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Thirteenth Annual Report Radiation Exposure For DOE and DOE Contractor Employees-1980

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THIRTEENTH ANNUAL REPORT
RADIATION EXPOSURES FOR DOE AND DOE CONTRACTOR EMPLOYEES
1980

PREFACE

This report is one of a series of annual reports provided by the U.S. Department of Energy (DOE) summarizing occupational radiation exposures received by DOE and DOE contractor employees. These reports provide an overview of radiation exposures received each year as well as identification of trends in exposures being experienced over the years.

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. At the same time, a contract was made with Union Carbide Corporation at Oak Ridge, Tennessee, to computerize the processing of the radiation exposure reporting system. Annual summary reports were published from 1969 through 1973 (WASH-1350-R1 through WASH-1350-R6), and included information on AEC contractor employees and visitors, as well as employees and visitors of companies in the private sector licensed by the AEC.

In January 1975, with the separation of the AEC into the Energy Research and Development Agency (ERDA) and the U.S. Nuclear Regulatory Commission (NRC), each agency assumed responsibility for collecting and maintaining occupational exposure information reported by the facilities under its jurisdiction. Former AEC licensees reported to the NRC while contractors reported to ERDA. At the same time, a contract was made with Union Carbide Corporation at Oak Ridge, Tennessee, to computerize the reporting and processing of both the ERDA and NRC radiation exposure reporting systems. On October 1, 1977, DOE was formed and assumed the responsibilities of ERDA. Processing and programming of exposure information continued at Oak Ridge until October 1978, when the management and further development of the DOE radiation exposure reporting system was assigned to the System Safety Development Center, EG&G Idaho, Inc.; the NRC system remained at Oak Ridge.

Radiation exposure data for ERDA and ERDA contractor employees and visitors for 1974 through 1976 were reported in ERDA 76/119, ERDA 77-29, and DOE/EV-0011/9. The DOE and DOE contractor radiation exposure data for 1977, 1978, and 1979 were presented in DOE/EV-0066/10, 11, and 12, respectively. This report contains 1980 radiation exposure data for DOE and DOE contractors. A revised version of the 1979 report was issued.

Previous reports for AEC/ERDA/DOE government and contractor employees and visitors may be obtained from the U.S. DOE Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

SUMMARY

All Department of Energy (DOE) and DOE contractors are required by DOE Order 5484.1, Chapter IV to submit occupational exposure records to a central repository. The data required includes a summary of whole-body exposures to ionizing radiation, a summary of internal depositions of radioactive materials above specified limits, and occupational exposure reports for terminating employees. This report is a summary of the data submitted by DOE and DOE contractors for 1980.

A total of 85,465 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposures in 1980. This represents 62.1% of all DOE and DOE contractor employees and is a decrease from the number of individuals monitored in 1979. In addition to the employees, 87,590 visitors were monitored.

Of all employees monitored, 52.72% received a dose equivalent that was less than measurable, 45.51% a measurable exposure less than 1 rem, and 1.77% an exposure greater than 1 rem. The exposure received by 87.96% of the visitors to DOE facilities was less than measurable. Only 12.03% of the visitors received a measurable exposure less than 1 rem, and 0.01% of the visitors received an exposure greater than 1 rem. No employees or visitors received a dose equivalent greater than 4 rem.

The collective dose equivalent for DOE and DOE contractor employees was 7,405 person-rem. The collective dose equivalent for visitors was 619 person-rem. The total dose equivalent for employees and visitors combined was 8,024 person-rem. The average dose equivalent for all individuals (employees and visitors) monitored was 46 mrem and the average dose equivalent for all employees who received a measurable exposure was 187 mrem. The highest average dose equivalent was observed for employees monitored at fuel processing facilities (333 mrem) and the lowest among visitors (7 mrem) to DOE facilities. These averages are significantly less than the DOE 5-rem/year radiation protection standard for whole-body exposures.

Five cases of internal depositions were reported in 1980. In all cases, the depositions were less than the annual dose-equivalent standard. Internal depositions were the result of accidental, not planned, exposures.

A total of 8,968 monitored employees terminated their employment in 1980. The average cumulative dose equivalent for terminated employees who worked one to two years was 0.36 rem; three to four years, 0.57 rem; five to six years, 0.57 rem; and longer than six years, 2.97 rem. The average cumulative dose equivalent for employees who terminated with more than six years of employment appears high in comparison with the other data. However, this average includes the cumulative exposure of individuals who worked for DOE or DOE contractors for over 20 years.

Seven individuals terminated their employment with two or more DOE employers during one calendar quarter in 1980. The average individual quarterly dose equivalent for these transient workers was 1.22 rem, which is less than the quarterly radiation protection standard of 3 rem.

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INTRODUCTION

One of the basic Department of Energy (DOE) radiation protection policy objectives is that radiation exposures be maintained as low as is reasonably achievable (ALARA) and within the occupational exposure guidelines provided in DOE Order 5480.1, Chapter XI (Table 1). Assurance that occupational exposures do not exceed the guidelines is not considered, in itself, sufficient. All operations are to be conducted "in a manner to assure that radiation exposures to individuals and population groups are limited to the lowest levels technically and economically feasible."

TABLE 1. Radiation Protection Standards for External and Internal Dose Equivalents for Individuals in Controlled Areas

Type of Exposure	Exposure Period	Dose Equivalent (Dose or Dose Commitment)(rem)[a]
Whole body, head and trunk, gonads, lens of the eye,[b] red bone marrow, active blood-forming organs.	Year	5[c]
	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[d]	Year	30
	Calendar quarter	10
Hands[d] and feet	Year	75
	Calendar quarter	25

(a)To meet the dose commitment standards above, 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 radionuclide(s) that would commit the individual to an organ dose which exceeds the limits specified in this table.

(b)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).

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

(d)All reasonable effort shall be made to keep exposure of forearms and hands to the general limit for the skin.

To assist in the determination that exposures to individuals are maintained at the lowest level practicable, DOE requires the submittal of occupational radiation exposure records to a central repository. The data required includes a summary of whole-body exposure to ionizing radiation, a summary of internal depositions of radioactive materials, and occupational exposure reports for terminating employees. The central data base also includes occupational radiation exposure information for the Atomic Energy Commission (AEC) and the Energy Research and Development Agency (ERDA).

This report is a summary of the data submitted in 1980 by DOE and DOE contractor offices. For the purpose of trend analysis, the data is compared to that reported in previous years. The data used to prepare this report is presented in Appendix A, "Distribution of Whole-Body Exposures by Facility Type for Each DOE Field Organization, 1980"; Appendix B, "Distribution of Annual Whole Body Exposures by Contractor for Each DOE Field Organization, 1980"; and Appendix C, "Distribution of Annual Whole-Body Exposures for DOE Government Employees and Visitors by DOE Field Organization, 1980."

SUMMARY OF WHOLE-BODY IONIZING RADIATION EXPOSURES

Monitoring is required by DOE Order 5480.1, Chapter XI, where the potential exists for an individual to receive a dose or dose commitment in any calendar quarter in excess of the 10% of the quarterly or annual occupational exposure guidelines shown in Table 1. Depending on the administrative policy of the contractor, monitoring may also be provided to individuals, such as clerical workers, for whom the exposure potential is extremely low.

The number of individuals who received an occupational whole-body exposure in one of 18 dose-equivalent intervals ranging from "less than measurable" to "greater than 10 rem" is provided annually by each DOE contractor and DOE office. A positive, measurable exposure is any recorded exposure greater than the minimum sensitivity of a personnel monitoring device. The data is further subdivided into one of 10 facility types.

Contractors have the option of reporting the distribution of whole-body occupational dose equivalents only for those individuals for whom monitoring is required, or for all those for whom monitoring is provided. Many contractors choose to report the latter, thus increasing the number of individuals who are considered to be radiation workers. To account for this effect, the average dose equivalent per individual receiving a measurable exposure is calculated as well as the average dose equivalent per individual monitored.

The annual collective dose equivalent is calculated by multiplying the number of individuals in each dose range by the midpoint of the range, and then summing the products. This procedure allows an estimate of the collective dose equivalent to be calculated without knowledge of each individual's annual dose. However, a source of error is introduced into the calculation by the assumption that the midpoint of the dose-equivalent range is the mean dose equivalent of the individuals reported in each dose-equivalent range. Frequently, the actual mean dose equivalent in each range is less than the assumed arithmetic mean. Thus, collective dose equivalents presented in this report may be slightly higher than the actual collective dose equivalents.

DISTRIBUTION BY DOSE INTERVAL

The number of employees and visitors who received a dose equivalent in each of 18 dose-equivalent ranges is presented in Table 2. There were no DOE employees or visitors who received a dose equivalent greater than 4 rem. A total of 85,465 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposure in 1980. This represents 62.1% of all DOE and DOE contractor employees. In addition to the employees, 87,590 visitors were monitored at DOE facilities. Visitors may include radiation workers from another DOE facility present on an interim basis.

TABLE 2. Distribution of Whole Body Ionizing Radiation Exposures for DOE/DOE Contractor Employees and Visitors by Dose-Equivalent Interval

Dose-Equivalent Interval	Number of Persons			Collective Person-rem		
(rem)	Employees	Visitors	Total	Employees	Visitors	Total
<Measurable	45,054	77,045	122,099	0	0	0
Measurable to 0.10	29,384	10,109	39,493	1,470	505	1,975
0.10 to 0.25	4,902	341	5,243	858	60	918
0.25 to 0.50	2,674	62	2,736	1,003	23	1,026
0.50 to 0.75	1,244	18	1,262	777	12	789
0.75 to 1.00	691	9	700	604	8	612
1 to 2	1,113	4	1,117	1,670	6	1,676
2 to 3	387	2	389	967	5	972
3 to 4	16	0	16	56	0	56
4 to 5	0	0	0	0	0	0
5 to 6	0	0	0	0	0	0
6 to 7	0	0	0	0	0	0
7 to 8	0	0	0	0	0	0
8 to 9	0	0	0	0	0	0
9 to 10	0	0	0	0	0	0
>10	0	0	0	0	0	0
TOTAL	85,465	87,590	173,055	7,405	619	8,024

A comparison of DOE and DOE contractor employees, the number of employees monitored and the number of employees who did not receive a measurable dose equivalent in the last five years is presented in Figure 1. The number of employees monitored in 1980 decreased from the number reported in previous years (Figure 1). This was primarily due to the decision of a contractor to report only the dose-equivalent distribution for those employees for whom monitoring is required rather than all employees.

Of all employees monitored, 52.72% received a dose equivalent that was less than measurable, 45.51% a measurable exposure less than 1 rem, and 1.77% an exposure greater than 1 rem (Figure 2). The exposure received by 87.96% of the visitors to DOE facilities was less than measurable. Only 12.03% of the visitors received an exposure between measurable and 1 rem, and 0.01% of the visitors received an exposure greater than 1 rem (Figure 2).

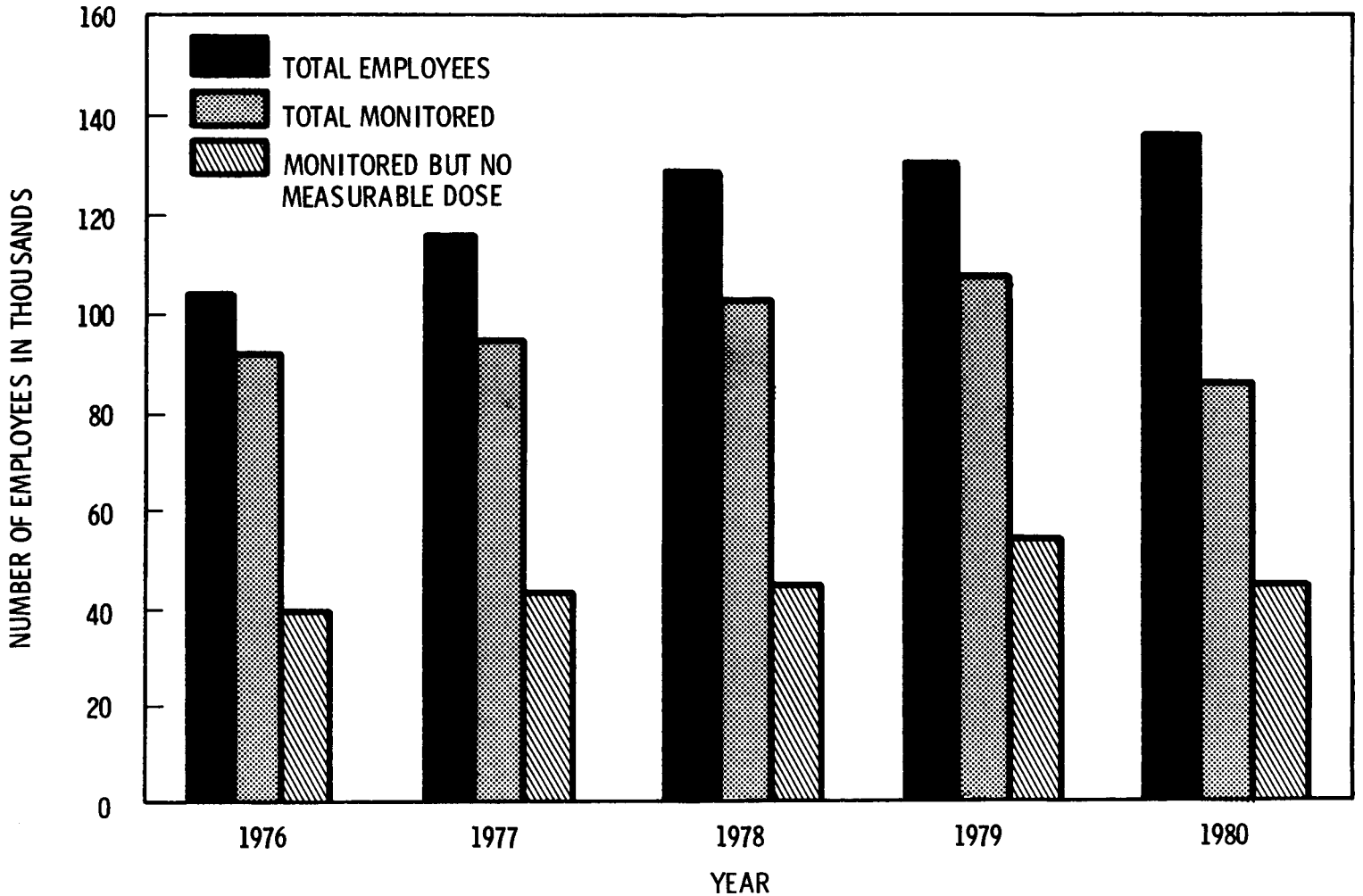

FIGURE 1. Comparison of Number of Employees, Number of Employees Monitored, and Number of Employees Monitored Who Received No Measurable Dose Equivalent

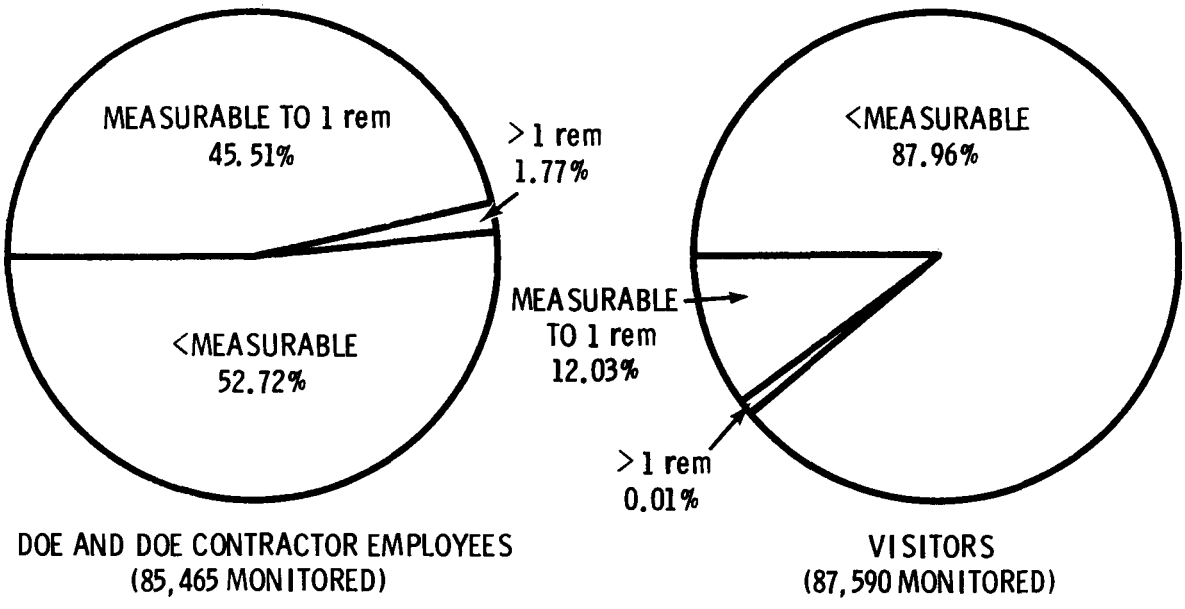

FIGURE 2. Percent of Monitored Employees and Percent of Monitored Visitors Who Received an Exposure Less Than Measurable, Less Than 1 rem, or Greater Than 1 rem

The collective dose equivalent was 7,405 person-rem for all DOE and DOE contractor employees, and 619 person-rem for visitors to DOE facilities, for a total collective dose equivalent of 8,024 person-rem. The contribution of the individuals in each dose-equivalent interval to the collective dose equivalent is shown in Figure 3. Individuals whose exposure was less than 1 rem contributed the greatest portion of the total person-rem.

The distribution of whole-body exposures for the years 1965-1980 is presented in Table 3. As can be observed in Table 3, the number of employees who received a dose equivalent greater than 1 rem has gradually declined since 1965. This same downward trend in the occupational exposures can be observed in Figure 4 that shows the collective dose equivalent for all individuals from 1965 to 1980 who received an exposure greater than 1 rem. The collective dose equivalent for individuals who received an exposure less than 1 rem was not included because prior to 1974, a less-than-measurable exposure was not distinguished from measurable exposures in the reporting system. This decrease in the collective dose equivalent has been achieved even though some work was performed in older facilities which were not constructed using current design criteria. This trend reflects both changes in the nature of the work performed at DOE facilities and the consistent application of ALARA practices throughout all DOE operations.

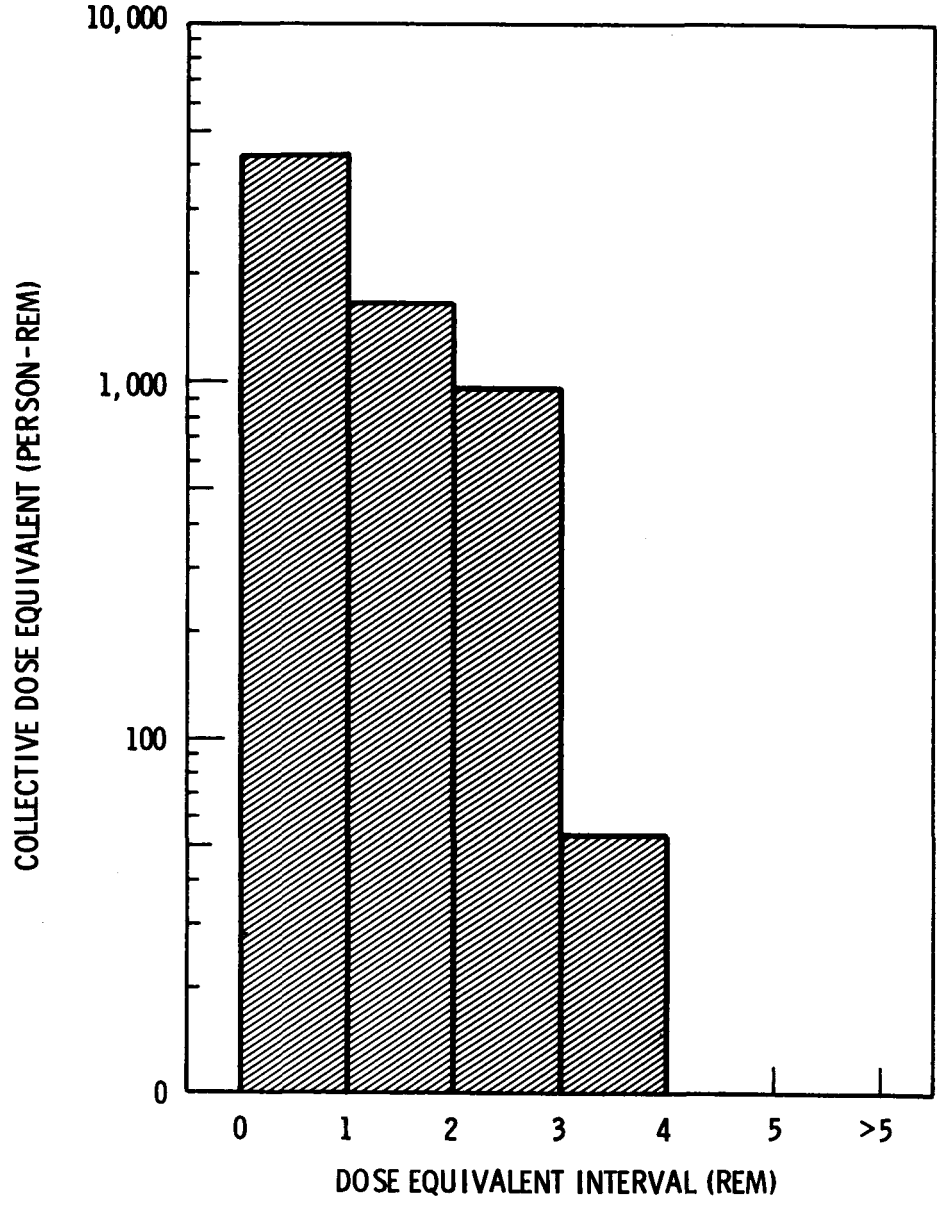

FIGURE 3. Contribution of Each Dose-Equivalent Interval to the Total Collective Dose Equivalent, 1980

TABLE 3. Distribution of Whole-Body Ionizing Radiation Exposures for DOE/DOE Contractor Employees, 1965-1980

Year	Dose Equivalent Ranges (rem)														Total Monitored
	0-1[a] <Meas.	Meas.-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	>12	
1965	128,360		4,158	1,704	515	294	70	32	26	25	22	6	2		135,214
1966	131,522		3,706	1,630	593	313	88	47	24	6	2			1	137,932
1967	102,510		3,472	1,572	555	168	35	29	23	17	4	1			108,386
1968	103,206		2,799	1,408	425	144	3	1							107,986
1969	98,625		2,554	1,313	335	86	4					1			102,918
1970	92,185		2,698	1,329	279	158	5	4	2		1				96,661
1971	90,640		2,380	888	275	118	8	3				1		2	94,315
1972	86,077		2,130	929	219	95	8	2							89,460
1973	89,071		1,944	727	172	60	2	1							91,977
1974	43,184	32,500	1,667	688	149	40	4								78,232
1975	43,310	42,141	1,846	753	232	142				1					88,425
1976	40,083	47,886	1,679	475	70	6	1								90,200
1977	43,017	49,948	1,579	545	103	23			1	2				2	95,220
1978	44,898	55,296	1,323	439	53	11									102,020
1979[b]	50,003	53,235	1,286	416	33	10	1				0			2	104,986
1980	45,054	38,895	1,113	387	16										85,465

[a]Separation of data prior to 1974 is unavailable.
[b]The 1979 data differs slightly from those listed in the original 1979 report because of an error in the dose-equivalent calculation by a contractor.

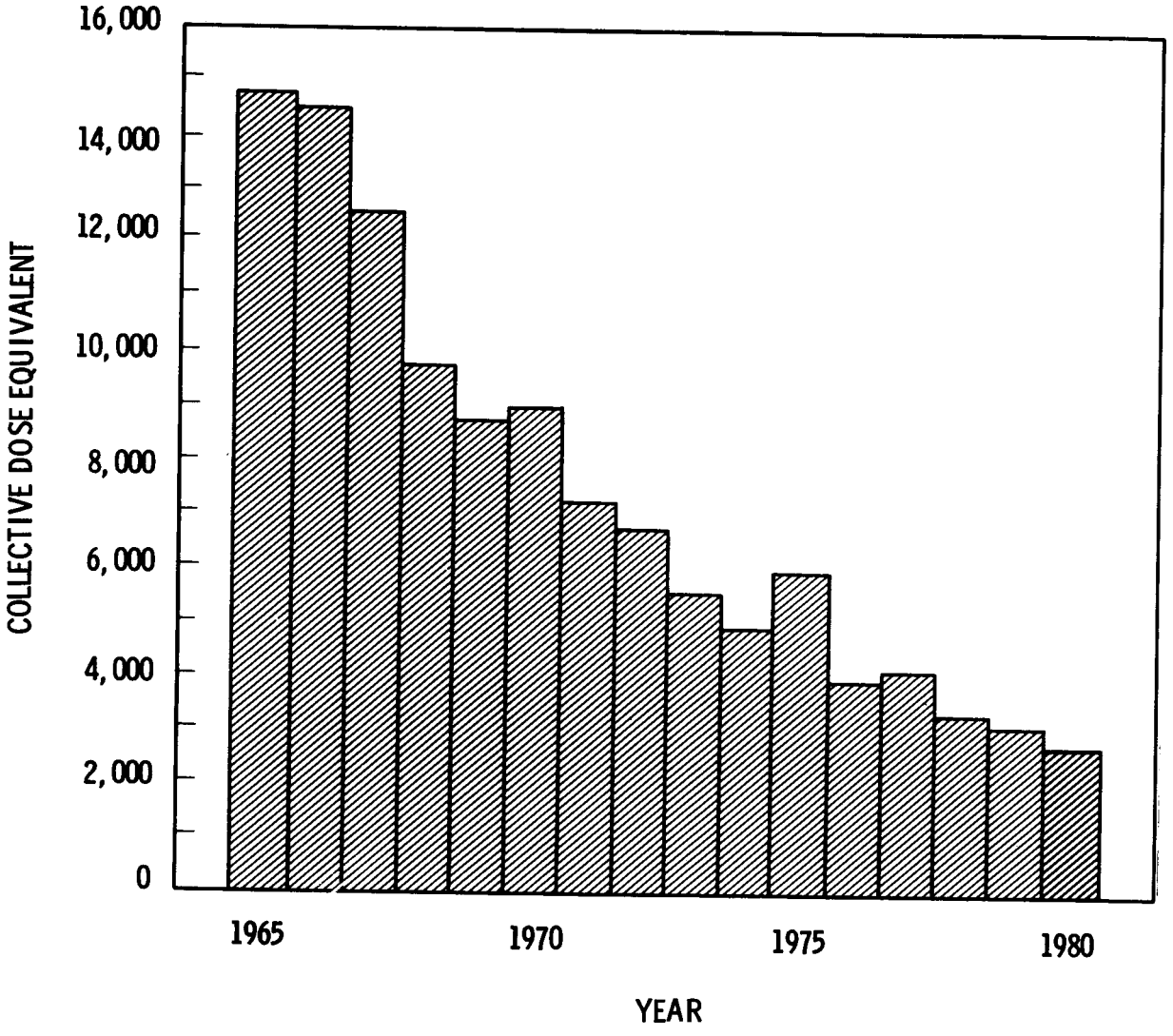

FIGURE 4. Total Collective Dose Equivalent for All DOE/DOE Contractor Employees Who Received an Exposure Greater Than 1 rem, 1965-1980

DISTRIBUTION BY FACILITY TYPE

The number of individuals and the distribution of the annual whole-body exposures in each of 11 facility categories was reported to the central repository. For the purpose of this report, visitors were considered a facility type. The contribution of each facility type to the collective dose equivalent is shown in Figure 5. The largest percentage of the total collective dose equivalent was in the category "Other." Examples of facilities included in the "Other" category include radioactive waste handling and construction. "General Research" was a close second. As would be expected, the smallest contribution was from DOE offices. A summary of the data submitted is presented in Table 4.

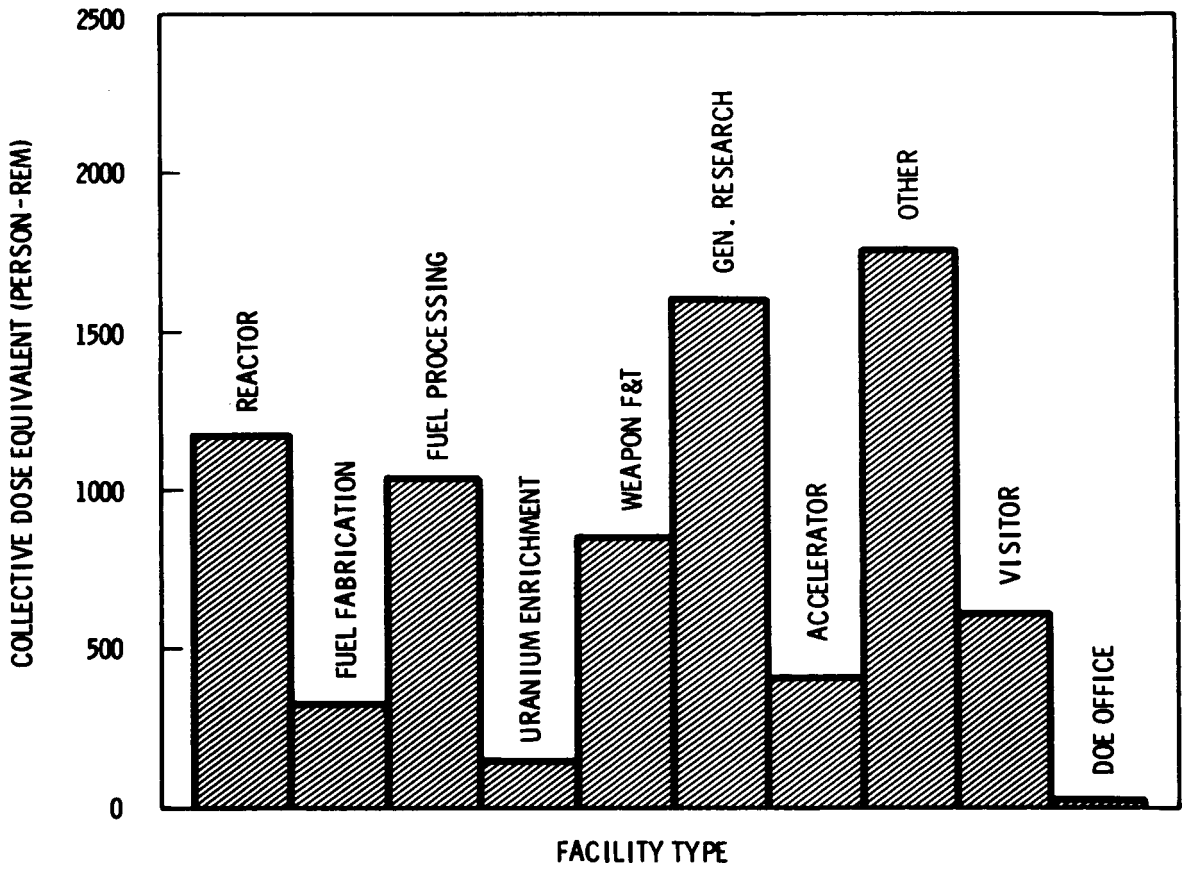

FIGURE 5. Contribution of Each Facility Type to the Total Collective Dose Equivalent

TABLE 4. Distribution of Annual Whole-Body Exposures for DOE/DOE Contractor Employees and Visitors by Facility Type, 1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)																	Total Person-Rem
		< Meas.	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	10-11	11-12	>12	
Reactor	6,921	2,654	2,569	699	449	171	77	165	135	2										1,185
Fuel Fabrication	2,102	734	793	266	143	57	43	55	11											323
Fuel Processing	3,147	778	1,041	356	329	199	116	237	91											1,047
Uran. Enrichment	1,871	535	861	364	87	19	4	1												156
Weapon F&T	15,904	8,659	5,967	629	315	143	82	93	14	2										869
Gen. Research	36,110	22,933	10,749	1,225	558	296	155	163	24	7										1,611
Accelerator	5,315	3,347	1,244	360	159	77	45	70	11	2										412
Other	12,037	3,870	5,670	982	631	282	169	329	101	3										1,773
Visitors	87,590	77,045	10,109	341	62	18	9	4	2											619
DOE Offices	2,058	1,544	490	21	3															29
TOTAL EXPOSURES	173,055	122,099	39,493	5,243	2,736	1,262	700	1,117	389	16										8,024
TOTAL PERSON-REM			1,975	918	1,026	789	612	1,676	972	56										8,024

The average dose equivalent by facility type per individual monitored and per individual monitored with measurable exposure is shown in Table 5. The average dose equivalent per individual monitored for all facilities combined was 46 mrem. The highest average dose equivalent per individual monitored was observed at fuel processing facilities (333 mrem) and the lowest was observed for visitors to DOE facilities (7 mrem). The average dose equivalent per individual monitored with a measurable exposure was 158 mrem. The highest average dose equivalent for all monitored employees was observed at fuel processing facilities (442 mrem) and the lowest was observed for DOE office personnel (56 mrem).

TABLE 5. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Facility Type, 1980

Facility Type	No. Individuals Monitored	No. Individuals With Measurable Exposure	Total No. Person-rem	Average Dose Equivalent (mrem) Per Individual Monitored	Average Dose Equivalent (mrem) Per Individual Monitored With Measurable Exposures
Reactor	6,921	4,267	1,185	171	277
Fuel Fab.	2,102	1,368	323	153	236
Fuel Proc.	3,147	2,369	1,047	333	442
Uran. Enrich.	1,871	1,336	156	83	117
Weapon F&T	15,904	7,245	869	54	120
Gen. Research	36,110	13,177	1,611	44	122
Accelerator	5,315	1,968	412	77	209
Other	12,037	8,167	1,773	147	217
Visitors	87,590	10,545	619	7	58
DOE Offices	2,058	514	29	14	56
TOTAL	173,055	50,956	8,024	46	158

DISTRIBUTION BY FIELD ORGANIZATION

For each field organization, the number of employees monitored and the collective dose equivalent are shown in Table 6. Differences in the collective dose equivalent at each field organization reflect differences in the nature of the work performed and the administrative policy concerning whether the dose distribution is reported for all employees or only for those for whom monitoring is required. Table 7 provides an indication of the work done at each field organization by showing what fraction of the collective dose equivalent at each field organization is attributed to each facility type. Trends in collective dose equivalent from 1975 to 1980 can be observed for each field organization in Table 8.

TABLE 6. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1980

Field Organization	No. Individuals Monitored	No. Individuals With Measurable Exposure	Collective Dose Equivalent (Person-rem)	Average Dose Equivalent (mrem) Per Individual Monitored	Average Dose Equivalent (mrem) Per Individual Monitored With Measurable Exposures
Albuquerque	30,163	17,386	1,700	56	98
Chicago	19,475	6,077	918	47	151
Grand Junction	180	51	9	50	176
Idaho	38,651	1,901	593	15	312
Nevada	21,919	694	50	2	72
Oak Ridge	5,828	4,250	604	104	142
Pittsburgh Naval Reactor	2,606	2,157	186	71	86
Richland	9,466	7,583	2,256	238	298
San Francisco	30,725	3,050	240	8	79
Schenectady Naval Reactor	2,295	1,353	79	34	58
Savannah River	11,747	6,454	1,391	118	216
TOTAL	173,055	50,956	8,026	46	158

TABLE 7. Fraction of Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors Attributed to a Facility Type Within Each Field Organization, 1980

Field Organization	Facility Type									
	Reactor	Fuel Fab.	Fuel Proc.	Uran. Enrich.	Weapon F&T	Gen. Research	Acceler.	Other	Visitor	DOE Office
Albuquerque					0.45	0.30		<0.01	0.24	0.01
Chicago	0.04					0.32	0.44	0.09	0.11	
Grand Junction								1.00		
Idaho	0.31		0.68							0.01
Nevada					0.44				0.46	
Oak Ridge		0.18		0.26	0.08	0.36		0.10	0.02	
Pittsburgh Naval Reactor	0.42					0.52		0.01	.04	0.01
Richland	0.29	0.02				0.09		0.58	0.02	<0.01
San Francisco		0.21			0.01	0.69	0.03		0.06	
Savannah River	0.13	0.09	0.46		0.02	0.06		0.22	0.01	<0.01
Schenectady Naval Reactor	0.56					0.37		0.01	0.05	0.01
ALL FIELD ORGANIZATIONS COMBINED	0.15	0.04	0.13	0.02	0.11	0.20	0.05	0.22	0.08	<0.01

TABLE 8. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1975-1980[a]

Field Organization	1975	1976	1977	1978	1979	1980
Albuquerque	2,324	1,437	2,300	2,399	1,873	1,700
Chicago	1,638	1,354	1,373	1,167	1,061	918
Grand Junction	5	<1	<1	2	8	9
Idaho	611	790	929	899	876	593
Nevada	55	25	49	47	55	50
Oak Ridge	1,284	1,351	1,300	1,566	1,332	604
Pittsburgh Naval Reactor	1,876	1,609	653	252	196	186
Richland	2,257	2,265	3,197	2,596	2,571	2,256
San Francisco	283	285	334	307	264	240
Schenectady Naval Reactor	1,022	203	148	111	114	79
Savannah River	1,268	1,278	1,298	1,289	1,343	1,391
TOTAL	12,622	10,597	11,581	10,635	9,693	8,024

(a)Throughout this report, minor variations in collective dose-equivalent values may occur due to computer rounding.
(b)The 1979 data differ slightly from those listed in the 1979 report because of an error in the dose-equivalent calculation by a contractor.

SUMMARY OF INTERNAL EXPOSURES

Internal body depositions of radioactive material result from accidental, not planned, exposures. A report of internal body deposition of radioactive materials is required when:

1. any uptake of radioactive material occurred 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% of the pertinent annual dose equivalent standard set forth in DOE Order 5484.1, Chapter XI; or when

2. any previously unreported uptake of radioactive material was determined to have been reportable according to the above criteria by reason of the most recent dose-equivalent estimates.

Table 9 gives a four-year comparison of new cases of internal body depositions. Only those cases occurring within each year are included. Cases where the effects of prior years' depositions are continuing or where a new uptake is not clearly identified are not included.

TABLE 9. Dose Distributions for Cases of Internal Body Depositions, 1977-1980

Year	Radionuclide	Critical Organ	Dose Equivalent Interval (rem) 7.5-10	10-15	15-25	25-50	50-100	100-200
1977	^{238}Pu	Lung	1		1	1		
1978	^{239}Pu, ^{240}Pu, ^{241}Pu	Lung	1					
	^{125}I	Thyroid	1					
1979	^{234}U, ^{235}U, ^{238}U	Lung	2					
1980	^{238}Pu	Bone			3(a)	1(b)		
	^{234}U, ^{235}U, ^{238}U	Lung	1					

(a)These previously unreported individuals exceeded 50% of the annual standard during 1980 as a result of chronic buildup due to translocation from the lungs from prior years' exposure. No acute exposure is known to have occurred.

(b)One individual exceeded 100% of the annual standard in 1980 for unknown reasons. This individual received a Type B plutonium lung exposure as a result of an incident in 1971, and has been excluded from work with plutonium since that time. Since the systemic burden was less than half the standard in 1978, this new information was also reported. This individual's case is being closely followed to see if some mechanism for the increase in systemic burden can be determined.

Of 13 reported internal deposition cases for 1980, five are considered new and are included in Table 9. The 8 remaining cases are not included for the following reasons: in seven cases, the current burden has decreased from the measured level of previous years. These instances are judged as continued tracking of a previous uptake. In one other case, the reported current burden was slightly higher than was previously measured, indicating either a re-evaluation of the burden, or a possible new uptake.

SUMMARY OF WORKER TERMINATIONS

A total of 8,929 monitored workers terminated their employment with DOE or DOE contractors in 1980. Table 10 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 cumulative dose equivalent for workers terminating in 1980 after 1 to 365 days of employment was significantly less than the 5 rem/year radiation protection standard for the whole body.

The average cumulative dose equivalent for workers who terminated after more than six years of employment was 2.97 rem. This average appears high in comparison with the average cumulative dose equivalent for employees who terminated with less than six years of employment. However, this average includes the cumulative exposure of individuals who worked for DOE or DOE contractors for more than 20 years.

TABLE 10. Average Cumulative Dose Equivalent for Individuals Terminating in 1980

Length of Employment	Number of Terminated Employees	Total Cumulative Dose Equivalent (Person-rem)	Average Cumulative Dose Equivalent Per Terminated Employee (rem)
1-90 days	1,709	596.54	0.35
90-180 days	892	265.42	0.30
180-365 days	1,164	472.32	0.41
1-2 years	1,267	460.31	0.36
3-4 years	1,281	735.59	0.57
5-6 years	566	321.30	0.57
>6 years	2,050	6082.14	2.97

SUMMARY OF TRANSIENT WORKERS

Seven individuals terminated their employment with two or more employers during one calendar quarter in 1980. The average individual quarterly dose equivalent for these transient workers was 1.22 rem, which is less than the quarterly radiation protection standard of 3 rem for the whole body (Table 1). This average dose equivalent is greater than that observed in 1979, when the two individuals who terminated with two or more employers in one calendar quarter did not receive a measurable dose equivalent (Table 11).

TABLE 11. Summary of Transient Workers, 1973-1980

Year	Number of Transient Workers	Total Person-rem Accumulated	Average Individual Quarterly Exposure (rem)
1973	62	140.49	2.27
1974	26	31.19	1.20
1975	8	22.71	2.84
1976	9	2.48	0.28
1977	12	2.01	0.17
1978	9	0.20	0.02
1979	2	0.00	0.00
1980	7	8.55	1.22
TOTAL	135	207.63	1.54

APPENDIX A

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE FOR EACH DOE FIELD ORGANIZATION, 1980

TABLE A.1
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
ALBUQUERQUE FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)															Total Person-rem
		< Meas.	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																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	7685	1146	5497	488	252	125	74	87	14	2								770
Gen. Research	9740	6691	2316	320	165	98	50	84	10	6								511
Accelerator																		
Other	89	68	7	6	7			1										6
Visitors	11848	4309	7417	104	9	5	2	2										400
DOE Offices	801	563	233	4	1													13
TOTAL	30163	12777	15470	922	434	228	126	174	24	8								1700
TOTAL PERSON-REM			774	161	163	143	110	261	60	28								1700

TABLE A.2
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
CHICAGO FIELD ORGANIZATION
1980

Facility Type	Total Monitored	< Meas.	Dose Equivalent Ranges (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	Total Person-rem
Reactor	255	54	80	70	34	13	4											41
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	5605	3061	2071	248	101	71	35	15	3									290
Accelerator	5123	3197	1218	350	156	76	44	69	11	2								405
Other	928	635	205	44	13	4	2	12	10	3								81
Visitors	7521	6413	900	161	33	6	4	2	2									101
DOE Offices	43	38	4	1														
TOTAL	19475	13398	4478	874	337	170	89	98	26	5								918
TOTAL PERSON-REM			224	153	127	106	78	147	65	18								918

TABLE A.3
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
GRAND JUNCTION FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)															Total Person-rem
		< Meas.	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																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research																		
Accelerator																		
Other	159	108	20	22	8		1											9
Visitors	21	21																
DOE Offices																		
TOTAL	180	129	20	22	8		1											9
TOTAL PERSON-REM			1	4	3		1											9

TABLE A.4
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
IDAHO FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)																Total Person-rem
		< Meas.	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	3014	1934	682	219	100	41	14	24										184
Fuel Fabrication																		
Fuel Processing	1350	617	298	104	80	65	34	109	43									404
Uran. Enrichment																		
Weapon F&T																		
Gen. Research																		
Accelerator																		
Other																		
Visitors	34058	34057	1															
DOE Offices	229	142	82	5														5
TOTAL	38651	36750	1063	328	180	106	48	133	43									593
TOTAL PERSON-REM			53	57	68	66	42	200	107									593

TABLE A.5
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
NEVADA FIELD ORGANIZATION
1980

Facility Type	Total Monitored	< Meas.	Dose Equivalent Ranges (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	Total Person-rem
Reactor																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	7672	7374	254	36	7	1												22
Gen. Research																		
Accelerator																		
Other	235	233	2															
Visitors	13460	13069	339	44	8													28
DOE Offices	552	549	3															
TOTAL	21919	21225	598	80	15	1												50
TOTAL PERSON-REM			30	14	5	1												50

TABLE A.6
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
OAK RIDGE FIELD ORGANIZATION
1980

Facility Type	Total Monitored	< Meas.	Dose Equivalent Ranges (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	Total Person-rem
Reactor																		
Fuel Fabrication	722	134	320	146	74	22	18	8										111
Fuel Processing																		
Uran. Enrichment	1871	535	861	364	87	19	4	1										156
Weapon F&T	287	21	127	75	47	12	3	2										50
Gen. Research	1419	552	524	141	83	47	24	37	10	1								216
Accelerator																		
Other	1119	7	1098	11	3													58
Visitors	410	329	56	8	9	5	3											13
DOE Offices																		
TOTAL	5828	1578	2986	745	303	105	52	48	10	1								604
TOTAL PERSON-REM			149	130	114	66	45	72	25	3								604

TABLE A.7
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
PITTSBURGH NAVAL REACTORS FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)															Total Person-rem
		< Meas.	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	947	106	651	131	52	7												79
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1342	214	944	116	56	10	2											97
Accelerator																		
Other	26	11	14	1														1
Visitors	239	109	130															7
DOE Offices	52	9	41	2														2
TOTAL	2606	449	1780	250	108	17	2											186
TOTAL PERSON-REM			89	44	40	11	2											186

TABLE A.8
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
RICHLAND FIELD ORGANIZATION
1980

Facility Type	Total Monitored	< Meas.	Dose Equivalent Ranges (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	Total Person-rem
Reactor	685	15	172	79	71	37	39	136	134	2								652
Fuel Fabrication	82	1	17	26	19	8	2	3	6									39
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	2273	273	1640	209	78	30	26	16	1									216
Accelerator																		
Other	4664	498	2480	520	404	226	146	301	89									1310
Visitors	1697	1086	596	10	3	2												34
DOE Offices	65	10	44	9	2													5
TOTAL	9466	1883	4949	853	577	303	213	456	230	2								2256
TOTAL PERSON-REM			248	149	217	190	186	684	575	7								2256

TABLE A.9
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SAN FRANCISCO FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)															Total Person-rem
		< Meas.	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																		
Fuel Fabrication	890	540	282	38	10	3	5	9	3									52
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	96	83	8	3	1	1												2
Gen. Research	13718	11327	2197	135	37	14	5	3										165
Accelerator	192	150	26	10	3	1	1	1										7
Other																		
Visitors	15767	15514	239	14														14
DOE Offices	62	61	1															
TOTAL	30725	27675	2753	200	51	19	11	13	3									240
TOTAL PERSON-REM			138	35	19	12	10	19	7									240

TABLE A.10
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SAVANNAH RIVER FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)																Total Person-rem
		< Meas.	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	1011	205	378	150	179	73	20	5	1									185
Fuel Fabrication	408	59	174	56	40	24	18	35	2									122
Fuel Processing	1797	161	743	252	249	134	82	128	48									642
Uran. Enrichment																		
Weapon F&T	164	35	81	27	8	4	5	4										25
Gen. Research	1039	416	485	53	38	26	13	8										87
Accelerator																		
Other	4776	2281	1833	377	196	52	20	15	2									309
Visitors	2318	1972	346															17
DOE Offices	234	164	70															4
TOTAL	11747	5293	4110	915	710	313	158	195	53									1391
TOTAL PERSON-REM			206	160	266	196	138	293	132									1391

TABLE A.11
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SCHENECTADY NAVAL REACTORS FIELD ORGANIZATION
1980

Facility Type	Total Monitored	Dose Equivalent Ranges (rem)															Total Person-rem
		< Meas.	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	1009	340	606	50	13													44
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	974	399	572	3														29
Accelerator																		
Other	41	29	11	1														1
Visitors	251	166	85															4
DOE Offices	20	8	12															1
TOTAL	2295	942	1286	54	13													79
TOTAL PERSON-REM			64	10	5													79

APPENDIX B

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR FOR EACH DOE FIELD ORGANIZATION, 1980

TABLE B.1
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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.																	
Employees		862	3	1													44
Visitors																	
Total		862	3	1													44
General Electric Co.																	
Employees	239	105	18	5	1												11
Visitors	7	1															
Total	246	106	18	5	1												11
Inhalation Toxicology																	
Employees	298	54	7	3	2		1										8
Visitors	273	2															
Total	571	56	7	3	2		1										8
Mason & Hanger-Silas																	
Employees	106	448	117	43	28	5	27	10	2								153
Visitors	861	78															4
Total	967	526	117	43	28	5	27	10	2								157
Monsanto Research Co.																	
Employees	613	860	61	18	8	4	1										70
Visitors	707	20															1
Total	1320	880	61	18	8	4	1										71

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																
	< Meas.	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	Total Person-rem
Rockwell International																	
Employees		3192	286	185	88	65	59	4									489
Visitors		6674															334
Total		9866	286	185	88	65	59	4									823
Ross Aviation, Inc.																	
Employees	46	6															
Visitors																	
Total	46	6															
Sandia Laboratories, NM																	
Employees	1968	492	66	19	13	1	5	1	2								69
Visitors	1370	313	24	1	3	1											23
Total	3338	805	90	20	16	2	5	1	2								92
Sandia Laboratories, CA																	
Employees	624	260	3	1													14
Visitors	147	1															
Total	771	261	3	1													14
Teledyne Isotopes																	
Employees	22	1	6	7			1										5
Visitors																	
Total	22	1	6	7			1										5

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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 Bendix Corp.																	
Employees	188	30	3														2
Visitors																	
Total	188	30	3														2
The Zia Company																	
Employees	1082	264	23	15	4	5	1										31
Visitors																	
Total	1082	264	23	15	4	5	1										31
University of California																	
Employees	2719	1246	221	127	79	44	77	9	4								388
Visitors	944	328	80	8	2	1	2										39
Total	3663	1574	301	135	81	45	79	9	4								427
TOTAL ALBUQUERQUE	12214	15237	918	433	228	126	174	24	8								1687

TABLE B.2
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1980

Dose Equivalent Ranges (rem)

Contractor	< Meas.	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	Total Person-rem
Ames Laboratory																	
Employees	75	31	6	5	5	4	9	1									27
Visitors	124	14															1
Total	199	45	6	5	5	4	9	1									28
Argonne National Lab.																	
Employees	2239	439	176	104	69	34	13	3									192
Visitors	3703	79	24	2													9
Total	5942	518	200	106	69	34	13	3									201
Brookhaven National Lab.																	
Employees	183	1281	267	105	59	29	39	9	2								300
Visitors	88	279	80	15	3	4	2	2									47
Total	271	1560	347	120	62	33	41	11	2								347
Chicago Misc.																	
Employees	308	310	74	16	4	3	9	10	3								89
Visitors	296	45	1														2
Total	604	355	75	16	4	3	9	10	3								91
Fermi National Accel.																	
Employees	1185	648	152	61	22	15	21	1									143
Visitors	2189	482	56	16	3												42
Total	3374	1130	208	77	25	15	21	1									185

TABLE B.2 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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.																	
Employees	1975	153	17	12	4		5										25
Visitors																	
Total	1975	153	17	12	4		5										25
Princeton University																	
Employees	911	690	15	1													38
Visitors																	
Total	911	690	15	1													38
TOTAL CHICAGO	13276	4451	868	337	169	89	98	26	5								914

TABLE B.3
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
GRAND JUNCTION FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Bendix Field Eng.																	
Employees	108	20	22	8		1											9
Visitors	21																
Total	129	20	22	8		1											9
TOTAL GRAND JUNCTION	129	20	22	8		1											9

TABLE B.4
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
Arrington Const.																	
Employees	7	2		2													1
Visitors																	
Total	7	2		2													1
Biggers Const.																	
Employees	1	3															
Visitors																	
Total	1	3															
Bingham Mechanical																	
Employees	6	4	3	1			3										6
Visitors																	
Total	6	4	3	1			3										6
C-L Electric Company																	
Employees	3																
Visitors																	
Total	3																
EG&G, Idaho, Inc.																	
Employees	1500	529	174	88	40	12	24										161
Visitors	26312	1															
Total	27812	530	174	88	40	12	24										161

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Exxon Nuclear Co.																	
Employees	567	157	74	60	55	26	88	43									340
Visitors	7745																
Total	8312	157	74	60	55	26	88	43									340
Idaho Miscellaneous																	
Employees	333	169	49	13	1	3											25
Visitors																	
Total	333	169	49	13	1	3											25
Jones-Boecon																	
Employees	5	10															1
Visitors																	
Total	5	10															1
Lehigh Design Co.																	
Employees	28	5															
Visitors																	
Total	28	5															
Morrison-Knudsen																	
Employees	94	90	22	16	10	7	18										54
Visitors																	
Total	94	90	22	16	10	7	18										54

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Ormond Const.																	
Employees	7	9	1														1
Visitors																	
Total	7	9	1														1
Waters Asbestos																	
Employees		2															
Visitors																	
Total		2															
TOTAL IDAHO	36608	981	323	180	106	48	133	43									588

TABLE B.5
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																
	< Meas.	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	Total Person-rem
Air Resources Lab.																	
Employees	43	1															
Visitors	20																
Total	63	1															
CER Geonuclear																	
Employees	1																
Visitors																	
Total	1																
Defense Nuclear Agency																	
Employees	299	5															
Visitors	3286	126	9	1													9
Total	3585	131	9	1													9
Eberline Instrument																	
Employees	1																
Visitors																	
Total	1																
EG&G, Inc.																	
Employees	997	76	4	2													5
Visitors	211																
Total	1208	76	4	2													5

TABLE B.5 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																
	< Meas.	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	Total Person-rem
Environmental Protec.																	
Employees	167	2															
Visitors	70																
Total	237	2															
Fenix & Scisson, Inc.																	
Employees	247	25	7	2													3
Visitors	383																
Total	630	25	7	2													3
Holmes & Narver, Inc.																	
Employees	351	6															
Visitors	230																
Total	581	6															
Nevada Misc.																	
Employees	340	4															
Visitors	282	5															
Total	622	9															
Reynolds Electrical																	
Employees	4680	126	22	3	1												12
Visitors	3495																
Total	8175	126	22	3	1												12

TABLE B.5
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
U.S. Department of Interior																	
Employees	100	6	1														
Visitors	20	1															1
Total	120	7	1														
Wackenhut Services																	
Employees	258	1	1														
Visitors	32																
Total	290	1	1														
Westinghouse Electric																	
Employees	123	4	1														
Visitors	81																
Total	204	4	1														
TOTAL NEVADA	15717	388	45	8	1												31

TABLE B.6
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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 Research Lab.																	
Employees	114	11															1
Visitors	15	2															
Total	129	13															1
Goodyear Atomic Corp.																	
Employees	386	268	240	77	19	4	1										101
Visitors																	
Total	386	268	240	77	19	4	1										101
National Lead Co.																	
Employees	118	288	118	70	22	18	8										103
Visitors																	
Total	118	288	118	70	22	18	8										103
Oak Ridge Assoc. Univ.																	
Employees	409	111	22	2													10
Visitors																	
Total	409	111	22	2													10
Puerto Rico Nuclear Ctr.																	
Employees	36	43	19	5													7
Visitors	59	9															
Total	95	52	19	5													8

TABLE B.6 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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																	
Employees	16	32	28	4													8
Visitors																	
Total	16	32	28	4													8
Rust Engineering Co.																	
Employees		1093	9	3													57
Visitors																	
Total		1093	9	3													57
Union Carbide Corp./ORGDP																	
Employees	47	301	68	4													28
Visitors																	
Total	47	301	68	4													28
Union Carbide Corp./Y-12																	
Employees	21	124	76	36	6	3	2										42
Visitors																	
Total	21	124	76	36	6	3	2										42
Union Carbide Corp./ORNL																	
Employees		364	101	74	46	22	35	10	1								193
Visitors	255	45	8	9	5	3											13
Total	255	409	109	83	51	25	35	10	1								205

TABLE B.6 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Union Carbide Corp./Paducah																	
Employees	102	292	56	6													27
Visitors																	
Total	102	292	56	6													27
Woven Structures, Inc.																	
Employees		3		13	7	2	2										14
Visitors																	
Total		3		13	7	2	2										14
TOTAL OAK RIDGE	1578	2986	745	303	105	52	48	10	1								605

TABLE B.7
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
PITTSBURGH NAVAL REACTOR FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Duquesne Light Co.																	
Employees		190	83	36	3												39
Visitors	13	71															4
Total	13	261	83	36	3												43
Westinghouse Electric/BAPL																	
Employees	201	802	55	22	8	2											65
Visitors	69	37															2
Total	270	839	55	22	8	2											67
Westinghouse Electric/NRF																	
Employees	119	603	109	50	6												72
Visitors	27	22															1
Total	146	625	109	50	6												73
Westinghouse Plant Appa.																	
Employees	11	14	1														1
Visitors																	
Total	11	14	1														1
TOTAL PITTSBURGH	440	1739	248	108	17	2											183

TABLE B.8
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1980

Dose Equivalent Ranges (rem)

Contractor	< Meas.	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	Total Person-rem
Automation Industries																	
Employees	63	153	4														8
Visitors	7																
Total	70	153	4														8
Pacific Northwest Laboratory																	
Employees	195	736	74	28	8	10	5	1									84
Visitors	84	37	3	2	2												4
Total	279	773	77	30	10	10	5	1									88
BCS Richland Inc.																	
Employees	2	14															1
Visitors		1															
Total	2	15															1
Hanford Eng. Dev. Lab.																	
Employees	78	904	135	50	22	16	11										132
Visitors	107	61	1														3
Total	185	965	136	50	22	16	11										135
Hanford Environ. Health Found.																	
Employees	1	4															
Visitors																	
Total	1	4															

TABLE B.8 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
J. A. Jones Const. Co.																	
Employees	148	636	167	168	100	74	210	82									771
Visitors	4	4															
Total	152	640	167	168	100	74	210	82									771
Rockwell Hanford Oper.																	
Employees	284	1673	349	236	126	72	91	7									529
Visitors	713	443	4														23
Total	997	2116	353	236	126	72	91	7									552
United Nuclear Ind. Inc.																	
Employees	16	189	105	90	45	41	139	140	2								691
Visitors	37	21	2	1													2
Total	53	210	107	91	45	41	139	140	2								693
TOTAL RICHLAND	1739	4876	844	575	303	213	456	230	2								2249

TABLE B.9
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
Rockwell International Energy Systems Group																	
Employees	540	282	38	10	3	5	9	3									52
Visitors	410	75	1														4
Total	950	357	39	10	3	5	9	3									56
Stanford Linear Accel. Ctr.																	
Employees	150	26	9	3													4
Visitors																	
Total	150	26	9	3													4
University of California/LBL																	
Employees	3472	1458	58	11	4	1											91
Visitors																	
Total	3472	1458	58	11	4	1											91
University of California/LLL																	
Employees	7609	718	73	24	10	3	3										71
Visitors	14111	87	8														6
Total	21720	805	81	24	10	3	3										77
University of California/LEHR																	
Employees	107	16	2	1													2
Visitors																	
Total	107	16	2	1													2

TABLE B.9 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
University of California/LNM																	
Employees	114	5	3	1	1	2	1										5
Visitors																	
Total	114	5	3	1	1	2	1										5
University of California/MC																	
Employees	25																
Visitors																	
Total	25																
University of California/NTS																	
Employees	83	8	3	1	1												2
Visitors	993	77	5														5
Total	1076	85	8	1	1												7
TOTAL SAN FRANCISCO	27614	2752	200	51	19	11	13	3									240

TABLE B.10
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAVANNAH RIVER FIELD ORGANIZATION
1980

Contractor	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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	
E. I. Du Pont/SRP-Opns.																	
Employees	2167	2684	628	540	267	139	183	52									1140
Visitors	1972	346															17
Total	4139	3030	628	540	267	139	183	52									1157
E. I. Du Pont/SRP-Const.																	
Employees	881	984	286	170	46	19	12	1									229
Visitors																	
Total	881	984	286	170	46	19	12	1									229
Savannah River Ecol. Lab																	
Employees	58	14	1														1
Visitors																	
Total	58	14	1														1
Southern Bell Tel.																	
Employees	40	4															
Visitors																	
Total	40	4															
U. S. Forest Service																	
Employees	11	8															
Visitors																	
Total	11	8															
TOTAL SAVANNAH RIVER	5129	4040	915	710	313	158	195	53									1387

TABLE B.11
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SCHENECTADY NAVAL REACTORS FIELD ORGANIZATION
1980

	Dose Equivalent Ranges (rem)																
Contractor	< Meas.	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	Total Person-rem
General Electric Co.																	
Employees	739	1178	53	13													73
Visitors	166	85															4
Total	905	1263	53	13													77
General Electric/MAO																	
Employees	29	11	1														1
Visitors																	
Total	29	11	1														1
TOTAL SCHENECTADY	934	1274	54	13													78

APPENDIX C

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION, 1980

TABLE C.1
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1980

Organization	Dose Equivalent Ranges (rem)																Total Person-rem
	< Meas.	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 Operations	270	63															3
Amarillo Area Office	2	34															2
Dayton Area Office	9	11															1
Kansas City Area Office	12																
Los Alamos Area Office	263	63		1													4
Pinellas Area Office	3	5															
Rocky Flats Area Office		57	4														4
Sandia Area Office	4																
TOTAL	563	233	4	1													13
Brookhaven Area Office		2															
Chicago Operations	26	2	1														
Environmental Meas. Lab.	27	14															1
New Brunswick Lab.	69	9	5		1												2
TOTAL	122	27	6		1												3

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1980

Organization	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Idaho Operations	142	82	5														5
TOTAL	142	82	5														5
Nevada Operations	5508	210	35	7													19
TOTAL	5508	210	35	7													19
Pittsburgh Naval Reactors	9	41	2														2
TOTAL	9	41	2														2
Richland Operations	144	73	9	2													6
TOTAL	144	73	9	2													6
San Francisco Operations	61	1															
TOTAL	61	1															

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1980

Organization	Dose Equivalent Ranges (rem)																Total
	< Meas.	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	Person-rem
Schenectady Naval Reactor	8	11															1
West Milton Field Office		1															
TOTAL	8	12															1
Savannah River Operations	164	70															4
TOTAL	164	70															4

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