE and DOE contractor operations not subject to Nuclear Regulatory Commission licensing.

Two basic requirements exist for all DOE operations. The first requirement is that all operations shall be conducted in a manner to assure that radiation exposure to individuals and population groups is limited to the lowest levels technically and economically practicable. The second requirement is that radiation exposure to individuals or population groups be maintained below prescribed limits. The DOE prescribed limits for occupationally exposed individuals are given in the following table as excerpted from DOE (ERDA) Manual Chapter 0524:

**INDIVIDUALS IN CONTROLLED AREAS**  
**RADIATION PROTECTION STANDARDS FOR EXTERNAL**  
**AND INTERNAL DOSE EQUIVALENTS**

Type of Exposure	Exposure Period	Dose Equivalent (Dose or Dose Commitment* (rem))
Whole body, head and trunk, gonads, lens of the eye**, red bone marrow, active blood forming organs.	Year	5***
	Calendar Quarter	3
Unlimited areas of the skin (except hands and forearms). Other organs, tissues, and organ systems (except bone).	Year	15
	Calendar Quarter	5
Bone	Year	30
	Calendar Quarter	10
Forearms****	Year	30
	Calendar Quarter	10
Hands**** and feet	Year	75
	Calendar Quarter	25

\*To meet the above dose commitment standards, operations must be conducted in such a manner that it would be unlikely that an individual would assimilate in a critical organ, by inhalation, ingestion, or absorption, a quantity of a radionuclide(s) that would commit the individual to an organ dose which exceeds the limits specified in the above table.

\*\*A beta exposure below a maximum energy of 700 keV will not penetrate the lens of the eye; therefore, the applicable limit for these energies would be that for the skin (15 rem/year).

\*\*\*In special cases with the approval of the Director, Operational and Environmental Safety Division, a worker may exceed 5 rem/year provided his/her average exposure per year since age 18 will not exceed 5 rem/year.

\*\*\*\*All reasonable effort shall be made to keep exposure of forearms and hands to the general limit for the skin.

## WHOLE BODY RADIATION EXPOSURES

### General Trends

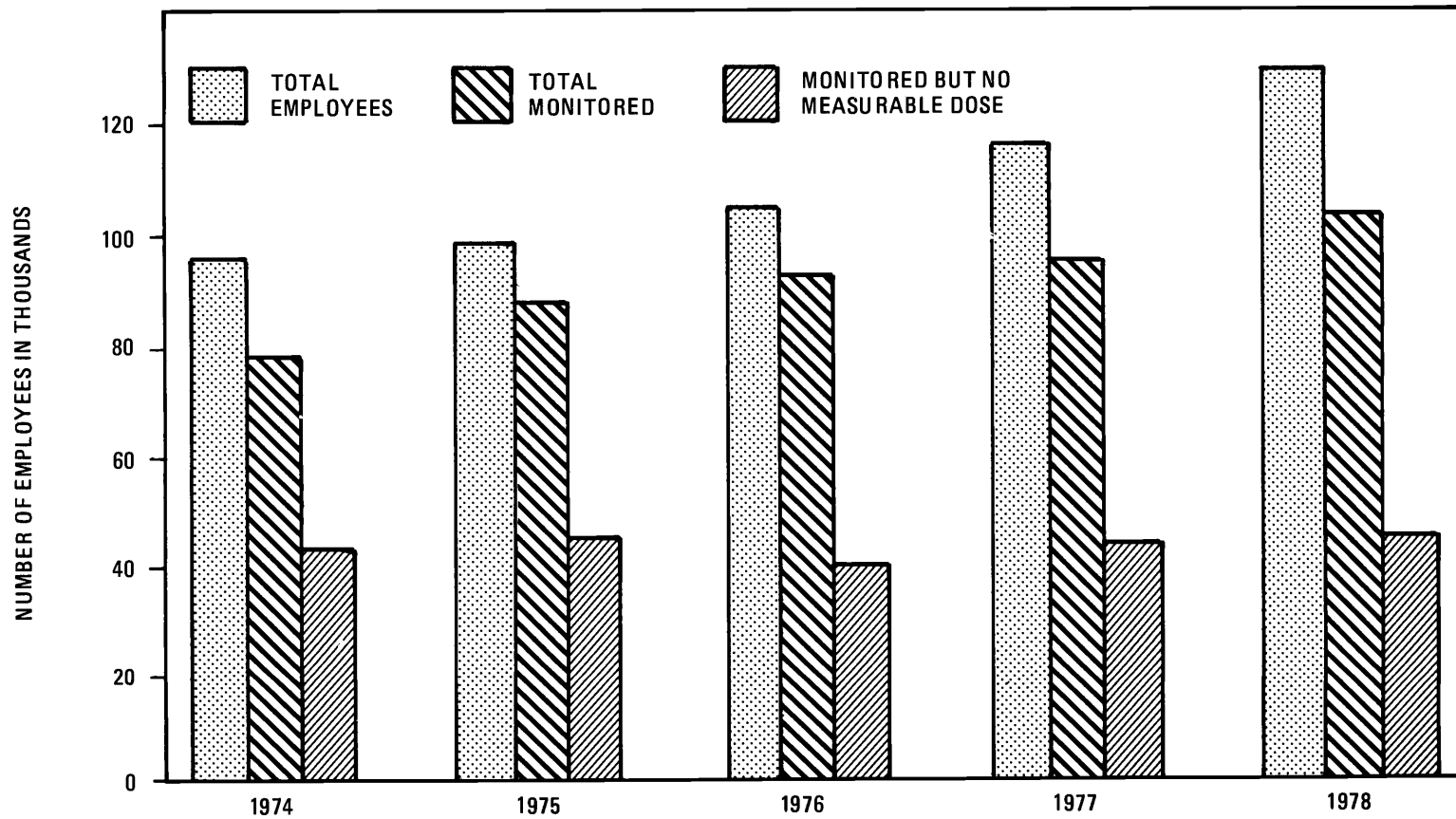
Radiation exposure data for AEC/ERDA/DOE and AEC/ERDA/DOE contractor employees\* for 1974-1978 are plotted in Figure 1. This shows that approximately 50% of the total workers monitored do not receive measurable exposure.

Data obtained from DOE reports on occupational exposure for years 1964-1978 are presented in Tables 1 and 3. These data were used to generate Table 2 and Figure 2 which show that the percent of individuals monitored who received dose equivalents greater than 1 rem and greater than 2 rem has declined significantly in the past 15 years. Table 2 presents the collective dose equivalent (man-rem) for DOE and DOE contractor employees for 1974 through 1978. The collective dose equivalents have been estimated by using the midpoint of each dose equivalent range shown in Table 1.

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\*Henceforth referred to as DOE and DOE contractor employees.

FIGURE 1. COMPARISON OF NUMBER OF EMPLOYEES, NUMBER OF EMPLOYEES MONITORED, AND NUMBER OF EMPLOYEES MONITORED THAT RECEIVED NO MEASURABLE DOSE EQUIVALENT



**TABLE 1**  
**DISTRIBUTION OF WHOLE BODY RADIATION EXPOSURES FOR**  
**DOE/DOE CONTRACTOR EMPLOYEES - 1964-1978**

Year	Dose Equivalent Ranges (rem)												Total Monitored	
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12		>12
1964	122711	3583	1823	575	176	43	20	10	7	6	10	1		128965
1965	128360	4158	1704	515	294	70	32	26	25	22	6	2		135214
1966	131522	3706	1630	593	313	88	47	24	6	2			1	137932
1967	102510	3472	1572	555	168	35	29	23	17	4	1			108386
1968	103206	2799	1408	425	144	3	1							107986
1969	98625	2554	1313	335	86	4					1			102918
1970	92185	2698	1329	279	158	5	4	2		1				96661
1971	90640	2380	888	275	118	8	3				1		2	94315
1972	86077	2130	929	219	95	8	2							89460
1973	89071	1944	727	172	60	2	1							91977
1974	75684	1667	688	149	40	4								78232
1975	85451	1846	753	232	142				1					88425
1976	87969	1679	475	70	6	1								90200
1977	92965	1579	645	103	23			1	2				2	95220
1978	100194	1323	439	53	11									102020

**TABLE 2**  
**COLLECTIVE DOSE EQUIVALENT\* FOR DOE/DOE CONTRACTOR**  
**EMPLOYEES AND VISITORS BY OPERATIONS OFFICE - 1974-1978**

Operations Office	1974	1975	Man-Rem 1976	1977	1978
Albuquerque	2405	2324	1437	2300	2399
Chicago	1943	1638	1354	1373	1167
Grand Junction	.....	5	< 1	< 1	2
Idaho	686	611	790	929	899
Nevada	58	55	25	49	47
Oak Ridge	1178	1284	1351	1300	1566
Pittsburgh Naval Reactors	587	1876	1609	653	252
Richland	2079	2257	2265	3197	1596
San Francisco	320	283	285	334	307
Schenectady Naval Reactors	261	1022	203	148	111
Savannah River	1484	1268	1278	1298	1289
<b>TOTAL</b>	<b>11001</b>	<b>12622</b>	<b>10597</b>	<b>11581</b>	<b>10635</b>

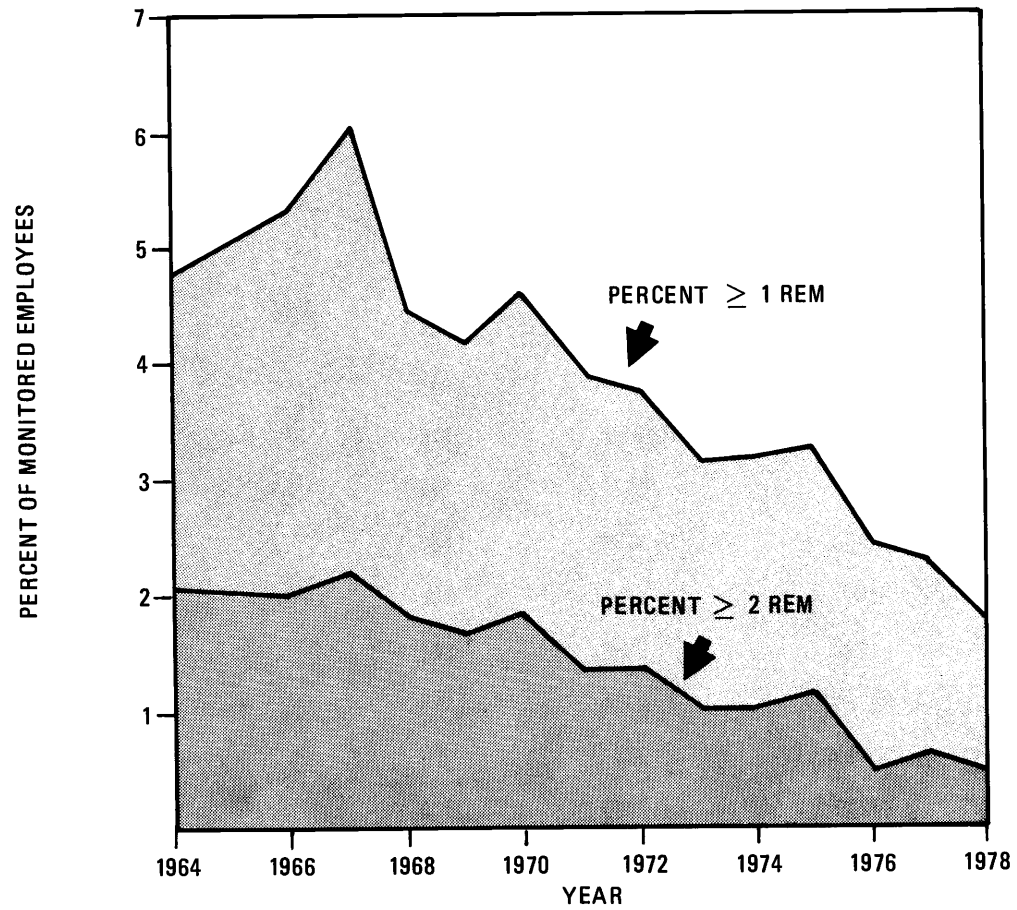
\*Throughout this report minor variations in collective dose equivalent values may occur due to computer rounding.

**TABLE 3**  
**DISTRIBUTION OF EMPLOYEES WHO RECEIVED ANNUAL WHOLE BODY**  
**DOSE EQUIVALENTS GREATER THAN 1 REM AND GREATER**  
**THAN 2 REM - 1964 - 1978**

Year	Number Employees Monitored	Number of Employees With Annual Whole Body Dose Equivalents		Collective Dose Equivalent (man-rem)*
		> 1 rem	>2 rem	
1964	128965	6254	2671	13411
1965	135214	6854	2696	14918
1966	137932	6410	2704	14173
1967	108386	5876	2404	12583
1968	107986	4780	1981	9877
1969	102918	4293	1739	8706
1970	96661	4476	1778	9135
1971	94315	3675	1295	7357
1972	89460	3383	1253	6769
1973	91977	2906	962	5623
1974	78232	2548	881	4944
1975	88425	2974	1128	6111
1976	90200	2231	552	3984
1977	95220	2255	676	4251
1978	102020	1826	503	3317

\*This column reflects the trend in high exposures since individuals with dose equivalents of less than 1 rem have been excluded. The annual collective dose equivalent has been estimated by using the midpoint of each dose equivalent range shown in Table 1.

FIGURE 2. PERCENT OF EMPLOYEES WITH WHOLE BODY DOSE EQUIVALENTS GREATER THAN 1 AND 2 REM





## DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE FOR 1978

Table 4 provides a breakdown of the 1978 whole body dose equivalents according to facility type. Table 5 shows that employees working in reactor, fuel processing, and accelerator facilities continue to receive the highest average exposures. The general research and other facilities accounted for approximately 39 percent of the total dose equivalent.

Appendix A contains whole body exposure distributions by facility type as reported to each of the 11 DOE operations offices or Naval Reactors offices.

Appendix B contains whole body exposure distributions for each contractor. These are placed alphabetically under their respective DOE operations office or Naval Reactors office.

Appendix C contains whole body exposure distributions for each DOE operations office.

**TABLE 4**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES FOR DOE/DOE CONTRACTOR**  
**EMPLOYEES AND VISITORS MONITORED - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Reactor	6613	2270	2426	698	562	199	109	173	174	2								1375
Fuel Fab	1096	131	505	174	123	57	39	59	8									280
Fuel Proc	3003	728	862	373	299	211	164	234	111	18	3							1201
Uran Enrich	12035	659	10739	541	77	9	7	3										677
Weapon F&T	18296	7030	9701	937	344	115	61	101	7									1072
Gen Research	38646	25650	9651	1811	745	315	181	241	40	9	3							1941
Accelerator	3178	1599	770	320	182	89	51	127	25	13	2							571
Other	17347	5655	8267	1633	714	352	253	385	74	11	3							2223
Visitors	102994	80034	22482	347	89	25	9	6	2									1256
DOE Offices	1806	1176	590	32	5	1	2											39
<b>TOTAL</b>	<b>205014</b>	<b>124932</b>	<b>65993</b>	<b>6866</b>	<b>3140</b>	<b>1373</b>	<b>876</b>	<b>1329</b>	<b>441</b>	<b>53</b>	<b>11</b>							<b>10635</b>

**TABLE 5**  
**COLLECTIVE DOSE EQUIVALENT (MAN-REM) PER FACILITY TYPE**  
**DOE/DOE CONTRACTOR EMPLOYEES AND VISITORS - 1978**

Facility Type	Total No. Individuals Monitored	No. Individuals With Measurable Exposure	Total No. Man-rem	Average Dose Equivalent (rem) Per Individual Monitored	Average Dose Equivalent (rem) Per Individual Monitored With Measurable Exposures
Reactor	6613	4343	1375	0.21	0.32
Fuel Fab	1096	965	280	0.26	0.29
Fuel Proc	3003	2275	1201	0.40	0.53
Uran Enrich	12035	11376	677	0.06	0.06
Weapon F&T	18296	11266	1072	0.06	0.10
Gen Research	38646	12996	1941	0.05	0.15
Accelerator	3178	1579	571	0.18	0.36
Other	17347	11692	2223	0.13	0.19
Visitors	102994	22960	1256	0.01	0.06
DOE Offices	1806	630	39	0.02	0.06
<b>TOTAL</b>	<b>205014</b>	<b>80082</b>	<b>10635</b>	<b>0.05</b>	<b>0.13</b>

## AVERAGE DOSE EQUIVALENT RATIOS

It is known that dose equivalent data are inadequate in assessing whether radiation exposures are reduced to as low as practicable. Variables such as facility age and design, along with all the other factors which enter into accomplishing the program objectives may far outweigh the efforts of management, radiation workers, and safety personnel in reducing personnel exposures to the levels that exist at similar facilities elsewhere.

In some instances, it might be desirable to compare average radiation dose equivalent associated with the same facility type but at different locations. Average dose equivalent ratios have been calculated for each facility type under an operations office and are presented in Table 6. The average dose equivalent ratio is defined as the ratio of the average personnel dose equivalent for a facility type within an operations office and the average personnel dose equivalent for that facility type. The numbers in Table 6 are derived by discarding all dose equivalents less than 0.5 rem. By discarding numbers less than 0.5 rem, it is intended to include only those people working in the radiation areas. No interpretation of these numbers is possible other than those numbers less than 1 indicate low average dose equivalent relative to the average for that facility type while those ratios greater than 1 indicate a higher average dose equivalent.

**TABLE 6  
AVERAGE DOSE EQUIVALENT RATIOS FOR 1978\***

Operations Office	Type of Facility									
	Reactor	Fuel Fab	Fuel Process	Uran Enrich	Weapons Fab& Test	General Research	Accel	Other	Visitors	DOE Offices
Albuquerque					1.01	1.21		0.74	0.80	1.00
Chicago	0.63					0.98	1.00	1.61	1.12	
Grand Junction										
Idaho	0.72		1.22							
Nevada					0.60				0.70	
Oak Ridge		0.87		1.00	0.79	0.98		0.62	0.70	
Pittsburgh Naval Reactors	0.45					0.84				
Richland	1.27	1.03				0.89		1.00	2.24	
San Francisco					0.60	0.81	0.86	1.24		
Schenectady Naval Reactors	0.55									
Savannah River	0.56	1.09	0.81		0.60	0.83		0.76		

\*The average dose equivalent ratio is defined as the average personnel dose equivalent for a facility type within an operations office divided by the average personnel dose equivalent for that facility type within DOE and DOE contractors.

## INTERNAL EXPOSURES

DOE (ERDA) Manual Chapter 0525 required DOE contractors to submit a report on personnel with an internal body deposition of radioactive materials. A report was required when:

- A. Any uptake of radioactive material occurring during the reporting year that, either independently, or when added to a current burden, was estimated to result in a dose commitment to the critical organ in excess of 50 percent of the pertinent annual dose equivalent standard set forth in Appendix 0524.
- B. Any previously unreported uptake of radioactive material that was determined to have been reportable according to the above criteria by reason of more recent dose equivalent estimates.

The annual dose equivalent limit for the lungs, liver, and kidneys is 15 rem each, while for the bone it is 30 rem.

In 1978, 21 workers were determined to have radioactive material in their bodies which resulted in a dose equivalent to the critical organ in excess of 50 percent of the annual dose equivalent limit. Nineteen of these workers met this criteria due to an internal body deposition of radioactive materials prior to 1978. Table 7 gives a breakdown of these 21 cases.

**TABLE 7**  
**DOSE DISTRIBUTIONS FROM INTERNAL BODY DEPOSITIONS\***

Radionuclids	Critical Organ	Dose Equivalent Ranges (rem)					
		7.5-10	10-15	15-25	25-50	50-100	100-200
Depositions prior to 1978							
U-234, U-235, U-238	Lung	5	5				
U-234, U-238	Lung	2					
U-235	Lung	2					
Pu-238	Bone Liver		1	1			
Am-241	Bone Liver					1	1
1978 Depositions							
Pu-239, Pu-240, Pu-241	Lung	1					
I-125	Thyroid	1					

\*Includes only those persons with internal body depositions which resulted in a dose equivalent to the critical organ in excess of 50 percent of the annual dose equivalent limit.

## WORKER TERMINATIONS

There were 10320 monitored workers in 1978 who terminated their employment with DOE or DOE contractors. Table 8 gives the length of employment as well as the average cumulative dose equivalent for the workers in each time interval. These data indicate that the average dose equivalent for workers terminating in 1978 was a small fraction of the 5-rem-per-year limit.



**TABLE 8**  
**LENGTH OF EMPLOYMENT FOR INDIVIDUALS TERMINATING IN 1978**

	<b>1-90 Days</b>	<b>90-180 Days</b>	<b>180-365 Days</b>	<b>1-2 Years</b>	<b>2-4 Years</b>	<b>4-6 Years</b>	<b>&gt;6 Years</b>
Total Number	2539	1343	1096	1387	1203	548	2204
Total Cumulative Dose Equivalent (rem)	701	331	338	476	581	286	6719
Average Cumulative Dose Equivalent (rem)	0.28	0.25	0.31	0.34	0.48	0.52	3.05

**WHOLE BODY DOSE EQUIVALENTS  
GREATER THAN 5 REM**

No DOE or DOE contractor employee received a whole body dose equivalent greater than 5 rem during 1978.

**APPENDIX A  
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES  
FOR EACH DOE OPERATIONS OFFICE  
BY FACILITY TYPE  
1978**

**TABLE A-1**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**ALBUQUERQUE OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem	
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10		
Reactor																			
Fuel Fab																			
Fuel Proc																			
Uran Enrich																			
Weapon F&T	8336	496	6831	473	264	106	59	100	7										809
Gen Research	7954	5376	1836	383	147	58	48	86	20	7	2								505
Accelerator																			
Other	1446	1173	199	31	24	11	4	4											41
Visitors	25532	5546	19863	89	19	12	2	1											1027
DOE Offices	829	582	229	12	3	1	2												17
<b>TOTAL</b>	<b>44097</b>	<b>13164</b>	<b>28958</b>	<b>988</b>	<b>457</b>	<b>188</b>	<b>115</b>	<b>191</b>	<b>27</b>	<b>7</b>	<b>2</b>								<b>2399</b>

**TABLE A-2**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**CHICAGO OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem	
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10		
Reactor	349	100	148	38	27	17	13	5	1										.56
Fuel Fab																			
Fuel Proc																			
Uran Enrich																			
Weapon F&T																			
Gen Research	5105	3074	1441	295	143	64	37	40	9	1	1								340
Accelerator	3005	1494	733	302	175	88	49	124	25	13	2								556
Other	1089	678	302	46	26	12	6	5	2	10	2								102
Visitors	10680	9517	951	147	46	7	7	4	1										110
DOE Offices	25	14	11																1
<b>TOTAL</b>	<b>20253</b>	<b>14877</b>	<b>3586</b>	<b>828</b>	<b>417</b>	<b>188</b>	<b>112</b>	<b>178</b>	<b>38</b>	<b>24</b>	<b>5</b>								<b>1165</b>

**TABLE A-3**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**GRAND JUNCTION OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)													Total Man-Rem									
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10								
Reactor																										
Fuel Fab																										
Fuel Proc																										
Uran Enrich																										
Weapon F&T																										
Gen Research																										
Accelerator																										
Other	116	104	5	3	4																					2
Visitors	4	4																								<1
DOE Offices	1	1																								<1
<b>TOTAL</b>	<b>121</b>	<b>109</b>	<b>5</b>	<b>3</b>	<b>4</b>																					<b>2</b>

**TABLE A-4**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**IDAHO OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem	
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10		
Reactor	2890	1539	835	242	155	48	32	35	4										263
Fuel Fab																			
Fuel Proc	1315	499	268	112	86	66	53	126	84	18	3								628
Uran Enrich																			
Weapon F&T																			
Gen Research																			
Accelerator																			
Other																			
Visitors	36163	36148	15																1
DOE Offices	252	122	126	4															7
<b>TOTAL</b>	<b>40620</b>	<b>38308</b>	<b>1244</b>	<b>358</b>	<b>241</b>	<b>114</b>	<b>85</b>	<b>161</b>	<b>88</b>	<b>18</b>	<b>3</b>								<b>899</b>

**TABLE A-5**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**NEVADA OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)													Total Man-Rem		
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10	
Reactor																			
Fuel Fab																			
Fuel Proc																			
Uran Enrich																			
Weapon F&T	6663	6419	204	34	5	1													19
Gen Research																			
Accelerator																			
Other	164	161	3																<1
Visitors	11961	11617	285	49	9	1													27
DOE Offices	202	194	5	3															1
<b>TOTAL</b>	<b>18990</b>	<b>18391</b>	<b>497</b>	<b>86</b>	<b>14</b>	<b>2</b>													<b>47</b>



**TABLE A-6**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**OAK RIDGE OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)														Total Man-Rem		
		< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	> 10
Reactor																		108
Fuel Fab	589	62	315	99	56	31	10	14	2									
Fuel Proc																		677
Uran Enrich	12035	659	10739	541	77	9	7	3										227
Weapon F&T	3041		2577	396	61	4	2	1										287
Gen Research	7560	5998	1060	241	125	59	28	40	8	1								
Accelerator																		242
Other	4033	85	3651	273	16	5	3											24
Visitors	1118	805	280	19	9	5												1
DOE Offices	21	1	20															
<b>TOTAL</b>	<b>28397</b>	<b>7610</b>	<b>18642</b>	<b>1569</b>	<b>344</b>	<b>113</b>	<b>50</b>	<b>58</b>	<b>10</b>	<b>1</b>								<b>1566</b>

**TABLE A-7**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**PITTSBURGH NAVAL REACTORS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	Dose Equivalent Ranges (rem)										Total Man-Rem				
								1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10					
Reactor	810	86	546	105	50	22	1														79	
Fuel Fab																						
Fuel Proc																						
Uran Enrich																						
Weapon F&T																						
Gen Research	1819	411	1093	181	92	21	10	11														159
Accelerator																						
Other																						
Visitors	452	235	214	3																		11
DOE Offices	57	18	35	3	1																	3
<b>TOTAL</b>	<b>3138</b>	<b>750</b>	<b>1888</b>	<b>292</b>	<b>143</b>	<b>43</b>	<b>11</b>	<b>11</b>														<b>252</b>

**TABLE A-8**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**RICHLAND OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Reactor	583	2	45	84	70	42	48	122	168	2								721
Fuel Fab	91	1	10	17	24	11	11	15	2									56
Fuel Proc																		
Uran Enrich																		
Weapon F&T																		
Gen Research	1955	30	1229	400	138	68	42	46	2									336
Accelerator																		
Other	4375	89	2053	893	475	256	205	344	60									1442
Visitors	870	287	547	29	5			1	1									38
DOE Offices	40		30	9	1													3
<b>TOTAL</b>	<b>7914</b>	<b>409</b>	<b>3914</b>	<b>1432</b>	<b>713</b>	<b>377</b>	<b>306</b>	<b>528</b>	<b>233</b>	<b>2</b>								<b>2596</b>

**TABLE A-9**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**SAN FRANCISCO OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem			
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10				
Reactor	3		3																		
Fuel Fab																					
Fuel Proc																					
Uran Enrich																					
Weapon F&T	105	87	10	4	3	1															3
Gen Research	12220	10082	1859	199	48	21	4	6	1												174
Accelerator	173	105	37	18	7	1	2	3													15
Other	1155	761	274	54	17	16	4	18	9	1	1										101
Visitors	12468	12238	220	9	1																13
DOE Offices	69	53	16																		1
<b>TOTAL</b>	<b>26193</b>	<b>23326</b>	<b>2419</b>	<b>284</b>	<b>76</b>	<b>39</b>	<b>10</b>	<b>27</b>	<b>10</b>	<b>1</b>	<b>1</b>										<b>307</b>

**TABLE A-10**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**SCHENECTADY NAVAL REACTORS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)														Total Man-Rem
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	> 10	
Reactor	978	304	531	88	47	6	1	1										66
Fuel Fab																		
Fuel Proc																		
Uran Enrich																		
Weapon F&T																		
Gen Research	1046	338	676	30	2													40
Accelerator																		
Other																		
Visitors	252	177	75															4
DOE Offices	31	12	19															1
<b>TOTAL</b>	<b>2307</b>	<b>831</b>	<b>1301</b>	<b>118</b>	<b>49</b>	<b>6</b>	<b>1</b>	<b>1</b>										<b>111</b>

**TABLE A-11**  
**DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES**  
**SAVANNAH RIVER OPERATIONS OFFICE - 1978**

Facility Type	Total Monitored	< Meas.	< 0.10	Dose Equivalent Ranges (rem)													Total Man-Rem		
				0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10	
Reactor	1000	239	318	141	213	64	14	10	1										190
Fuel Fab	416	68	180	58	43	15	18	30	4										115
Fuel Proc	1688	229	594	261	213	145	111	108	27										573
Uran Enrich																			
Weapon F&T	151	28	79	30	11	3													15
Gen Research	982	349	453	82	50	24	12	12											99
Accelerator																			
Other	4969	2604	1780	333	152	52	31	14	3										292
Visitors	3494	3460	32	2															2
DOE Offices	227	171	55	1															3
<b>TOTAL</b>	<b>12927</b>	<b>7148</b>	<b>3491</b>	<b>908</b>	<b>682</b>	<b>303</b>	<b>186</b>	<b>174</b>	<b>35</b>										<b>1289</b>

**APPENDIX B  
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES  
FOR EACH OPERATIONS OFFICE  
BY CONTRACTOR  
1978**

**TABLE B-1**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**ALBUQUERQUE OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)															Total Man-Rem	
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10
Albuquerque Misc. 01-00-0209-00																	
Employees		2465	17	6	1		1										131
Visitors																	
Total		2465	17	6	1		1										131
General Electric Co. 01-06-0006-01																	
Employees	151	117	17	3		1											11
Visitors	2																<1
Total	153	117	17	3		1											11
Inhalation Toxicology 01-08-0009-01																	
Employees	187	129	14	5	2	2	1	2									20
Visitors	169	2															<1
Total	356	131	14	5	2	2	1	2									20
Mason & Hanger-Silas 01-01-0001-01																	
Employees	68	290	91	31	11	3	2	1									57
Visitors	726	10															1
Total	794	300	91	31	11	3	2	1									58
Monsanto Research Co. 01-03-0002-01																	
Employees	102	1121	101	50	23	8		11									130
Visitors	595	81															4
Total	697	1202	101	50	23	8		11									134



TABLE B-1 (continued)  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978

ALBUQUERQUE OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)														Total Man-Rem	
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10
Rockwell International																
01-07-0007-01																
Employees		2838	242	174	71	47	86	6								
Visitors		19047	1													
Total		21885	243	174	71	47	86	6								
Ross Aviation, Inc.																
01-00-0212-01																
Employees	9	31	3													
Visitors																
Total	9	31	3													
Sandia Laboratories, NM																
01-08-0008-01																
Employees	1463	797	100	30	10	5	13	7	3	2						
Visitors	1980	537	50	8	1	2	1									
Total	3443	1334	150	38	11	7	14	7	3	2						
Sandia Laboratories, CA																
01-08-0008-02																
Employees	853	116	2	2												
Visitors	139	5														
Total	992	121	2	2												
The Bendix Corp.																
01-04-0003-01																
Employees	175		5													
Visitors	2															
Total	177		5													

**TABLE B-1 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**ALBUQUERQUE OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
The Zia Company 01-05-0005-01																	
Employees	1164	168	28	24	11	4	4										39
Visitors																	
Total	1164	168	28	24	11	4	4										39
Univ of California/LASL 01-05-0004-01																	
Employees	2864	794	267	110	46	41	72	11	4								342
Visitors	1933	181	38	11	11												27
Total	4797	975	305	121	57	41	72	11	4								369
Subtotal	12582	28729	976	454	187	113	191	27	7	2							2381

**TABLE B-2**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**CHICAGO OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>Ames Laboratory</b>																	
03-00-0011-01																	
Employees	61	24	22	8	3	2	3	4									26
Visitors	222																<1
Total	283	24	22	8	3	2	3	4									26
<b>Argonne National Lab.</b>																	
03-00-0012-02																	
Employees	2208	554	213	132	64	39	40	4									259
Visitors	7408	122	26	16													17
Total	9616	676	239	148	64	39	40	4									275
<b>Brookhaven National Lab.</b>																	
03-02-0010-01																	
Employees	315	1098	223	111	65	40	80	23	13	3							448
Visitors	105	199	80	16	5	7	3	1									46
Total	420	1297	303	127	70	47	83	24	13	3							494
<b>Chicago Miscellaneous</b>																	
03-00-0013-00																	
Employees	327	181	72	18	8	6	7	2	10	2							98
Visitors		342	3	3													19
Total	327	523	75	21	8	6	7	2	10	2							117
<b>Fermi National Accel.</b>																	
03-01-0135-01																	
Employees	1224	477	123	84	36	17	36	2	1								177
Visitors	1782	288	38	11	2		1										28
Total	3006	765	161	95	38	17	37	2	1								205

**TABLE B-2 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**CHICAGO OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Massachusetts Inst. 03-00-0035-01																	
Employees	131	105	19	17	5	1	7	2									34
Visitors																	
Total	131	105	19	17	5	1	7	2									34
Princeton University 03-00-0037-01																	
Employees	1000	175	3	1			1										11
Visitors																	
Total	1000	175	3	1			1										11
Subtotal	14783	3565	822	417	188	112	178	38	24	5							1162

**TABLE B-3**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**GRAND JUNCTION OFFICE**

Contractor	Dose Equivalent Ranges (rem)															Total Man-Rem	
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10
Bendix Field Eng. 04-00-0001-00																	
Employees	104	5	3	4													
Visitors	4																
Total	108	5	3	4													
Subtotal	108	5	3	4													

**TABLE B-3  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978**

**IDAHO OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)															Total Man-Rem	
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10
<b>Allied Chemical Corp.</b>																	
05-00-0169-01																	
Employees	430	136	62	58	48	38	95	67	14								462
Visitors	9980	7															<1
Total	10410	143	62	58	48	38	95	67	14								462
<b>Arrington Const.</b>																	
05-00-0070-01																	
Employees	4	8	2		2		1										4
Visitors																	
Total	4	8	2		2		1										4
<b>Biggers Const.</b>																	
05-00-0074-01																	
Employees		11															1
Visitors																	
Total		11															1
<b>Bingham Mechanical</b>																	
05-00-0082-01																	
Employees	5	15	9	6	3	2	2	2									16
Visitors																	
Total	5	15	9	6	3	2	2	2									16
<b>C-L Electric Company</b>																	
05-00-0075-01																	
Employees		3	2		1												1
Visitors																	
Total		3	2		1												1

**TABLE B-3 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

IDAHO OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)														Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	>10
Consultants & Design																	
05-00-0181-01																	
Employees	7																<1
Visitors																	<1
Total	7																
EG&G Idaho, Inc.																	
05-00-0182-01																	
Employees	1361	598	173	116	32	26	32	2									199
Visitors	25771	8															<1
Total	27132	606	173	116	32	26	32	2									200
Idaho Miscellaneous																	
05-00-0078-00																	
Employees	155	191	52	33	15	5	9	7	4	3							103
Visitors																	
Total	155	191	52	33	15	5	9	7	4	3							103
Jones - Boecon																	
05-00-0183-01																	
Employees	15	20	6	1													2
Visitors																	
Total	15	20	6	1													2
Lehigh Design Co.																	
05-00-0071-01																	
Employees	23	19				1											2
Visitors																	
Total	23	19				1											2

TABLE B-3 (continued)  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978

IDAHO OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)														Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	>10
Morrison-Knudsen 05-00-0134-01																	
Employees	36	82	30	21	11	13	22	9									91
Visitors																	
Total	36	82	30	21	11	13	22	9									91
Ormond Construction 05-00-0069-01																	
Employees	2	16	18	6	2			1									10
Visitors																	
Total	2	16	18	6	2			1									10
Waters Asbestos 05-00-0156-01																	
Employees		4															<1
Visitors																	
Total		4															<1
Subtotal	37789	1118	354	241	114	85	161	88	18	3							892



**TABLE B-4**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**NEVADA OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)														Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	>10
<b>Air Resources Lab.</b>																	
06-00-0159-01																	
Employees	36		1														<1
Visitors	29																<1
Total	65		1														<1
<b>Defence Nuclear Agency</b>																	
06-00-0027-01																	
Employees	166	3															<1
Visitors	1750	85	9	1													6
Total	1916	88	9	1													6
<b>Eberline Instrument</b>																	
06-00-0218-01																	
Employees	180	5															<1
Visitors																	<1
Total	180	5															<1
<b>EG&amp;G, Inc.</b>																	
06-00-0028-01																	
Employees	917	74	6		1												5
Visitors	171	2															<1
Total	1088	76	6		1												5
<b>EPA/NERC</b>																	
06-00-0116-01																	
Employees	207		1														<1
Visitors	53																<1
Total	260		1														<1

**TABLE B-4 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**NEVADA OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)													Total Man-Rem				
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8		8-9	9-10	>10	
Fenix & Scisson, Inc.																		
06-00-0113-01																		
Employees	218	13	1															1
Visitors	563																	<1
Total	781	13	1															1
Holmes & Narver, Inc.																		
06-00-0029-01																		
Employees	293	2																<1
Visitors	325																	<1
Total	618	2																<1
Nevada Miscellaneous																		
06-00-0157-00																		
Employees	299	4																<1
Visitors	455	2																<1
Total	754	6																<1
Reynolds Electrical																		
06-00-0093-01																		
Employees	3865	85	23	5														10
Visitors	3528	1																<1
Total	7393	86	23	5														10
Department of Interior																		
06-00-0216-01																		
Employees	99	19																1
Visitors	97																	<1
Total	196	19																1

TABLE B-4 (continued)  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978

NEVADA OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>Wackenhut Services</b>																	
06-00-0118-01																	
Employees	238	1	1														<1
Visitors	80	1															<1
Total	318	2	1														<1
<b>Westinghouse Electric</b>																	
06-00-0217-01																	
Employees	62	1	1														<1
Visitors	145																<1
Total	207	1	1														<1
<b>Subtotal</b>	<b>13776</b>	<b>298</b>	<b>43</b>	<b>6</b>	<b>1</b>												<b>25</b>

**TABLE B-5**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**OAK RIDGE OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)															Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10	
Comp. Animal Res. Lab. 08-00-0044-01																		
Employees	108	4																<1
Visitors	11																	<1
Total	119	4																<1
Goodyear Atomic Corp. 08-04-0049-01																		
Employees	418	395	163	49	9	7	3											83
Visitors																		
Total	418	395	163	49	9	7	3											83
National Lead Co. 08-01-0047-01																		
Employees	62	314	99	56	31	10	14	2										108
Visitors																		
Total	62	314	99	56	31	10	14	2										108
Oak Ridge Assoc. Univ. 08-00-0128-01																		
Employees	315	135	23	3														12
Visitors																		
Total	315	135	23	3														12
Puerto Rico Nuclear Ctr. 08-05-0046-02																		
Employees	102	3		1														1
Visitors	740	245	11															14
Total	842	248	11	1														15

TABLE B-5 (continued)  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978

OAK RIDGE OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)														Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	>10
RMI Company																	
08-00-0043-01																	
Employees	16	21	26	5													7
Visitors																	
Total	16	21	26	5													7
Rust Engineering Co.																	
08-00-0045-01																	
Employees		1374	97	1													86
Visitors																	
Total		1374	97	1													86
Union Carbide Corp./ORGDP																	
08-00-0042-01																	
Employees		8159	207	15													450
Visitors																	
Total		8159	207	15													450
Union Carbide Corp./Y-12																	
08-00-0042-02																	
Employees		5304	556	70	5	2	2	2									402
Visitors																	
Total		5304	556	70	5	2	2	2									402
Union Carbide Corp./ORNL																	
08-00-0042-03																	
Employees	5541	445	194	117	58	28	39	6	1								238
Visitors	54	35	8	9	5												10
Total	5595	480	202	126	63	28	39	6	1								247

TABLE B-5 (continued)  
DOE CONTRACTORS  
AVERAGE WHOLE BODY EXPOSURES - 1978

OAK RIDGE OPERATIONS OFFICE

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Union Carbide Corp. 08-00-0042-04																	
Employees	241	2185	171	13													144
Visitors																	
Total	241	2185	171	13													144
Woven Structures, Inc. 08-00-0048-01																	
Employees	1	2	14	5	5	3											10
Visitors																	
Total	1	2	14	5	5	3											10
Subtotal	7609	18621	1569	344	113	50	58	10	1								1565

**TABLE B-6**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**PITTSBURGH NAVAL REACTORS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Duquesne Light Co.																	
09-02-0051-01																	
Employees		204	67	37	18	1											48
Visitors	11	109															5
Total	11	313	67	37	18	1											53
Westinghouse Electric/BAPL																	
09-00-0050-02																	
Employees	406	940	94	43	15	9	10										112
Visitors	121	81															4
Total	527	1021	94	43	15	9	10										116
Westinghouse Electric/NRF																	
09-01-0050-01																	
Employees	91	495	125	62	10	1	1										79
Visitors	103	24	3														2
Total	194	519	128	62	10	1	1										80
Subtotal	732	1853	289	142	43	11	11										249

**TABLE B-7**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**RICHLAND OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)											Total Man-Rem				
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6		6-7	7-8	8-9	9-10
<b>Automation Industries</b>																
10-00-0205-01																
Employees	5	35	21	6												8
Visitors		1														<1
Total	5	36	31	6												8
<b>Battelle Memorial Inst.</b>																
10-00-0013-02																
Employees	9	747	187	59	32	18	25	1								168
Visitors	100	70	5													4
Total	109	817	192	59	32	18	25	1								172
<b>BCS Richland Inc.</b>																
10-00-0056-01																
Employees		5	1													<1
Visitors		2														<1
Total		7	1													<1
<b>Hanford Eng. Dev. Lab.</b>																
10-00-0142-01																
Employees	21	482	213	79	36	24	21	1								169
Visitors	9	30	4	2			1	1								7
Total	30	512	217	81	36	24	22	2								175
<b>Hanford Environ. Health Found.</b>																
10-00-0057-01																
Employees		1	2													<1
Visitors																
Total		1	2													<1



**TABLE B-7 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**RICHLAND OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>J. A. Jones Const. Co.</b>																	
10-00-0058-01																	
Employees	53	813	244	224	158	131	245	49									871
Visitors																	
Total	53	813	244	224	158	131	245	49									871
<b>Rockwell Hanford Opns.</b>																	
10-00-0220-01																	
Employees	31	1199	625	245	98	74	99	11									563
Visitors	110	359	18	1													21
Total	141	1558	643	246	98	74	99	11									585
<b>United Nuclear Ind., Inc.</b>																	
10-00-0055-01																	
Employees	3	55	101	94	53	59	137	170	2								778
Visitors	3	21	2	2													2
Total	6	76	103	96	53	59	137	170	2								780
<b>Subtotal</b>	<b>344</b>	<b>3820</b>	<b>1423</b>	<b>712</b>	<b>377</b>	<b>306</b>	<b>528</b>	<b>233</b>	<b>2</b>								<b>2592</b>

**TABLE B-8**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**SAN FRANCISCO OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>Atomics International</b>																	
11-00-0060-01																	
Employees	761	274	54	17	16	4	18	9	1	1							101
Visitors	616	158	6	1													9
Total	1377	432	60	18	16	4	18	9	1	1							110
<b>Stanford Linear Accel. Ctr.</b>																	
11-00-0062-01																	
Employees	105	37	18	6	1	1	1										10
Visitors																	
Total	105	37	18	6	1	1	1										10
<b>Univ. of California/LBL</b>																	
11-00-0004-02																	
Employees	3063	1057	93	12	4	1	2										80
Visitors																	
Total	3063	1057	93	12	4	1	2										80
<b>Univ. of California/LLL</b>																	
11-00-0004-03																	
Employees	6759	779	106	27	16	3	4	1									89
Visitors	11313	62	3														4
Total	18072	841	109	27	16	3	4	1									92
<b>Univ. of California/CF</b>																	
11-00-0004-04																	
Employees	141	11		3													2
Visitors	309																<1
Total	450	11		3													2

**TABLE B-8 (continued)**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**SAN FRANCISCO OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>Univ. of California/LNM</b>																	
11-00-0004-05																	
Employees	99	10		7	1	1	2										8
Visitors																	
Total	99	10		7	1	1	2										8
<b>Univ. of California/MC</b>																	
11-00-0004-06																	
Employees	20	2															<1
Visitors																	
Total	20	2															<1
<b>Univ. of California/NTS</b>																	
11-00-0004-07																	
Employees	87	13	4	3	1												3
Visitors																	
Total	87	13	4	3	1												3
<b>Subtotal</b>	<b>23273</b>	<b>2403</b>	<b>284</b>	<b>76</b>	<b>39</b>	<b>10</b>	<b>27</b>	<b>10</b>	<b>1</b>	<b>1</b>							<b>305</b>

**TABLE B-9**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**SCHENECTADY NAVAL REACTORS OFFICE**

Contractor	Dose Equivalent Ranges (rem)															Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10		>10	
General Electric Co. 13-00-0006-06																		
Employees	642	1207	118	49	6		1	1										106
Visitors	177	75																4
Total	819	1282	118	49	6		1	1										109
Subtotal	819	1282	118	49	6		1	1										109

**TABLE B-10**  
**DOE CONTRACTORS**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

**SAVANNAH RIVER OPERATIONS OFFICE**

Contractor	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
<b>E. I. duPont/SRP-OPNS</b>																	
14-00-0063-01																	
Employees	2098	2368	673	559	264	162	164	32									1079
Visitors	3460	32	2														2
Total	5558	2400	675	559	264	162	164	32									1081
<b>E. I. duPont/SRP-CON</b>																	
14-00-0063-02																	
Employees	1363	1020	232	123	39	24	10	3									206
Visitors																	
Total	1363	1020	232	123	39	24	10	3									206
<b>Savannah River Ecol. Lab.</b>																	
14-00-0064-01																	
Employees	56	16															1
Visitors																	
Total	56	16															1
<b>Subtotal</b>	<b>6977</b>	<b>3436</b>	<b>907</b>	<b>682</b>	<b>303</b>	<b>186</b>	<b>174</b>	<b>35</b>									<b>1287</b>

**APPENDIX C**  
**DISTRIBUTION OF DOE OPERATIONS OFFICE EMPLOYEES'**  
**AVERAGE WHOLE BODY EXPOSURES**  
**1978**

**TABLE C-1**  
**DOE OPERATIONS OFFICE EMPLOYEES**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

Office	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Headquarters 00-00-0000-00	8	44															2
Subtotal	8	44															2
Albuquerque Operations 01-00-0000-00	234	98	3														5
Amarillo Area Office 01-01-0000-00	8	17	5														2
Dayton Area Office 01-03-0000-00	2	20															1
Kansas City Area Office 01-04-0000-00	7																<1
Los Alamos Area Office 01-05-0000-00	326	21	2	2	1	2											5
Pinellas Area Office 01-06-0000-00	4	4	1														<1
Rocky Flats Area Office 01-07-0000-00		67	1	1													4
Sandia Area Office 01-08-0000-00	1	2															<1
Subtotal	582	229	12	3	1	2											17

TABLE C-1 (continued)  
DOE OPERATIONS OFFICE EMPLOYEES  
AVERAGE WHOLE BODY EXPOSURES - 1978

Office	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Chicago Operations 03-00-0000-00	7	5															<1
Batavia Area Office 03-01-0000-00	1																<1
Brookhaven Area Office 03-02-0000-00	3	3															<1
New Brunswick Lab 03-03-0000-00	57	5	5														1
Environmental Meas. Lab. 03-04-0000-00	26	8	1														1
Subtotal	94	21	6														2
Grand Junction Office 04-00-0000-00	1																<1
Subtotal	1																<1
Idaho Operations Office 05-00-0000-00	519	126	4														7
Subtotal	519	126	4														7



TABLE C-1 (continued)  
DOE OPERATIONS OFFICE EMPLOYEES  
AVERAGE WHOLE BODY EXPOSURES - 1978

Office	Dose Equivalent Ranges (rem)														Total Man-Rem		
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9		9-10	>10
Nevada Operations 06-00-0000-00	4615	199	43	8	1												21
Subtotal	4615	199	43	8	1												21
Oak Ridge Operations 08-00-0000-00		21															1
Paducah Area Office 08-02-0000-00	1																<1
Subtotal	1	21															1
Pittsburgh Naval Reactors 09-00-0000-00	18	31	3	1													2
Idaho Branch 09-01-0000-00		4															<1
Subtotal	18	35	3	1													3
Richland Operations 10-00-0000-00	65	94	9	1													7
Subtotal	65	94	9	1													7
San Francisco Operations 11-00-0000-00	53	16															1
Subtotal	53	16															1

**TABLE C-1 (continued)**  
**DOE OPERATIONS OFFICE EMPLOYEES**  
**AVERAGE WHOLE BODY EXPOSURES - 1978**

Office	Dose Equivalent Ranges (rem)																Total Man-Rem
	< Meas.	< 0.10	0.10 0.25	0.25 0.50	0.50 0.75	0.75 1.00	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	>10	
Schenectady Naval Reactors 13-00-0000-00	11	17															1
West Milton Field Office 13-01-0000-00	1	2															<1
Subtotal	12	19															1
Savannah River Operations 14-00-0000-00	171	55	1														3
Subtotal	171	55	1														3
Morgantown ETC 15-00-0000-00	1	4															<1
Subtotal	1	4															<1



**UNITED STATES  
DEPARTMENT OF ENERGY  
WASHINGTON, D.C. 20585**

OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID  
U.S. DEPARTMENT OF ENERGY  
DOE 350



THIRD CLASS MAIL