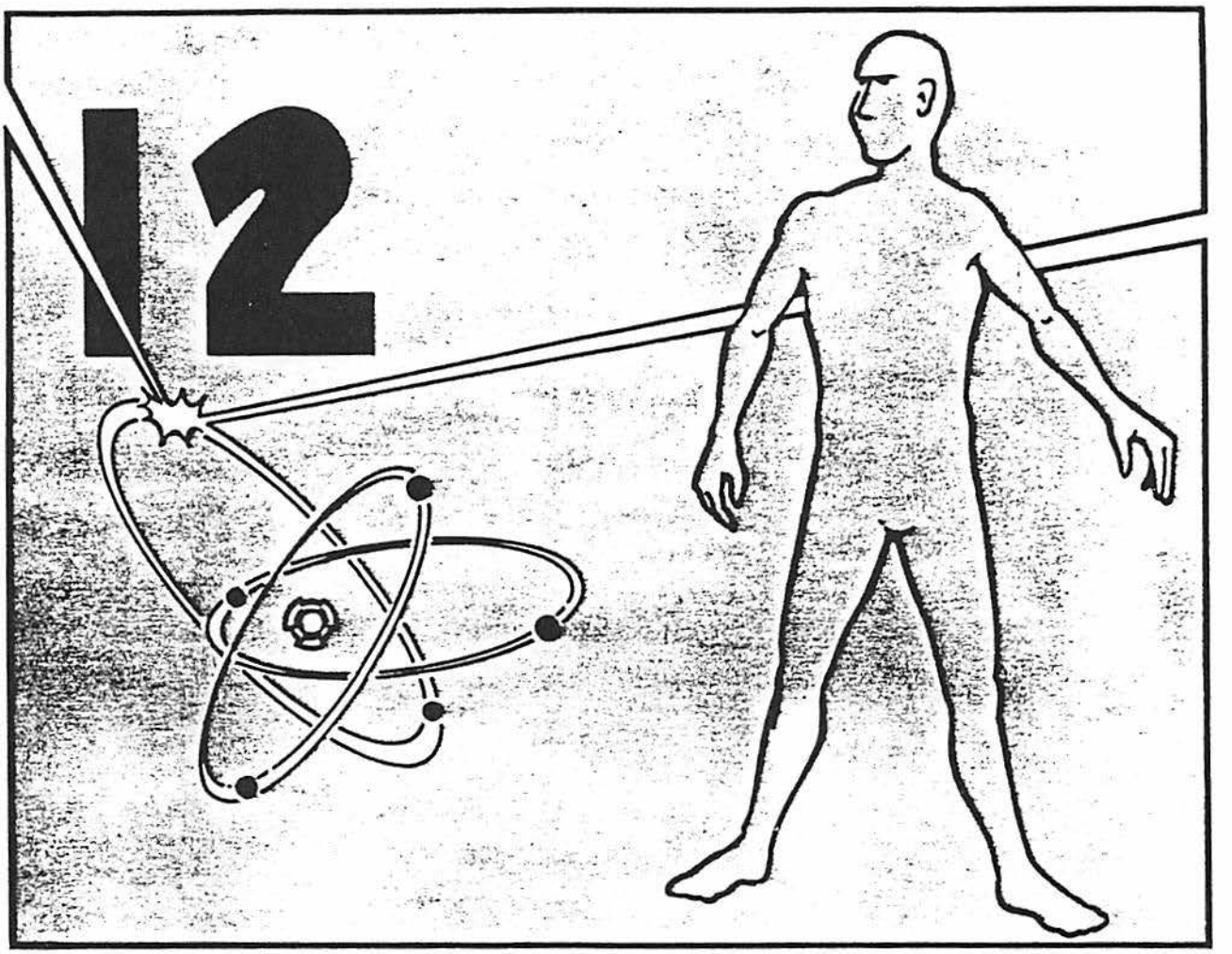

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Prepared for:
U.S. Department of Energy
Assistant Secretary for Environmental
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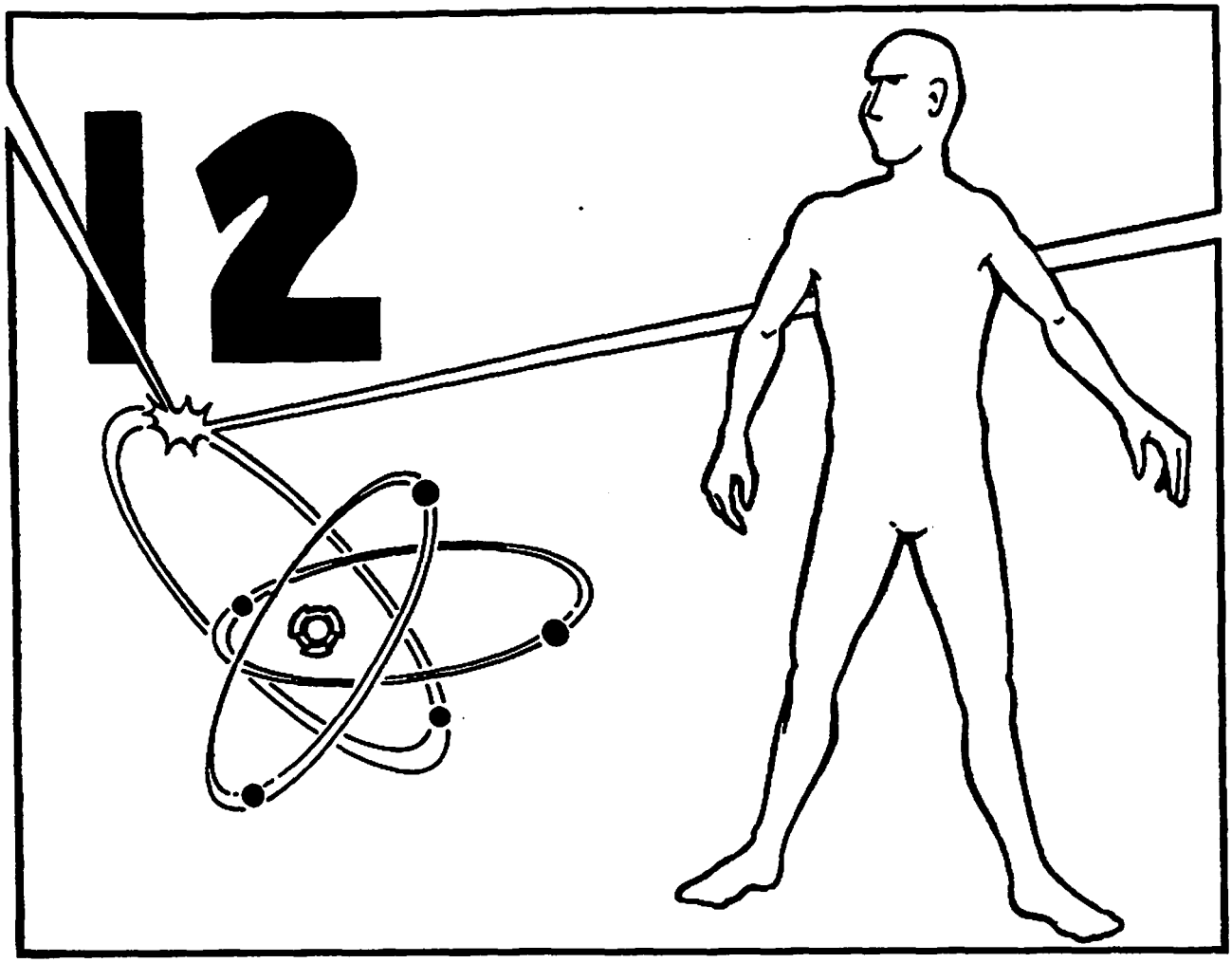

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Twelfth Annual Report Radiation Exposure For DOE and DOE Contractor Employees-1979

Prepared by:
Pacific Northwest Laboratory
Richland, Washington 99352

Under Contract No. DE-AC06-76RL01830

Prepared for:

U.S. Department of Energy
Assistant Secretary for Environmental
Protection, Safety, and Emergency Preparedness
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Washington, DC 20545

TWELFTH ANNUAL REPORT
RADIATION EXPOSURES FOR DOE AND DOE CONTRACTOR EMPLOYEES
1979

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/EVO-0066/10, 11, and 12 respectively. This report is a revision of the 1979 document.

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 include a summary of whole-body exposure 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 1979 and is a revision of the previously published report.

A total of 104,986 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposure in 1979. This represents 81% of all DOE and DOE contractor employees and is a 3% increase over the number of individuals monitored in 1978. In addition to the employees, 89,585 visitors were also monitored.

Of all employees monitored, 47.6% received a dose equivalent that was less than measurable, 50.8% a measurable exposure less than 1 rem, and 1.6% an exposure greater than 1 rem. The exposure received by 89.1% of the visitors to DOE facilities was less than measurable. Only 10.8% of the visitors received a measurable exposure less than 1 rem, and 0.1% of the visitors received an exposure greater than 1 rem. Three DOE contractor employees at three separate facilities received whole-body dose equivalents greater than 5 rem during 1979.

The collective dose equivalent for the DOE and DOE contractor employees was 9,043 person-rem. The collective dose equivalent for visitors was 622 person-rem. The total dose equivalent for employees and visitors combined was 9,665 person-rem. The average dose equivalent for all individuals (employees and visitors) monitored was 50 mrem and the average dose equivalent for all individuals who received a measurable exposure was 150 mrem. The highest average dose equivalent was observed for employees monitored at fuel processing facilities (324 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.

Two reported cases of internal depositions were reported in 1979. In both cases, the depositions were less than the annual dose-equivalent standard. Internal depositions were the result of accidental, not planned, exposures.

A total of 9,868 monitored employees terminated their employment in 1979. The average cumulative dose equivalent for terminated employees who worked one to two years was 0.29 rem; three to four years, 0.40 rem; five to six years, 0.68 rem; and longer than six years, 2.39 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.

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1979

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).

The DOE Office of Operational Safety initiated a study during FY-80 to review the status of the Radiation Records Repository. As part of that study , this revision of the Twelfth Annual Report of Radiation Exposures for DOE and DOE Contractor Employees was prepared. This report is a summary of the data submitted in 1979 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, 1979"; Appendix B, "Distribution of Annual Whole Body Exposures by Contractor for Each DOE Field Organization, 1979"; and Appendix C, "Distribution of Annual Whole Body Exposures for DOE Government Employees and Visitors by DOE Field Organization, 1979."

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 to 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 intervals is presented in Table 2. A total of 104,986 DOE and DOE contractor employees were monitored for whole body ionizing radiation exposure in 1979. This represents 81% of all DOE and DOE contractor employees. In addition to the employees, 89,585 visitors were also monitored. Visitors may include radiation workers employed by a DOE contractor present on an interim basis at another DOE facility.

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	50,003	79,841	129,844	0	0	0
Measurable to 0.10	42,266	9,333	51,599	2,113	467	2,580
0.10 to 0.25	5,630	243	5,873	985	43	1,028
0.25 to 0.50	3,011	83	3,094	1,129	31	1,160
0.50 to 0.75	1,512	46	1,558	946	28	974
0.75 to 1.00	816	13	829	714	11	725
1 to 2	1,286	23	1,309	1,929	34	1,963
2 to 3	416	3	419	1,040	8	1,048
3 to 4	33	0	33	115	0	115
4 to 5	10	0	10	45	0	45
5 to 6	1	0	1	5	0	5
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	1	0	1	9	0	9
>10	1	0	1	13	0	13
TOTAL	104,986	89,585	194,571	9,043	622	9,665

A comparison of the number of DOE and DOE contractor employees, the number of employees monitored and the number of employees monitored who did not receive a measurable dose equivalent for the past five years is presented in Figure 1. A gradual increase in the total number of employees can be observed. However, the number of employees monitored who did not receive a measurable dose equivalent has remained relatively constant until 1979, when this number increased slightly.

Of all employees monitored in 1979, 47.6% received a dose equivalent that was less than measurable, 50.8% a measurable exposure less than 1 rem, and 1.6% an exposure greater than 1 rem (Figure 2). The exposure received by 89.1% of the visitors to DOE facilities was less than measurable. Only 10.8% of the visitors received an exposure between measurable and 1 rem, and 0.1% of the visitors received an exposure greater than 1 rem (Figure 2). Three DOE contractor employees at three separate facilities received whole-body dose equivalents greater than 5 rem during 1979.

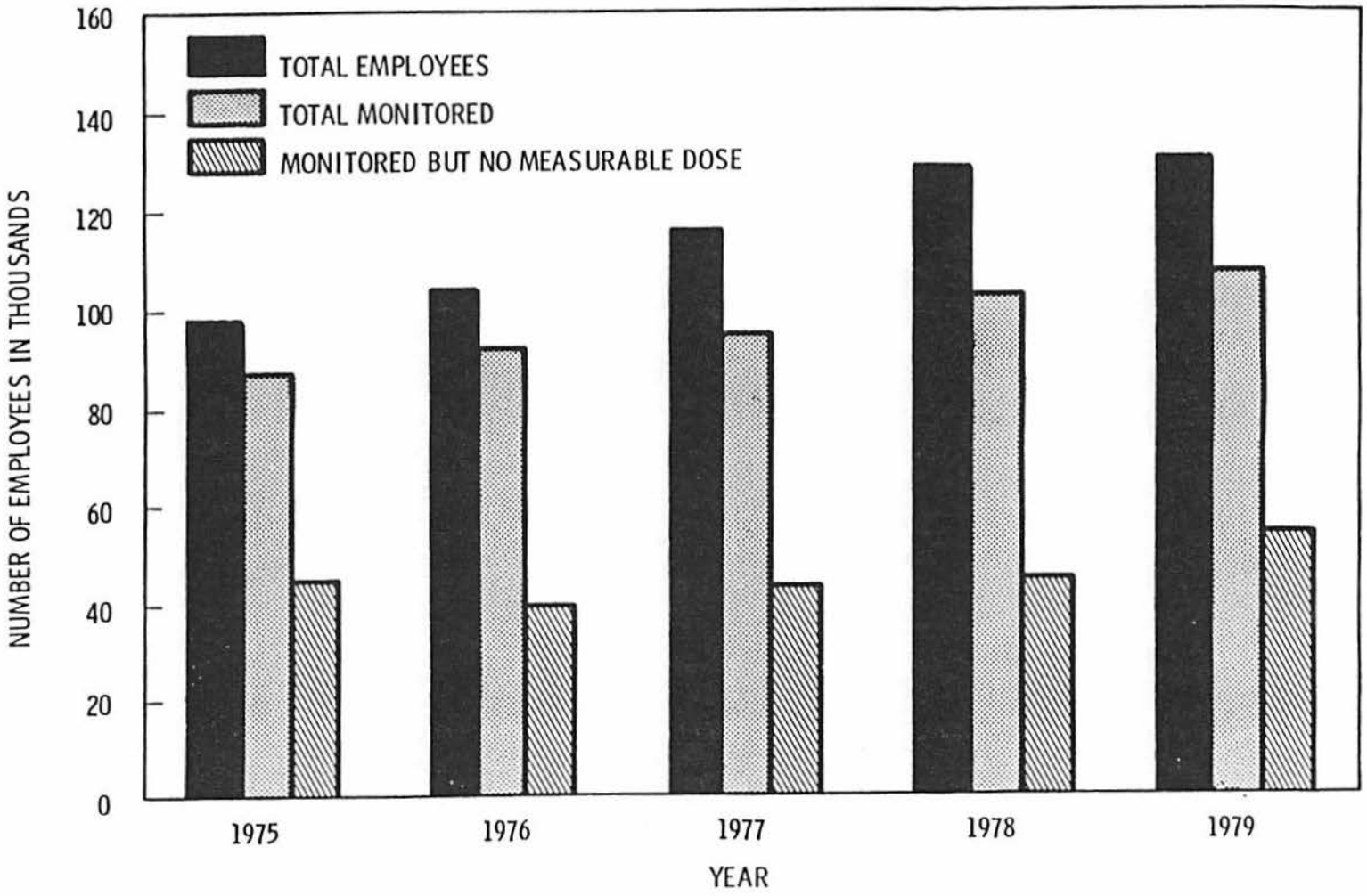

FIGURE 1. Comparison of Number of Employees, Number of Employees Monitored, and Number of Employees Monitored Who Received No Measurable Dose Equivalent

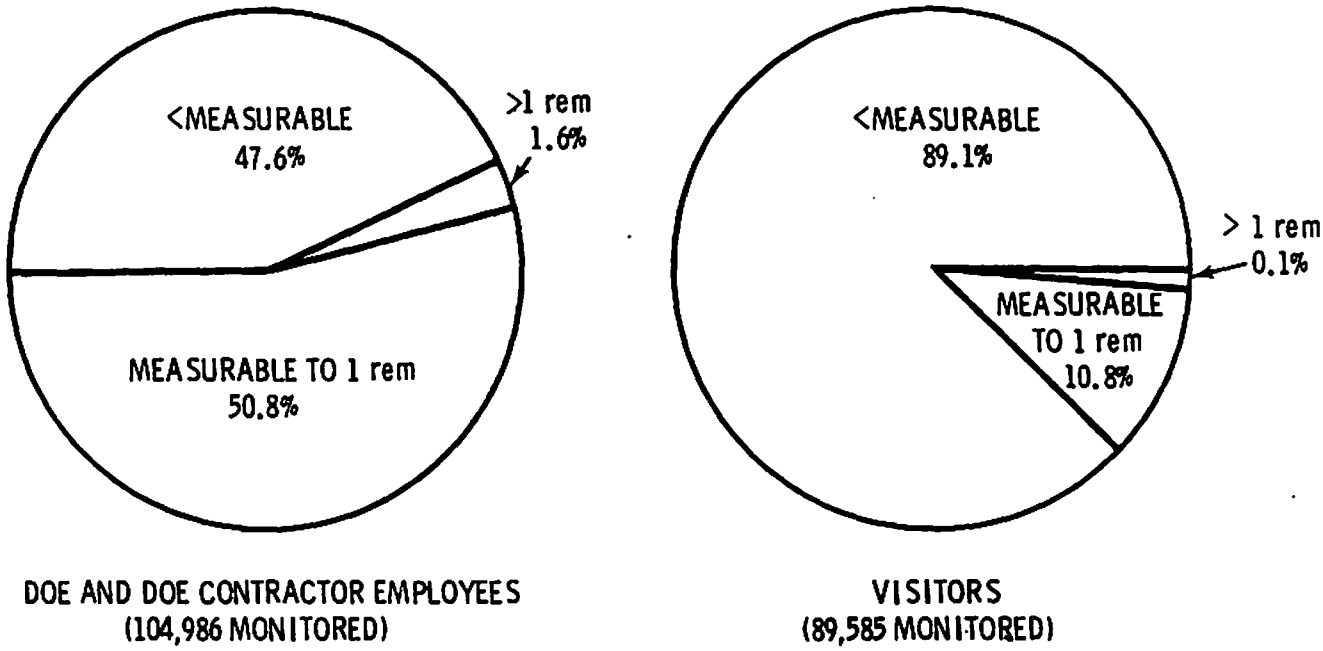

FIGURE 2. Percent of Monitored Employees and Percent of Monitored Visitors Who Received an Exposure Less than Measurable, Less Than 1 rem, or Greater Than 1 rem

The collective dose equivalent was 9,403 person-rem for all DOE and DOE contractor employees, and 622 person-rem for visitors to DOE facilities, for a total collective dose equivalent of 9,665 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 1965-1979 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 is shown in Figure 4, which shows the collective dose equivalent for all individuals from 1965-1979 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. These trends reflect both changes in the nature of the work performed at DOE facilities and the consistent application of ALARA practices throughout all DOE operations.

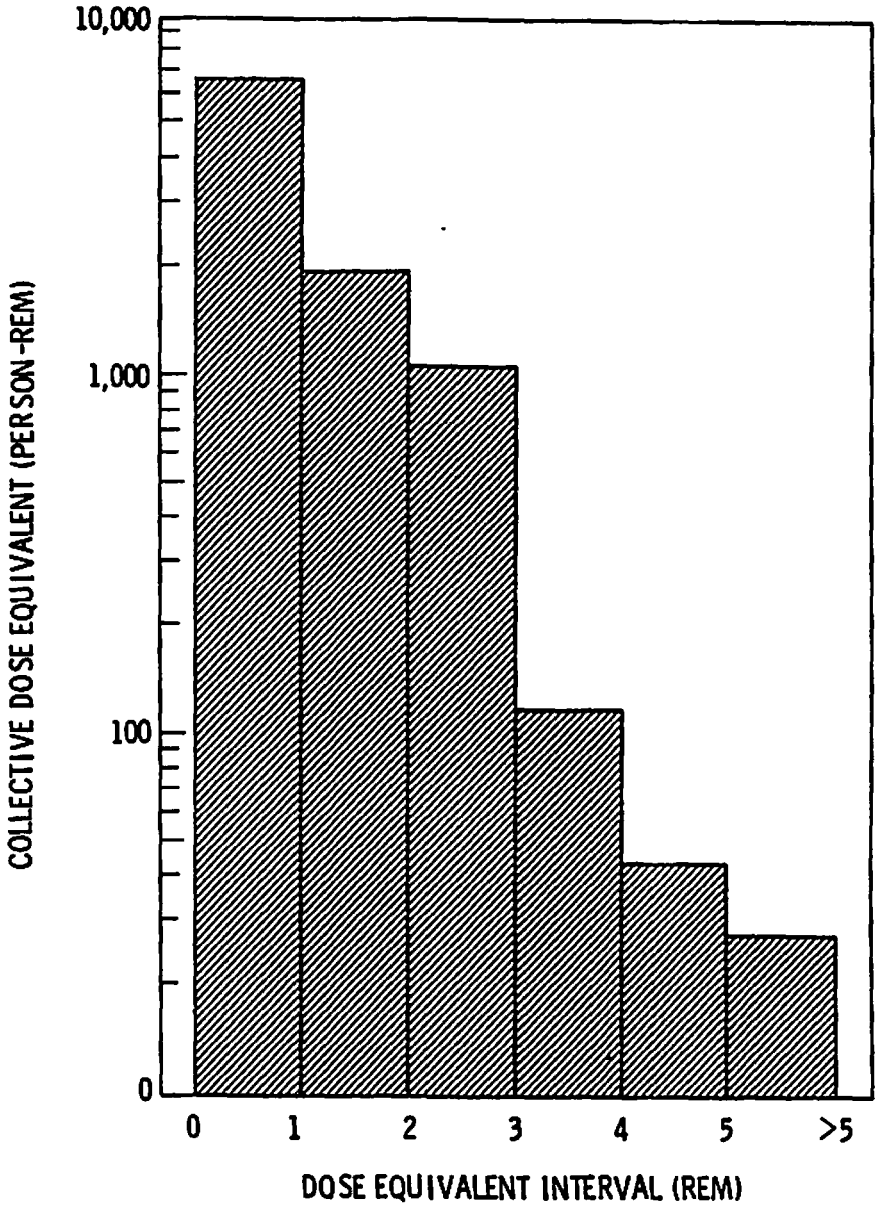

FIGURE 3. Contribution of Each Dose-Equivalent Interval to the Total Collective Dose Equivalent, 1979

TABLE 3. Distribution of Whole-Body Ionizing Radiation Exposures for DOE/DOE Contractor Employees, 1965-1979

	Dose Equivalent Ranges (rem)														
Year	0-1(a) <Meas.	0-1(a) 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	Total Monitored
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	50,003	53,235	1,286	416	33	10	1				0			0	104,986

(a)Separation of data prior to 1974 is unavailable.

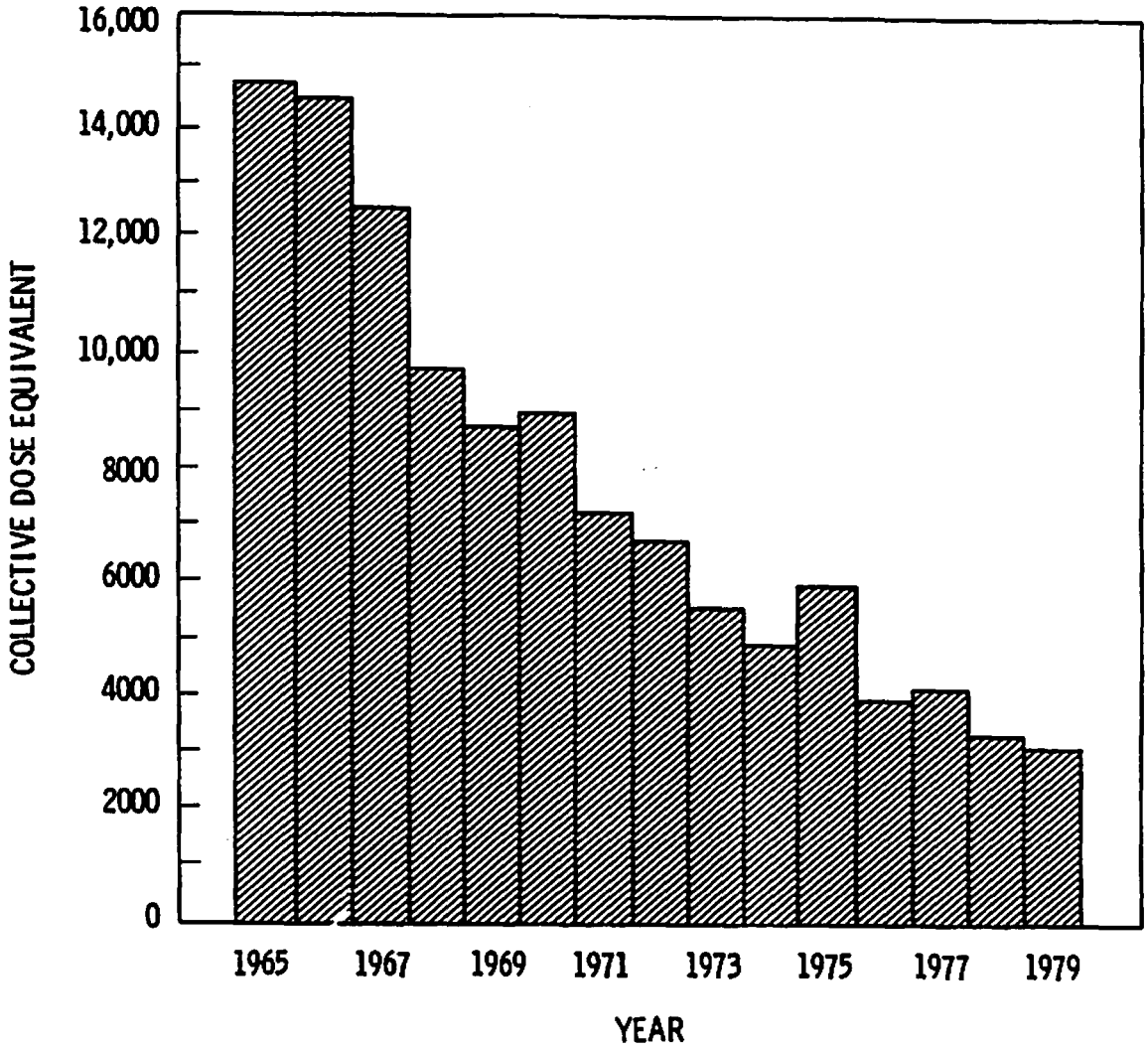

FIGURE 4. Total Collective Dose Equivalent for All DOE/DOE Contractor Employees Who Received an Exposure Greater Than 1 rem

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 construction and radioactive waste handling. "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.

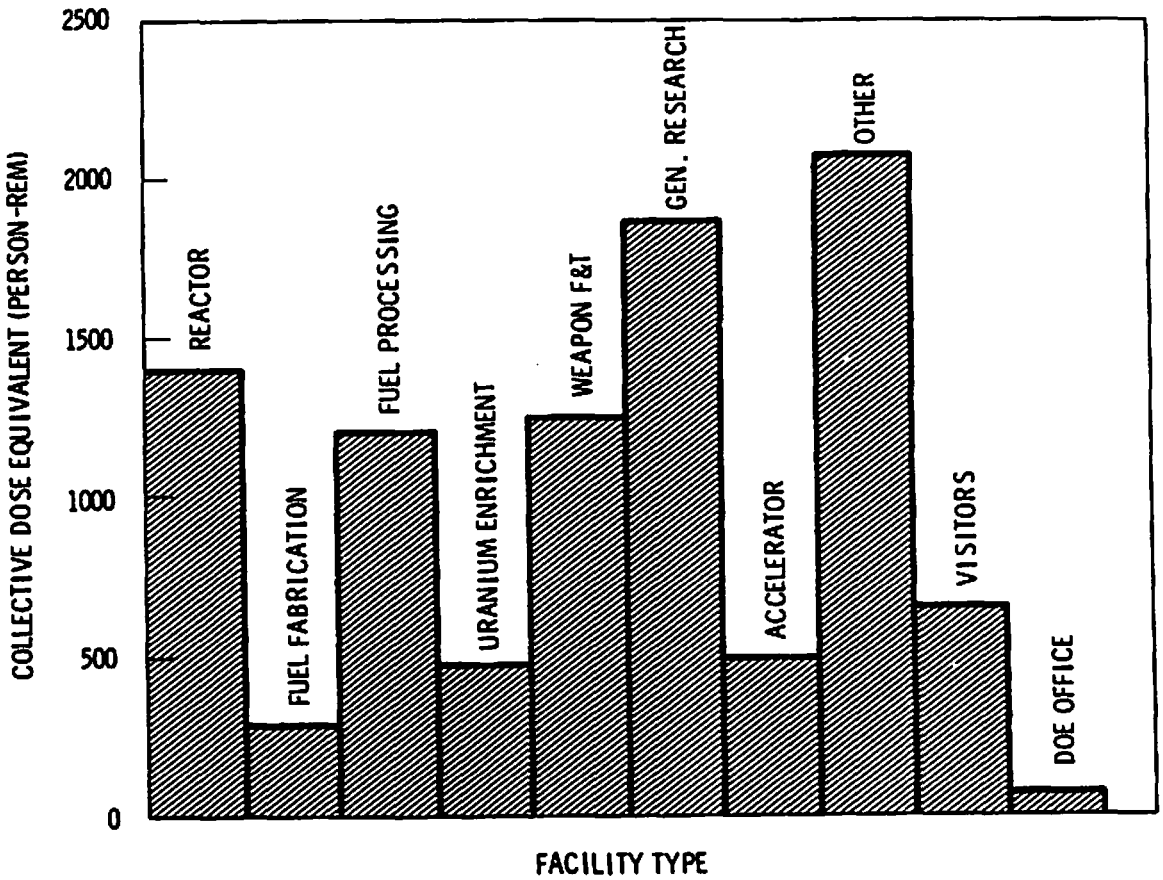

FIGURE 5. Contribution of Each Facility Type to the Total Collective Dose Equivalent

TABLE 4. Distribution of Annual Whole-Body Exposures for DOE/DOE Contractor Employees and Visitors by Facility Type, 1979

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	6,995	2,627	2,415	734	534	239	100	174	160	12								1,389
Fuel Fabrication	1,095	147	502	152	118	76	40	50	10									278
Fuel Processing	3,730	1,119	1,021	460	380	236	138	276	97	3								1,209
Uran. Enrichment	11,144	2,464	8,474	184	18	2	2											466
Weapon F&T	18,409	7,582	9,249	781	379	152	83	144	29	1	7	1				1		1,247
Gen. Research	41,711	28,157	10,438	1,658	715	340	171	198	25	6	2						1	1,845
Accelerator	3,402	1,787	878	299	182	76	52	95	24	8	1							492
Other	16,180	4,460	8,674	1,329	677	389	229	348	71	3								2,074
Visitors	89,585	79,841	9,333	243	83	46	13	23	3									622
DOE Offices	2,320	1,660	615	33	8	2	1	1										43
TOTAL EXPOSURES	194,571	129,844	51,599	5,873	3,094	1,558	829	1,309	419	33	10	1				1	1	9,665
TOTAL PERSON-REM			2,580	1,028	1,160	974	725	1,963	1,048	115	45	5				9	13	9,665

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 50 mrem. The highest average dose equivalent per individual monitored was observed at fuel processing facilities (324 mrem) and the lowest was observed for visitors to DOE facilities (7 mrem).

TABLE 5. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Facility Type, 1979

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	6,995	4,368	1,389	199	318
Fuel Fab.	1,095	948	278	253	293
Fuel Proc.	3,730	2,611	1,209	324	463
Uran. Enrich.	11,144	8,680	466	42	54
Weapon F&T	18,409	10,827	1,247	68	115
Gen. Research	41,711	13,554	1,845	44	136
Accelerator	3,402	1,615	492	145	305
Other	16,180	11,720	2,074	128	177
Visitors	89,585	9,744	622	7	64
DOE Offices	2,320	660	43	18	65
TOTAL	194,571	64,727	9,665	50	149

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 those for whom monitoring is required. Table 7 provides an indication of the work done at each field organization by showing the fraction of the collective dose equivalent at each field organization which is attributed to each facility type.

Trends in collective dose equivalents from 1974 to 1979 can be observed in Table 8 for each field organization.

TABLE 6. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1979

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	30,110	17,250	1,873	62	109
Chicago	20,101	5,078	1,061	53	209
Grand Junction	157	47	8	51	170
Idaho	41,256	2,552	876	21	343
Nevada	19,094	256	31	2	0.121
Oak Ridge	27,584	18,481	1,332	48	72
Pittsburgh Naval Reactor	2,596	2,091	196	76	93
Richland	9,729	8,807	2,571	264	292
San Francisco	30,271	2,593	264	9	102
Schenectady Naval Reactor	2,565	1,596	114	44	71
Savannah River	11,108	5,976	1,343	121	225
TOTAL	194,571	64,727	9,669	50	150

TABLE 7. Fraction of Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors Attributed to a Facility Type Within Each Field Organization, 1979

	Facility Type									
Field Organization	Reactor	Fuel Fab.	Fuel Proc.	Uran. Enrich.	Weapon F&T	Gen. Research	Acceler.	Other	Visitor	DOE Office
Albuquerque					0.524	0.273	0.001	0.191	0.012	
Chicago	0.056				0.307	0.456	0.055	0.126		
Grand Junction								1.00		
Idaho	0.293		0.697							0.010
Nevada					0.774				0.226	
Oak Ridge		0.072		0.350	0.158	0.228		0.173	0.017	0.001
Pittsburgh Naval Reactor	0.311					0.648		0.010	0.020	0.010
Richland	0.296	0.020				0.115		0.541	0.026	0.002
San Francisco					0.004	0.602	0.030	0.326	0.038	
Schenectady Naval Reactor	0.623					0.316		0.009	0.044	0.009
Savannah River	0.134	0.098	0.447		0.023	0.065		0.221	0.010	0.002
ALL FIELD ORGANIZATIONS COMBINED	0.144	0.029	0.125	0.048	0.129	0.191	0.051	0.215	0.064	0.004

TABLE 8. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1974-1979(a)

Field Organization	1974	1975	1976	1977	1978	1979
Albuquerque	2,405	2,324	1,437	2,300	2,399	1,873
Chicago	1,943	1,638	1,354	1,373	1,167	1,061
Grand Junction	0	5	<1	<1	2	8
Idaho	686	611	790	929	899	876
Nevada	58	55	25	49	47	31
Oak Ridge	1,178	1,284	1,351	1,300	1,566	1,332
Pittsburgh Naval Reactor	587	1,876	1,609	653	252	196
Richland	2,079	2,257	2,265	3,197	2,596	2,571
San Francisco	320	283	285	334	307	264
Schenectady Naval Reactor	261	1,022	203	148	111	114
Savannah River	1,434	1,268	1,278	1,298	1,289	1,343
TOTAL	10,951	12,622	10,597	11,581	10,635	9,669

(a)Throughout this report, minor variations in collective dose-equivalent values may occur due to computer rounding.

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 three-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, 1977-1979

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					

Of 16 reported body deposition cases for 1979, two are considered new and are included in Table 9. The 14 remaining cases are not included for the following reasons: in five 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 eight other cases, the reported current burden was slightly higher than was previously measured, indicating either a re-evaluation of the burden, or a possible new uptake. In one final case, a 1979 dose commitment of 33.75 rem to the bone was noted to be a translocation of a reported 1977 lung deposition.

SUMMARY OF WORKER TERMINATIONS

There were 8,968 monitored workers in 1979 who terminated their employment with DOE or DOE contractors. 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 1979 after 1 to 365 days of employment was significantly less than the 5 rem-per-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 2.39 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 1979

Length of Employment	Number of Terminated Employees	Total Cumulative Dose Equivalent (Person-rem)	Average Cumulative Dose Equivalent Per Terminated Employee (rem)
1-90 days	2,229	1,066	0.48
90-180 days	1,003	222	0.22
180-365 days	970	180	0.19
1-2 years	1,240	364	0.29
3-4 years	1,019	404	0.40
5-6 years	490	332	0.68
>6 years	2,017	4,829	2.39

APPENDIX A

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE FOR EACH DOE FIELD ORGANIZATION, 1979

TABLE A.1
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
ALBUQUERQUE FIELD ORGANIZATION
1979

Facility Type	Total Monitored	< 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
							Dose Equivalent Ranges (rem)											
Reactor																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	7940	847	5802	594	303	136	83	140	26	1	7	1						981
Gen. Research	9685	6753	2111	385	204	102	46	72	4	5	2						1	511
Accelerator																		
Other	46	35	11															1
Visitors	11642	4755	6834	40	9	1		3										357
DOE Offices	797	470	303	15	6	1	1	1										23
TOTAL	30110	12860	15061	1034	522	240	130	216	30	6	9	1					1	1873
TOTAL PERSON-REM			753	181	196	150	114	324	75	21	41	5					13	1873

TABLE A.2
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
CHICAGO FIELD ORGANIZATION
1979

Facility Type	Total Monitored	< 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
				Dose Equivalent Ranges (rem)														
Reactor	314	75	94	79	38	12	9	7										59
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	5259	2976	1697	315	131	67	39	25	8	1								326
Accelerator	3205	1642	843	293	175	73	51	95	24	8	1							484
Other	887	678	144	30	8	6	5	6	10									58
Visitors	10413	9636	508	144	59	40	9	14	3									134
DOE Offices	23	16	7															
TOTAL	20101	15023	3293	861	411	198	113	147	45	9	1							1061
TOTAL PERSON-REM			165	151	154	124	99	221	112	31	4							1061

TABLE A.3
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
GRAND JUNCTION FIELD ORGANIZATION
1979

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	148	101	18	20	8	1												8
Visitors	8	8																
DOE Offices	1	1																
TOTAL	157	110	18	20	8	1												8
TOTAL PERSON-REM			1	3	3	1												8

TABLE A.4
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
IDAHO FIELD ORGANIZATION
1979

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	3024	1780	691	257	155	84	33	21	3									256
Fuel Fabrication																		
Fuel Processing	2066	910	421	193	173	98	68	142	58	3								609
Uran. Enrichment																		
Weapon F&T																		
Gen. Research																		
Accelerator																		
Other																		
Visitors	35929	35922	6	1														
DOE Offices	237	92	133	10	1	1												9
TOTAL	41256	38704	1251	461	329	183	101	163	61	3								876
TOTAL PERSON-REM			63	81	123	114	88	245	152	10								876

TABLE A.5
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
NEVADA FIELD ORGANIZATION
1979

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	6747	6613	99	20	12	2										1		24
Gen. Research																		
Accelerator																		
Other	197	195	2															
Visitors	11306	11192	105	7	2													7
DOE Offices	844	838	6															
TOTAL	19094	18838	212	27	14	2										1		31
TOTAL PERSON-REM			11	5	5	1										9		31

TABLE A.6
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
OAK RIDGE FIELD ORGANIZATION
1979

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	600	90	315	85	60	32	8	9	1									96
Fuel Processing																		
Uran. Enrichment	11144	2464	8474	184	18	2	2											466
Weapon F&T	3463		3266	140	48	9												211
Gen. Research	7706	6014	1177	245	117	75	23	46	9									304
Accelerator																		
Other	4059	83	3797	144	26	7	2											231
Visitors	593	448	118	8	6	4	4	5										23
DOE Offices	19	4	15															1
TOTAL	27584	9103	17162	806	275	129	39	60	10									1332
TOTAL PERSON-REM			858	141	103	81	34	90	25									1332

TABLE A.7
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
PITTSBURGH NAVAL REACTOR FIELD ORGANIZATION
1979

Facility Type	Total Monitored	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
Reactor	798	134	530	87	42	5												61
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1487	192	1050	153	65	11	12	4										127
Accelerator																		
Other	44	29	12	1	2													2
Visitors	219	142	77															4
DOE Offices	48	8	38	2														2
TOTAL	2596	505	1707	243	109	16	12	4										196
TOTAL PERSON-REM			85	43	41	10	11	6										196

TABLE A.8
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
RICHLAND FIELD ORGANIZATION
1979

Facility Type	Total Monitored	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
Reactor	667	13	85	88	85	46	41	140	157	12								761
Fuel Fabrication	84	1	6	20	17	16	12	9	3									52
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	2205	90	1525	367	109	45	31	36	2									296
Accelerator																		
Other	4913	248	2607	709	481	319	195	300	53	1								1391
Visitors	1807	566	1206	30	5													67
DOE Offices	53	4	42	6	1													4
TOTAL	9729	922	5471	1220	698	426	279	485	215	13								2571
TOTAL PERSON-REM			274	213	262	266	244	728	538	46								2571

TABLE A.9
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SAN FRANCISCO FIELD ORGANIZATION
1979

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	2	2																
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	106	98	6	1	1													1
Gen. Research	13352	11340	1801	127	55	18	5	5	1									159
Accelerator	197	145	35	6	7	3	1											8
Other	1054	680	280	37	18	10	4	15	8	2								86
Visitors	15508	153666	134	6	1			1										10
DOE Offices	52	47	5															
TOTAL	30271	27678	2261	177	82	31	10	21	9	2								264
TOTAL PERSON-REM			113	31	31	19	9	32	22	7								264

TABLE A.10
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SAVANNAH RIVER FIELD ORGANIZATION
1979

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	981	232	331	133	182	85	13	5										180
Fuel Fabrication	411	56	181	47	41	28	20	32	6									131
Fuel Processing	1664	209	600	267	207	138	70	134	39									600
Uran. Enrichment																		
Weapon F&T	153	24	76	26	15	5		4	3									31
Gen. Research	994	438	425	51	32	22	15	10	1									87
Accelerator																		
Other	4791	2387	1787	387	134	46	23	27										297
Visitors	1891	1614	272	5														14
DOE Offices	223	172	51															3
TOTAL	11108	5132	3723	916	611	324	141	212	49									1343
TOTAL PERSON-REM			186	161	229	203	123	318	123									1343

TABLE A.11
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY FACILITY TYPE
SCHENECTADY NAVAL REACTORS FIELD ORGANIZATION
1979

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	1209	391	684	90	32	7	4	1										71
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1023	354	652	15	2													36
Accelerator																		
Other	41	24	16	1														1
Visitors	269	192	73	2	1	1												5
DOE Offices	23	8	15															1
TOTAL	2565	969	1440	108	35	8	4	1										114
TOTAL PERSON-REM			72	19	13	5	4	1										114

APPENDIX B

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR FOR EACH DOE FIELD ORGANIZATION, 1979

TABLE B.1
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1979

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		1739	29	5	1	1											95
Visitors																	
Total		1739	29	5	1	1											95
General Electric Co.																	
Employees	190	110	19	7													11
Visitors	4																
Total	194	110	19	7													11
Inhalation Toxicology																	
Employees	270	76	8	1	2												7
Visitors	236																
Total	506	76	8	1	2												7
Mason & Hanger-Silas																	
Employees	27	347	172	61	21	9	28	10	1	4	1						185
Visitors	678	322															16
Total	705	669	172	61	21	9	28	10	1	4	1						201
Monsanto Research Co.																	
Employees	439	881	73	40	15	2	6										92
Visitors	610	39															2
Total	1049	920	73	40	15	2	6										94

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1979

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																	
Employees		2725	301	190	99	71	106	16		3							597
Visitors		6019															301
Total		8744	301	190	99	71	106	16		3							898
Ross Aviation, Inc.																	
Employees	35	11															1
Visitors																	
Total	35	11															1
Sandia Laboratories, NM																	
Employees	1587	733	90	30	15	5	8	1	4	2							115
Visitors	1843	374	23	5	1												25
Total	3430	1107	113	35	16	5	8	1	4	2							140
Sandia Laboratories, CA																	
Employees	796	98	2														5
Visitors	176	2					1										2
Total	972	100	2				1										7
The Bendix Corp.																	
Employees	191																
Visitors	1																
Total	192																

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1979

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 Zia Company																	
Employees	1238	144	54	19	1												24
Visitors																	
Total	1238	144	54	19	1												24
U. of California/LASL																	
Employees	2862	1060	231	154	84	41	64	3	1							1	360
Visitors	1207	78	17	4			2										11
Total	4069	1138	248	158	84	41	66	3	1							1	371
TOTAL ALBUQUERQUE	12390	14758	1019	516	239	129	215	30	6	9	1					1	1849

TABLE B.2
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1979

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	
Ames Laboratory																	
Employees	39	30	9	3	1	1	1	6	1								26
Visitors	150	13	3	1	2												3
Total	189	43	12	4	3	1	1	6	1								29
Argonne National Lab.																	
Employees	2302	439	220	123	67	37	23	2									220
Visitors	5081	72	47	47	29	6	5										60
Total	7383	511	267	170	96	43	28	2									281
Brookhaven National Lab.																	
Employees	191	1201	287	138	53	38	75	19	8	1							421
Visitors	92	233	68	9	7	2	7	2									49
Total	283	1434	355	147	60	40	82	21	8	1							469
Chicago Miscellaneous																	
Employees	394	224	52	11	4	3	7	10									65
Visitors	388	19	5														2
Total	782	243	57	11	4	3	7	10									67
Fermi National Accel.																	
Employees	1320	375	121	61	26	23	19	5									140
Visitors	2005	168	21	2	2	1	2	1									20
Total	3325	543	142	63	28	24	21	6									161

TABLE B.2 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1979

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	154	149	18	16	7	2	8										35
Visitors	1916	3															
Total	2070	152	18	16	7	2	8										35
Princeton University																	
Employees	892	348	3														18
Visitors																	
Total	892	348	3														18
TOTAL CHICAGO	14924	3274	854	411	198	113	147	45	9	1							1059

TABLE B.3
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
GRAND JUNCTION FIELD ORGANIZATION
1979

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
Bendix Field Eng.																	
Employees	101	18	20	8	1												8
Visitors	2																
Total	103	18	20	8	1												8
TOTAL GRAND JUNCTION	103	18	20	8	1												8

TABLE B.4
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1979

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	
Allied Chemical Corp.																	
Employees	499	117	65	64	44	26	73	42	3								316
Visitors	5412																
Total	5911	117	65	64	44	26	73	42	3								316
Arrington Const.																	
Employees	1	10	2		1												1
Visitors																	
Total	1	10	2		1												1
Biggers Const.																	
Employees		5			1												1
Visitors																	
Total		5			1												1
Bingham Mechanical																	
Employees	3	11	6	3	2		1										5
Visitors																	
Total	3	11	6	3	2		1										5
C-L Electric Company																	
Employees		2		1													
Visitors																	
Total		2		1													

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1979

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	
EG&G, Idaho, Inc.																	
Employees	1316	523	181	105	55	25	10										168
Visitors	26942		1														
Total	28258	523	182	105	55	25	10										169
Exxon Nuclear Co.																	
Employees	588	116	79	74	38	30	55	9									202
Visitors	3111	6															
Total	3699	122	79	74	38	30	55	9									203
Idaho Miscellaneous																	
Employees	203	156	63	51	26	8	11	3									85
Visitors																	
Total	203	156	63	51	26	8	11	3									85
Jones-Boecon																	
Employees	6	23		1	1	1											3
Visitors																	
Total	6	23		1	1	1											3
Lehigh Design Co.																	
Employees	27	7															
Visitors																	
Total	27	7															

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1979

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	
Morrison-Knudsen																	
Employees	46	116	46	29	13	11	13	7									79
Visitors																	
Total	46	116	46	29	13	11	13	7									79
Ormond Construction																	
Employees	1	24	8		1												3
Visitors																	
Total	1	24	8		1												3
Waters Asbestos																	
Employees		2															
Visitors																	
Total		2															
TOTAL IDAHO	38155	1118	451	328	182	101	163	61	3								867

TABLE B.5
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1979

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	
Air Resources Lab.																	
Employees	48																
Visitors	6																
Total	54																
CER Geonuclear																	
Employees	3																
Visitors																	
Total	3																
Defense Nuclear Agency																	
Employees	192	2															2
Visitors	2998	32	1														2
Total	3190	34	1														
EG&G, Inc.																	
Employees	865	35	1		1												3
Visitors	98																
Total	963	35	1		1												3
EPA/NERC																	
Employees	225	2															
Visitors	54																
Total	279	2															

TABLE B.5 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1979

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	
Fenix & Scisson, Inc.																	
Employees	215	10		2													1
Visitors	273																
Total	488	10		2													1
Holmes & Narver, Inc.																	
Employees	285	5															
Visitors	122																
Total	407	5															
Nevada Miscellaneous																	
Employees	249	2															
Visitors	244	1															
Total	493	3															
Reynolds Electrical																	
Employees	4192	36	19	10	1										1		19
Visitors	3256																
Total	7448	36	19	10	1										1		19
U.S. Dept. of Interior																	
Employees	149	5															
Visitors	20																
Total	169	5															

TABLE B.5 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1979

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
Wackenhut Services																	
Employees	244	4															
Visitors	67																
Total	311	4															
Westinghouse Electric																	
Employees	141																
Visitors	91																
Total	232																
TOTAL NEVADA	14037	134	21	12	2										1		26

TABLE B.6
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1979

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 Res. Lab.																	
Employees	107	19															1
Visitors	12																
Total	119	19															1
Goodyear Atomic Corp.																	
Employees	735	180	57	12	2												25
Visitors																	
Total	735	180	57	12	2												25
National Lead Co.																	
Employees	90	314	85	60	32	8	9	1									96
Visitors																	
Total	90	314	85	60	32	8	9	1									96
Oak Ridge Assoc. Univ.																	
Employees	412	153	12	2													11
Visitors																	
Total	412	153	12	2													11
Puerto Rico Nuclear Ctr.																	
Employees	123	49	25	1	2												8
Visitors	379	87															4
Total	502	136	25	1	2												12

TABLE B.6 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1979

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	14	45	19	2													6
Visitors																	
Total	14	45	19	2													6
Rust Engineering Co.																	
Employees		1374	97	1													86
Visitors																	
Total		1374	97	1													86
Union Carbide Corp./ORGDP																	
Employees		7578	88	4		2											398
Visitors																	
Total		7578	88	4		2											398
Union Carbide Corp./Y-12																	
Employees		6132	173	53	14	1											366
Visitors																	
Total		6132	173	53	14	1											366
Union Carbide Corp./ORNL																	
Employees	5441	468	202	112	68	22	46	9									254
Visitors	57	31	8	6	4	4	5										19
Total	5498	499	210	118	72	26	51	9									273

TABLE B.6 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1979

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	
Union Carbide Corp.																	
Employees	1729	716	39	2													43
Visitors																	
Total	1729	716	39	2													43
Woven Structures, Inc.																	
Employees			1	20	7	2											14
Visitors																	
Total			1	20	7	2											14
TOTAL OAK RIDGE	9099	17146	806	275	129	39	60	10									1331

TABLE B.7
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
PITTSBURGH NAVAL REACTOR FIELD ORGANIZATION
1979

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	
Duquesne Light Co.																	
Employees	1	204	72	37	5												40
Visitors	14	40															2
Total	15	244	72	37	5												42
Westinghouse Electric/BAPL																	
Employees	180	863	71	27	4	11	4										84
Visitors	76	20															1
Total	256	883	71	27	4	11	4										85
Westinghouse Electric/NRF																	
Employees	145	513	97	43	7	1											64
Visitors	52	17															1
Total	197	530	97	43	7	1											65
Westinghouse Plant Appa.																	
Employees	29	12	1	2													2
Visitors																	
Total	29	12	1	2													2
TOTAL PITTSBURGH	497	1669	241	109	16	12	4										193

TABLE B.8
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1979

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	
Automation Industries																	
Employees	28	218	16	1	1												15
Visitors	2	2															
Total	30	220	16	1	1												15
Pacific Northwest Laboratory																	
Employees	40	783	147	54	14	5	10	2									118
Visitors	40	53															3
Total	80	836	147	54	14	5	10	2									121
BCS Richland Inc.																	
Employees	4	4	1														
Visitors	1	2															
Total	5	6	1														
Hanford Eng. Dev. Lab.																	
Employees	50	742	220	55	31	26	26										177
Visitors	32	40	5														3
Total	82	782	225	55	31	26	26										180
Hanford Environ. Health Found.																	
Employees		4															
Visitors		1															
Total		5															

TABLE B.8 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1979

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	145	814	197	210	204	129	189	26	1								746
Visitors		3															
Total	145	817	197	210	204	129	189	26	1								746
Rockwell Hanford Oper.																	
Employees	71	1567	495	270	114	66	111	27									629
Visitors	435	958	21	3													53
Total	506	2525	516	273	114	66	111	27									682
United Nuclear Ind. Inc.																	
Employees	14	91	108	102	62	53	149	160	12								812
Visitors	3	47	4	2													4
Total	17	138	112	104	62	53	149	160	12								816
TOTAL RICHLAND	865	5329	1214	697	426	279	485	215	13								2561

TABLE B.9
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1979

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	680	280	37	18	10	4	15	8	2								86
Visitors	545	67	2	1													4
Total	1225	347	39	19	10	4	15	8	2								91
Stanford Linear Accel. Ctr.																	
Employees	145	35	6	6	1												6
Visitors																	
Total	145	35	6	6	1												6
U. of California/LBL																	
Employees	3557	1065	72	19	7		1										79
Visitors																	
Total	3557	1065	72	19	7		1										79
U. of California/LLL																	
Employees	7473	708	52	32	10	5	4	1									76
Visitors	14821	67	4				1										6
Total	22294	775	56	32	10	5	5	1									81
U. of California/LEHR																	
Employees	162	14	1	2													2
Visitors																	
Total	162	14	1	2													2

TABLE B.9 (Continued)
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1979

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. of California/LNM																	
Employees	122	14	2	3	3	1											5
Visitors																	
Total	122	14	2	3	3	1											5
U. of California/MC																	
Employees	26																
Visitors																	
Total	26																
U. of California/NTS																	
Employees	100	6	1	1													1
Visitors																	
Total	100	6	1	1													1
TOTAL SAN FRANCISCO	27631	2256	177	82	31	10	21	9	2								264

TABLE B.10
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SAVANNAH RIVER FIELD ORGANIZATION
1979

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	2212	2324	622	501	283	123	193	49									1109
Visitors	1614	272	5														14
Total	3826	2596	627	501	283	123	193	49									1124
E.I. du Pont/SRP-Const.																	
Employees	1060	1046	289	110	41	18	19										214
Visitors																	
Total	1040	1046	289	110	41	18	19										214
Savannah River Ecol. Lab.																	
Employees	38	28															1
Visitors																	
Total	38	28															1
Southern Bell Tel.																	
Employees	36	2															
Visitors																	
Total	36	2															
TOTAL SAVANNAH RIVER	4960	3672	916	611	324	141	212	49									1339

TABLE B.11
DISTRIBUTION OF ANNUAL WHOLE BODY EXPOSURES BY CONTRACTOR
SCHENECTADY NAVAL REACTORS FIELD ORGANIZATION
1979

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	
General Electric Co.																	
Employees	745	1336	105	34	7	4	1										107
Visitors	192	73	2	1	1												5
Total	937	1409	107	35	8	4	1										112
General Electric/MAO																	
Employees	24	16	1														1
Visitors																	
Total	24	16	1														1
TOTAL SCHENECTADY	961	1425	108	35	8	4	1										113
TOTAL DOE CONTRACTORS	123622	50799	5827	3084	1556	828	1308	419	33	10	1				1	1	9610

APPENDIX C

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION, 1979

TABLE C.1
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1979

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	196	120	2	1													7
Amarillo Area Office	1	22	11			1											4
Dayton Area Office	5	17															1
Kansas City Area Office	9																
Los Alamos Area Office	252	79		3			1										7
Pinellas Area Office	6	2															
Rocky Flats Area Office		61	2	2	1												5
Sandia Area Office	1	2															
TOTAL	470	303	15	6	1	1	1										23
Chicago Operations	16	7															
Environmental Meas. Lab.	28	3	4														1
New Brunswick Lab.	55	9	3														1
TOTAL	99	19	7														2

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1979

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
Grand Junction	7																
TOTAL	7																
Idaho Operations	549	133	10	1	1												9
TOTAL	549	133	10	1	1												9
Nevada Operations	4801	78	6	2													6
TOTAL	4801	78	6	2													6
Oak Ridge Operations	3	16															1
Paducah Area Office	1																
TOTAL	4	16															1
Pittsburgh Naval Reactors	8	38	2														2
TOTAL	8	38	2														2

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1979

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
Richland Operations	57	142	6	1													9
TOTAL	57	142	6	1													9
San Francisco Operations	47	5															
TOTAL	47	5															
Schenectady Naval Reactor	8	12															1
West Milton Field Office		3															
TOTAL	8	15															1
Savannah River Operations	172	51															3
TOTAL	172	51															3
TOTAL DOE GOVERNMENT	6222	800	46	10	2	1	1										56

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Sixteenth Annual Report

Radiation Exposures For DOE and DOE Contractor Employees - 1983

October 1984

Prepared for:

U.S. Department of Energy

Assistant Secretary for
Environmental Protection, Safety,
and Emergency Preparedness
Office of Nuclear Safety
Washington, D.C. 20545

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Sixteenth Annual Report Radiation Exposures For DOE and DOE Contractor Employees - 1983

October 1984

Prepared for U.S. Department of Energy
Assistant Secretary for Environmental Protection,
Safety, and Emergency Preparedness
Office of Nuclear Safety

Under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Richland, Washington 99352

SIXTEENTH ANNUAL REPORT
RADIATION EXPOSURES FOR DOE AND DOE CONTRACTOR EMPLOYEES
1983

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, 1979, 1980, 1981, and 1982 were presented in DOE/EV-0066/10, 11, 12, 13, and 14 and DOE/EP-0040/2 respectively. A revised version of the 1979 report was issued. This report contains 1983 radiation exposure data for DOE and DOE contractor employees and visitors.

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 contractor facilities 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 1983.

A total of 88,283 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposures in 1983. This represents 56.6 percent of all DOE and DOE contractor employees and is an increase from the number of individuals monitored in 1982. In addition to the employees, 84,851 visitors were monitored.

Of all employees monitored, 56.5 percent received a dose equivalent that was less than measurable, 41.6 percent a measurable exposure less than 1 rem, and 1.9 percent an exposure greater than 1 rem. The exposure received by 94.6 percent of the visitors to DOE facilities was less than measurable. Only 5.4 percent of the visitors received a measurable exposure less than 1 rem, and <0.01 percent of the visitors received an exposure greater than 1 rem. No employees or visitors received a dose equivalent greater than 5 rem.

The collective dose equivalent for DOE and DOE contractor employees was 7,858 person-rem. The collective dose equivalent for visitors was 300 person-rem. The total dose equivalent for employees and visitors combined was 8,158 person-rem. The average dose equivalent for all individuals (employees and visitors) monitored was 47 mrem and the average dose equivalent for all individuals who received a measurable exposure was 190 mrem. The highest average dose equivalent for all monitored employees was observed at fuel fabrication facilities (235 mrem) and the lowest among visitors (4 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 1983. 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 7,449 monitored employees terminated their employment in 1983. The average cumulative dose equivalent for terminated employees who worked one to two years was 0.33 rem; two to four years, 0.30 rem; four to six years, 0.41 rem; and longer than six years, 3.70 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.

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1983

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,[c] red bone marrow, active blood-forming organs.	Year	5[b]
	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]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.

[c]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).

[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 for 1983 by DOE and DOE contractor facilities. 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, 1983"; Appendix B, "Distribution of Annual Whole-Body Exposures by Contractor for Each DOE Field Organization, 1983"; and Appendix C, "Distribution of Annual Whole-Body Exposures for DOE Government Employees and Visitors by DOE Field Organization, 1983."

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 percent 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 16 dose-equivalent intervals ranging from "less than measurable" to "greater than 10 rem" is provided annually by each DOE and DOE contractor facility. 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 numerical 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 16 dose-equivalent ranges is presented in Table 2. There were no DOE employees or visitors who received a dose equivalent greater than 5 rem. A total of 88,283 DOE and DOE contractor employees were monitored for whole-body ionizing radiation exposure in 1983. This represents 56.6 percent of all DOE and DOE contractor employees. In addition to the employees, 84,851 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, 1983

Dose-Equivalent Interval (rem)	Number of Persons			Collective Person-rem		
	Employees	Visitors	Total	Employees	Visitors	Total
<Measurable	49,871	80,285	130,156	0	0	0
Measurable to 0.10	26,528	4,244	30,772	1,327	212	1,539
0.10 to 0.25	4,903	238	5,141	858	42	900
0.25 to 0.50	3,218	51	3,269	1,207	19	1,226
0.50 to 0.75	1,353	22	1,375	845	14	859
0.75 to 1.00	766	7	773	670	6	676
1 to 2	1,270	3	1,273	1,905	5	1,910
2 to 3	294	1	295	736	2	738
3 to 4	49	0	49	171	0	171
4 to 5	31	0	31	139	0	139
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	88,283	84,851	173,134	7,858	300	8,158

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 1983 increased slightly from the number reported in previous years (Figure 1).

Of the employees monitored in 1983, 56.5 percent received a dose equivalent that was less than measurable, 41.6 percent a measurable exposure less than 1 rem, and 1.9 percent an exposure greater than 1 rem (Figure 2). The exposure received by 94.6 percent of the visitors to DOE facilities was less than measurable. Only 5.4 percent of the visitors received an exposure between measurable and 1 rem, and <0.01 percent of the visitors received an exposure greater than 1 rem (Figure 2).

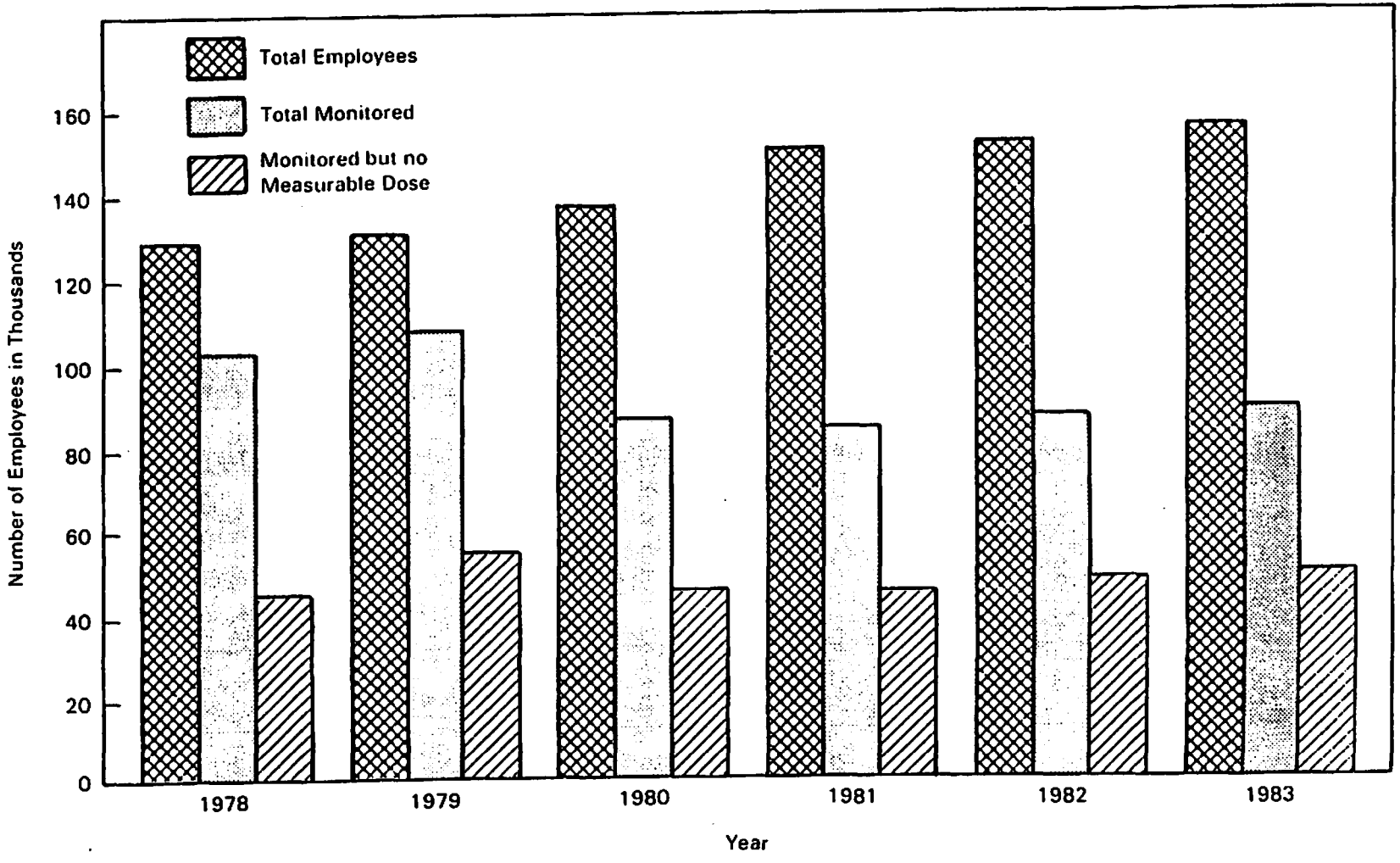

FIGURE 1. Comparison of Number of Employees, Number of Employees Monitored, and Number of Employees Monitored Who Received No Measurable Dose Equivalent

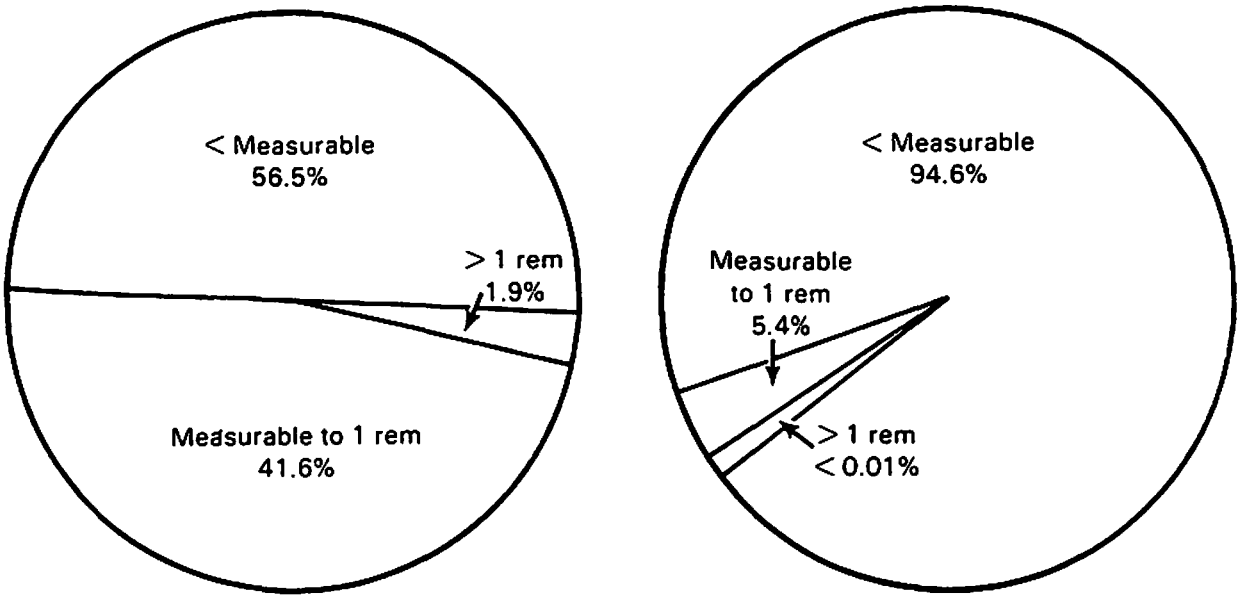

FIGURE 2. Percentage of Monitored Employees and Percentage of Monitored Visitors Who Received an Exposure Less Than Measurable, Measurable to 1 rem, or Greater Than 1 rem, 1983

The collective dose equivalent was 7,858 person-rem for all DOE and DOE contractor employees, and 300 person-rem for visitors to DOE facilities, for a total collective dose equivalent of 8,158 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 1965-1983 is presented in Table 3. As can be seen 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 seen in Figure 4, which shows the collective dose equivalent for all individuals from 1965 to 1983 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 that 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.

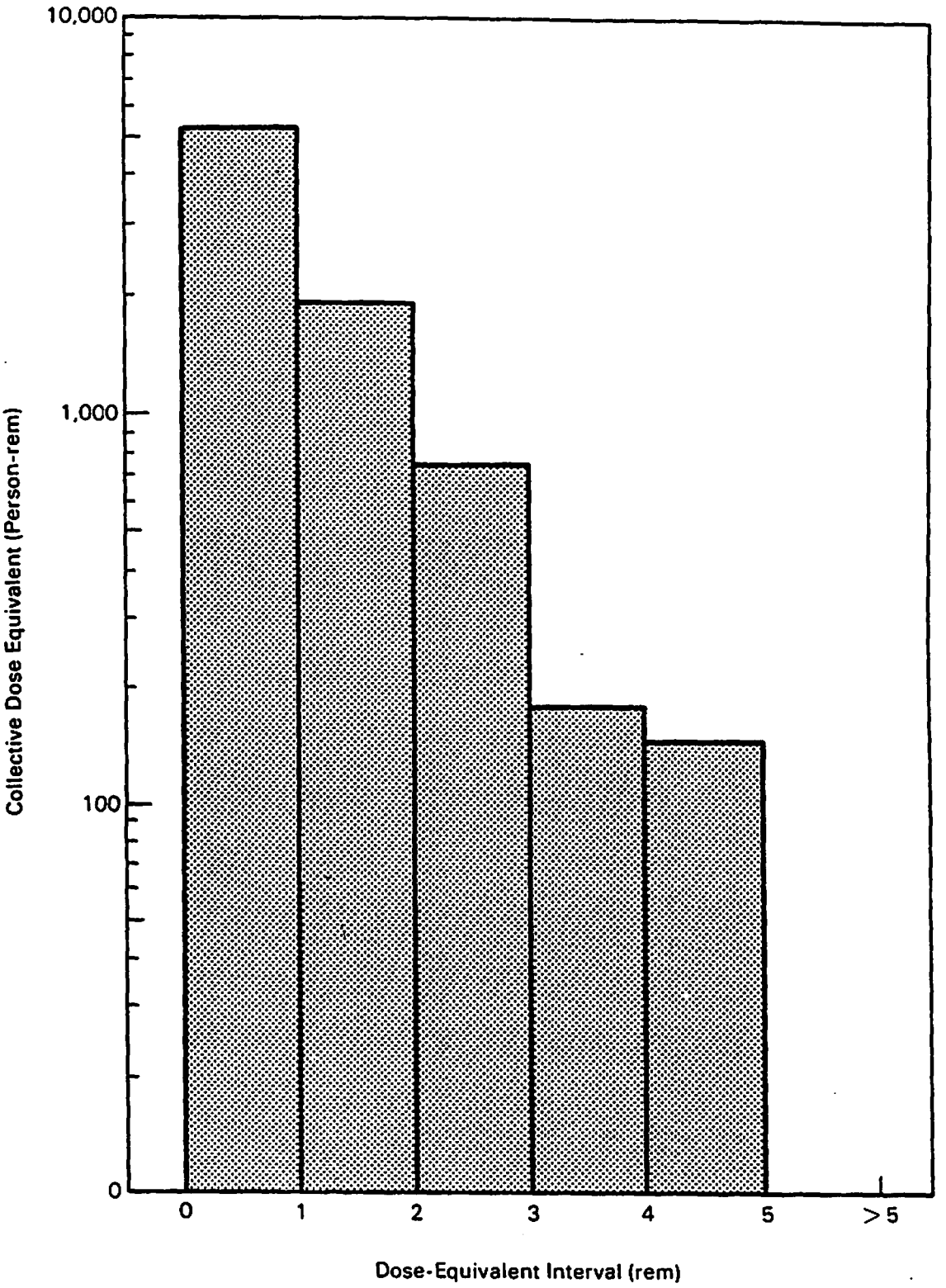

FIGURE 3. Contribution of Each Dose-Equivalent Interval to the Total Collective Dose Equivalent, 1983

TABLE 3. Distribution of Whole-Body Ionizing Radiation Exposures for DOE/DOE Contractor Employees, 1965-1983

	Number of Employees Receiving Exposures in Each Dose-Equivalent Range (rem)														
Year	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	Total Employees Monitored
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							2	104,986
1980	45,054	38,895	1,113	387	16										85,465
1981	45,224	36,561	967	263	29	5									83,049
1982	48,968	34,949	1,010	313	56	28									85,324
1983	49,871	36,768	1,270	294	49	31									88,283

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

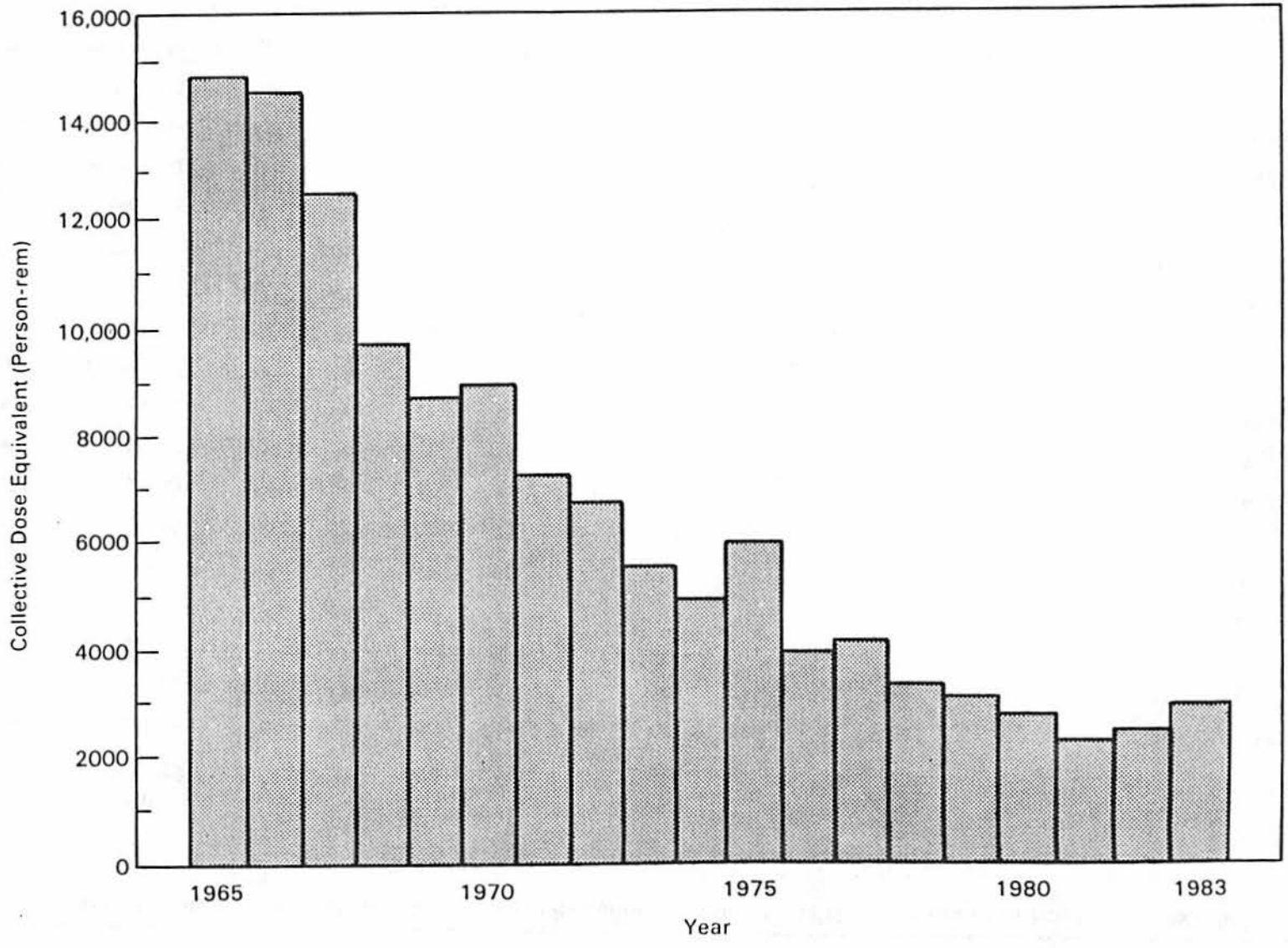

FIGURE 4. Total Collective Dose Equivalent for All DOE/DOE Contractor Employees Who Received an Exposure Greater Than 1 rem, 1965-1983

DISTRIBUTION BY FACILITY TYPE

The number of individuals and the distribution of the annual whole-body exposures in each of 10 facility categories were reported to the central repository. For 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 "Reactor." "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.

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 47 mrem. The highest average dose equivalent per individual monitored was observed at fuel fabrication facilities (235 mrem) and the lowest was observed for visitors to DOE facilities (4 mrem). The average dose equivalent per individual monitored with a measurable exposure was 190 mrem. The highest average dose equivalent for individuals monitored with a measurable exposure was observed at fuel fabrication facilities (321 mrem) and the lowest was observed for visitors (66 mrem).

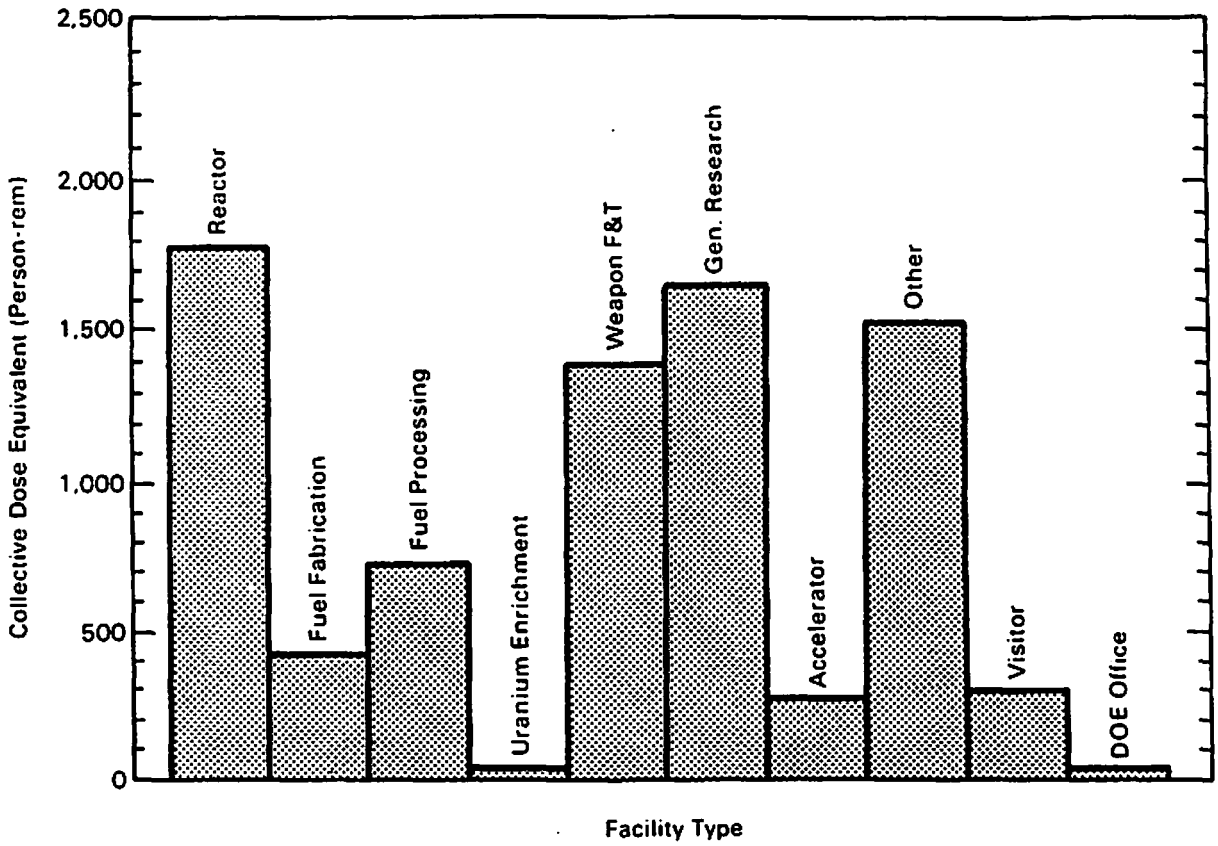

FIGURE 5. Contribution of Each Facility Type to the Total Collective Dose Equivalent, 1983

TABLE 4. Distribution of Annual Whole-Body Exposures for DOE/DOE Contractor Employees and Visitors by Facility Type, 1983

Facility Type	Total Persons Monitored	Number of Persons Receiving Exposures in Each Dose-Equivalent Range (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	8,386	2,689	2,998	1,022	752	299	158	327	139	2										1,781
Fuel Fab.	1,850	499	596	277	270	102	51	27	9	2	17									434
Fuel Proc.	3,727	1,286	1,196	393	370	224	109	149												726
Uran. Enrich.	1,155	766	317	61	10	1														31
Weapon F&T	20,497	11,091	7,361	937	473	213	135	279	8											1,399
Gen. Research	31,041	21,207	7,713	928	513	206	129	239	61	34	11									1,662
Accelerator	3,366	2,117	817	175	122	51	29	42	10	3										273
Other	15,926	8,407	5,027	1,091	704	257	155	207	67	8	3									1,522
Visitors	84,851	80,285	4,244	238	51	22	7	3	1											300
DOE Offices	2,335	1,809	503	19	4															30
TOTAL PERSONS	173,134	130,156	30,772	5,141	3,269	1,375	773	1,273	295	49	31									
TOTAL PERSON-REM		0	1,539	900	1,226	859	676	1,910	737	172	139									8,158

TABLE 5. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Facility Type, 1983

Facility Type	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 Exposure
Reactor	8,386	5,697	1,781	212	313
Fuel Fab.	1,850	1,351	434	235	321
Fuel Proc.	3,727	2,441	726	195	297
Uran. Enrich.	1,155	389	31	27	80
Weapon F&T	20,497	9,406	1,399	68	149
Gen. Research	31,041	9,834	1,662	54	169
Accelerator	3,366	1,249	273	81	219
Other	15,926	7,519	1,522	96	202
Visitors	84,851	4,566	300	4	66
DOE Offices	2,335	526	30	13	57
TOTAL	173,134	42,978	8,158	47	190

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 1977 to 1983 for each field organization are in Table 8.

TABLE 6. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1983

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 Exposure
Albuquerque	30,002	15,968	2,332	78	146
Chicago	16,528	3,854	623	38	162
Energy Tech. Centers	13	1	0	0	0
Idaho	35,074	1,685	353	10	209
Nevada	27,684	237	25	1	105
Oak Ridge	3,969	1,578	371	93	235
Pittsburgh Naval Reactor	2,918	2,250	220	75	98
Richland	12,422	6,720	2,458	198	366
San Francisco	22,879	1,734	267	12	154
Savannah River	19,061	7,230	1,293	68	179
Schenectady Naval Reactor	2,584	1,721	217	84	126
TOTAL	173,134	42,978	8,159	47	190

TABLE 7. Fraction of Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors Attributed to a Facility Type Within Each Field Organization, 1983

Field Organization	Facility Type									
	Reactor	Fuel Fab.	Fuel Proc.	Uran. Enrich.	Weapon F&T	Gen. Research	Acceler.	Other	Visitor	DOE Office
Albuquerque					0.57	0.34		<0.01	0.08	0.01
Chicago	0.10					0.26	0.43	0.11	0.10	
Energy Tech. Centers						0.00				
Idaho	0.35		0.48					0.15	0.00	0.01
Nevada					0.68			0.04	0.28	<0.01
Oak Ridge		0.27		0.08	0.12	0.45		0.05	0.03	
Pittsburgh Naval Reactor	0.38					0.59		<0.01	0.02	0.01
Richland	0.46	0.03				0.08		0.42	0.01	<0.01
San Francisco		0.55			0.01	0.37	0.03		0.04	<0.01
Savannah River	0.15	0.08	0.43		0.01	0.06		0.27	<0.01	<0.01
Schenectady Naval Reactor	0.85					0.14		<0.01	0.01	<0.01
ALL FIELD ORGANIZATIONS COMBINED	0.22	0.05	0.09	<0.01	0.17	0.20	0.03	0.19	0.04	<0.01

TABLE 8. Collective Dose Equivalent for DOE/DOE Contractor Employees and Visitors by Field Organization, 1977-1983[a]

Field Organization	1977	1978	1979[b]	1980	1981	1982	1983
Albuquerque	2,300	2,399	1,873	1,700	2,024	2,285	2,332
Chicago	1,373	1,167	1,061	918	758	587	623
Idaho	929	899	876	593	302	363	353
Nevada	49	47	55	50	36	29	25
Oak Ridge	1,300	1,566	1,332	604	437	401	371
Pittsburgh Naval Reactor	653	252	196	186	185	194	220
Richland	3,197	2,596	2,571	2,256	2,093	2,272	2,458
San Francisco	334	307	264	240	171	289	267
Savannah River	1,298	1,289	1,343	1,391	1,401	1,310	1,293
Schenectady Naval Reactor	148	111	114	79	76	147	217
TOTAL	11,581	10,635	9,693	8,024	7,483	7,879	8,158

(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 percent 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 five-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.

Of 10 internal deposition reports for 1983, five are considered new and are included in Table 9. The five remaining reports are not included for the following reasons: in three 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 two other cases, the reported burden was not in excess of 50 percent of the pertinent annual dose-equivalent standard.

TABLE 9. Dose Distributions for Cases of Internal Body Depositions, 1979-1983

Year	Radionuclide	Critical Organ	Dose-Equivalent Interval (rem) 7.5-10	10-15	15-25	25-50	50-100	100-200
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					
1981	^{238}Pu, ^{239}Pu, ^{240}Pu	Bone		1	1			
		Lung	1					
	^{234}U, ^{235}U, ^{238}U	Lung	3					
1982	^{238}Pu	Bone			1(a)	1(a)		
	^{238}Pu, ^{239}Pu, ^{240}Pu	Bone						1
		Liver	1					
1983	^{239}Pu, ^{240}Pu, ^{241}Am	Bone			1			
	^{234}U, ^{235}U	Lung	4					

(a) These previously unreported individuals exceeded 50 percent 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 percent 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.

SUMMARY OF WORKER TERMINATIONS

A total of 7,449 monitored workers terminated their employment with DOE or DOE contractors in 1983. 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 1983 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 3.70 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 1983

Length of Employment	Number of Terminated Employees	Total Cumulative Dose Equivalent (Person-rem)	Average Cumulative Dose Equivalent Per Terminated Employee (rem)
1-90 days	2,035	978.63	0.48
90-180 days	1,063	489.23	0.46
180-365 days	685	400.31	0.58
1-2 years	708	233.95	0.33
2-4 years	844	256.31	0.30
4-6 years	462	187.30	0.41
>6 years	1,652	6,112.75	3.70

APPENDIX A

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE FOR EACH DOE FIELD ORGANIZATION, 1983

TABLE A.1
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
ALBUQUERQUE FIELD ORGANIZATION
1983

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	10,135	1,268	7,054	780	410	202	134	279	8									1,325
Gen. Research	10,418	6,929	2,668	326	163	65	51	127	46	32	11							804
Accelerator																		
Other	139	106	24	8	1													3
Visitors	8,590	5,331	3,172	74	8	1	1	3										181
DOE Offices	720	400	305	11	4													19
TOTAL	30,002	14,034	13,223	1,199	586	268	186	409	54	32	11							2,332
TOTAL PERSON-REM			661	210	220	168	163	614	135	112	49							2,332

TABLE A.2
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
CHICAGO FIELD ORGANIZATION
1983

Dose-Equivalent Ranges (rem)

Facility Type	Total Monitored	< 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
Reactor	449	197	120	62	38	21	2	8		1								61
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	4,661	3,026	1,404	121	64	21	10	11	4									164
Accelerator	3,167	1,960	788	169	119	50	28	40	10	3								265
Other	609	461	102	11	12	4	3	2	4	7	3							68
Visitors	7,618	7,008	460	108	24	15	2		1									65
DOE Offices	24	22	2															
TOTAL	16,528	12,674	2,876	471	257	111	45	61	19	11	3							623
TOTAL PERSON-REM			144	82	96	69	39	92	48	39	14							623

TABLE A.3
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
ENERGY TECHNOLOGY CENTERS
1983

			Dose-Equivalent Ranges (rem)															
Facility Type	Total Monitored	< 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
Reactor																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	13	12	0	1														
Accelerator																		
Other																		
Visitors																		
DOE Offices																		
TOTAL	13	12	0	1														
TOTAL PERSON-REM		0	0	0														

TABLE A.4
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
IDAHO FIELD ORGANIZATION
1983

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	2,084	1,420	394	127	77	39	17	10										125
Fuel Fabrication																		
Fuel Processing	1,679	948	354	159	125	53	23	17										171
Uran. Enrichment																		
Weapon F&T																		
Gen. Research																		
Accelerator																		
Other	533	299	143	23	28	19	18	3										54
Visitors	30,609	30,609																
DOE Offices	169	113	54	2														3
TOTAL	35,074	33,389	945	311	230	111	58	30										353
TOTAL PERSON-REM			47	55	86	69	51	45										353

TABLE A.5
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
NEVADA FIELD ORGANIZATION
1983

Dose-Equivalent Ranges (rem)

Facility Type	Total Monitored	< 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
Reactor																		
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	9,752	9,595	110	33	12	2												17
Gen. Research																		
Accelerator																		
Other	910	904	4	2														1
Visitors	16,168	16,096	55	11	6													7
DOE Offices	854	852	2															
TOTAL	27,684	27,447	171	46	18	2												25
TOTAL PERSON-REM			9	8	7	1												25

TABLE A.6
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
OAK RIDGE FIELD ORGANIZATION
1983

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	429	38	93	123	146	26	2	1										100
Fuel Processing																		
Uran. Enrichment	1,155	766	317	61	10	1												31
Weapon F&T	359	87	116	108	38	9	1											45
Gen. Research	524	161	114	40	87	58	25	35	4									166
Accelerator																		
Other	964	860	51	35	15	1	2											17
Visitors	538	479	30	15	8	3	3											12
DOE Offices																		
TOTAL	3,969	2,391	721	382	304	98	33	36	4									371
TOTAL PERSON-REM			36	67	114	61	29	54	10									371

TABLE A.7
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
PITTSBURGH NAVAL REACTOR FIELD ORGANIZATION
1983

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	891	93	603	103	89	3												83
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1,487	197	1,035	168	61	9	10	7										129
Accelerator																		
Other	140	117	23															1
Visitors	347	250	97															5
DOE Offices	53	11	40	2														2
TOTAL	2,918	668	1,798	273	150	12	10	7										220
TOTAL PERSON-REM			90	48	56	7	9	10										220

TABLE A.8
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
RICHLAND FIELD ORGANIZATION
1983

Dose-Equivalent Ranges (rem)

Facility Type	Total Monitored	< 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
Reactor	2,324	547	501	332	274	138	121	271	139	1								1,136
Fuel Fabrication	258	32	66	57	45	31	17	9	1									80
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1,408	607	513	110	75	32	20	43	6	2								197
Accelerator																		
Other	6,250	2,568	2,195	508	409	191	121	195	62	1								1,028
Visitors	2,058	1,868	176	9	1	3	1											14
DOE Offices	124	80	41	3														3
TOTAL	12,422	5,702	3,492	1,019	804	395	280	518	208	4								2,458
TOTAL PERSON-REM			175	178	302	247	245	777	520	14								2,458

TABLE A.9
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
SAN FRANCISCO FIELD ORGANIZATION
1983

Facility Type	Total Monitored	< 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
							Dose-Equivalent Ranges (rem)											
Reactor																		
Fuel Fabrication	619	308	249	8	5	4	5	13	8	2	17							146
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T	118	105	6	3	4													2
Gen. Research	10,235	9,052	1,051	82	26	13	4	6	1									100
Accelerator	199	157	29	6	3	1	1	2										8
Other																		
Visitors	11,640	11,458	169	11	2													11
DOE Offices	68	65	3															
TOTAL	22,879	21,145	1,507	110	40	18	10	21	9	2	17							267
TOTAL PERSON-REM			75	19	15	11	9	32	23	7	76							267

TABLE A.10
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
SAVANNAH RIVER FIELD ORGANIZATION
1983

Dose-Equivalent Ranges (rem)

Facility Type	Total Monitored	< 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
Reactor	1,411	320	573	266	179	65	8											190
Fuel Fabrication	544	121	188	89	74	41	27	4										108
Fuel Processing	2,048	338	842	234	245	171	86	132										555
Uran. Enrichment																		
Weapon F&T	133	36	75	13	9													9
Gen. Research	1,273	715	424	70	37	8	9	10										75
Accelerator																		
Other	6,342	3,071	2,468	503	239	42	11	7	1									350
Visitors	7,014	6,975	27	10	2													4
DOE Offices	296	255	41															2
TOTAL	19,061	11,831	4,638	1,185	785	327	141	153	1									1,293
TOTAL PERSON-REM			232	207	294	204	123	230	3									1,293

TABLE A.11
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY FACILITY TYPE
SCHENECTADY NAVAL REACTOR FIELD ORGANIZATION
1983

Dose-Equivalent Ranges (rems)

Facility Type	Total Monitored	< 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
Reactor	1,227	112	807	132	95	33	10	38										185
Fuel Fabrication																		
Fuel Processing																		
Uran. Enrichment																		
Weapon F&T																		
Gen. Research	1,022	508	504	10														27
Accelerator																		
Other	39	21	17	1														1
Visitors	269	211	58															3
DOE Offices	27	11	15	1														1
TOTAL	2,584	863	1,401	144	95	33	10	38										217
TOTAL PERSON-REM			70	25	36	20	9	57										217

APPENDIX B

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR FOR EACH DOE FIELD ORGANIZATION, 1983

TABLE B.1
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1983

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	94	1,142	31	3													64
Visitors																	
Total	94	1,142	31	3													64
General Electric Co.																	
Employees	242	113	5	6													9
Visitors	16	2															
Total	258	115	5	6													9
Inhalation Toxicology																	
Employees	277	39	5	3	1												5
Visitors	348	6															
Total	625	45	5	3	1												5
Jacobs Engineering G																	
Employees	22	2															
Visitors																	
Total	22	2															
Jacobs Engr. Subcontractors																	
Employees	5																
Visitors																	
Total	5																
Mason & Hanger-Silas (Amarillo, TX)																	
Employees	635	152	85	39	22	6	28	5									111
Visitors	1,213	120	1														6
Total	1,848	272	86	39	22	6	28	5									117

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1983

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	
Mason & Hanger-Silas (Los Alamos, NM)																	
Employees	208	63	1														3
Visitors																	
Total	208	63	1														3
Monsanto Research Co.																	
Employees	88	1,468	110	16	3	3											103
Visitors	842	232															12
Total	930	1,700	110	16	3	3											115
Morrison-Knudsen Co.																	
Employees	7	6															
Visitors																	
Total	7	6															
Morrison-Knudsen Subcontractors																	
Employees	13	2															
Visitors																	
Total	13	2															
Rockwell International																	
Employees		4,173	548	345	177	125	251	3									1,038
Visitors		1,973															99
Total		6,146	548	345	177	125	251	3									1,137
Ross Aviation, Inc.																	
Employees	51	12	2														1
Visitors																	
Total	51	12	2														1

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1983

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
Sandia Laboratories (Albuquerque, NM)																	
Employees	2,090	495	66	16	4	4	2	6	1	1							74
Visitors	1,714	496	34	4	1		1										34
Total	3,804	991	100	20	5	4	3	6	1	1							108
Sandia Laboratories (Livermore, CA)																	
Employees	914	58	3		1												4
Visitors	163																
Total	1,077	58	3		1												4
Teledyne Isotopes																	
Employees	8	2	6	1													2
Visitors																	
Total	8	2	6	1													2
The Bendix Corp.																	
Employees	209	6	1	1													1
Visitors																	
Total	209	6	1	1													1
The Zia Company																	
Employees	908	477	29	22	5	4	2										47
Visitors																	
Total	908	477	29	22	5	4	2										47

TABLE B.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
ALBUQUERQUE FIELD ORGANIZATION
1983

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
University of California																	
Employees	2,532	1,536	222	122	54	43	123	40	31	10							671
Visitors	1,035	343	39	4		1	2										29
Total	3,567	1,879	261	126	54	44	125	40	31	10							700
TOTAL ALBUQUERQUE	13,634	12,918	1,188	582	268	186	409	54	32	11							2,313

TABLE B.2
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1983

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	
Ames Laboratory																	
Employees	3	41															2
Visitors																	
Total	3	41															2
Argonne National Lab.																	
Employees	1,876	317	123	75	26	8	8	4									111
Visitors	3,158	43		1													3
Total	5,034	360	123	76	26	8	8	4									114
Brookhaven National Lab.																	
Employees	879	518	116	88	47	24	47	10	4								239
Visitors	159	180	43	9	10	2		1									30
Total	1,038	698	159	97	57	26	47	11	4								269
Chicago Misc.																	
Employees	352	184	29	10	6	4	2	4	7	3							76
Visitors	270	16	3														1
Total	622	200	32	10	6	4	2	4	7	3							77
Fermi National Lab.																	
Employees	1,405	392	59	39	15	6	4										65
Visitors	1,894	211	62	14	5												30
Total	3,299	603	121	53	20	6	4										95
Massachusetts Inst. of Tech.																	
Employees	242	108	15	13	2	1											15
Visitors	1,509	8															
Total	1,751	116	15	13	2	1											15

TABLE B.2 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
CHICAGO FIELD ORGANIZATION
1983

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
Princeton University																	
Employees	813	846	18	6													48
Visitors																	
Total	813	846	18	6													48
TOTAL CHICAGO	12,560	2,864	468	255	111	45	61	19	11	3							620

TABLE B.3
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
ENERGY TECHNOLOGY CENTERS
1983

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
EG&G WASC, Inc.																	
Employees	5		1														
Visitors																	
Total	5		1														
TOTAL ENERGY TECHNOLOGY CENTERS	5		1														

TABLE B.4
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1983

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	
American Protective Service																	
Employees	50	74															4
Visitors																	
Total	50	74															4
Bendix Field Eng.																	
Employees	98	10	2		1												1
Visitors																	
Total	98	10	2		1												1
Biggers Const.																	
Employees	1	6			1												1
Visitors																	
Total	1	6			1												1
Bingham Mechanical																	
Employees	2	6	5	5	1												4
Visitors																	
Total	2	6	5	5	1												4
CL Electric Company																	
Employees		1															
Visitors																	
Total		1															
EG & G Idaho, Inc.																	
Employees	1,252	320	122	73	35	15	9										113
Visitors	20,779																
Total	22,031	320	122	73	35	15	9										113

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1983

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	
Exxon Nuclear Co.																	
Employees	834	212	109	94	41	18	8										118
Visitors	9,830																
Total	10,664	212	109	94	41	18	8										118
Idaho Miscellaneous																	
Employees	215	123	26	11	6	2	1										22
Visitors																	
Total	215	123	26	11	6	2	1										22
Lehigh Design Co., Inc																	
Employees	7	2															
Visitors																	
Total	7	2															
Morrison-Knudsen																	
Employees	55	68	19	12	6	1	5										23
Visitors																	
Total	55	68	19	12	6	1	5										23
Ormond Construction																	
Employees	2	8	4	5	2	3	4										13
Visitors																	
Total	2	8	4	5	2	3	4										13
Waters Asbestos																	
Employees		2	1	2		1											2
Visitors																	
Total		2	1	2		1											2

TABLE B.4 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
IDAHO FIELD ORGANIZATION
1983

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	
West Valley Nuclear																	
Employees	151	59	21	28	18	18	3										49
Visitors																	
Total	151	59	21	28	18	18	3										49
TOTAL IDAHO	33,276	891	309	230	111	58	30										350

TABLE B.5
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1983

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	55																
Visitors	4																
Total	59																
CER Geonuclear																	
Employees	3																
Visitors																	
Total	3																
Defense Nuclear Agency																	
Employees	973	4	2														1
Visitors	3,996	9	1														1
Total	4,969	13	3														2
EG&G, Inc.																	
Employees	1,368	11	1	1	1												2
Visitors	164	4	1														
Total	1,532	15	2	1	1												2
Environmental Protec.																	
Employees	106	2		1													
Visitors																	
Total	106	2		1													
Fenix & Scisson, Inc.																	
Employees	260	20	6	1													2
Visitors	134																
Total	394	20	6	1													2

TABLE B.5 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1983

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
Halliburton Services.																	
Employees	70																
Visitors	270																
Total	340																
Holmes & Narver, Inc.																	
Employees	569	4	1														
Visitors	232																
Total	801	4	1														
Nevada Misc.																	
Employees	549	1															
Visitors	365																
Total	914	1															
Reynolds Electrical																	
Employees	6,041	65	22	9	1												11
Visitors	4,318																
Total	10,359	65	22	9	1												11
U.S. Department of Interior																	
Employees	180	1															
Visitors	8																
Total	188	1															
Wackenhut Services																	
Employees	267	5	3														1
Visitors	55																
Total	322	5	3														1

TABLE B.5 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
NEVADA FIELD ORGANIZATION
1983

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
Westinghouse Electric																	
Employees	58	1															
Visitors	51																
Total	109	1															
TOTAL NEVADA	20,096	127	37	12	2												18

TABLE B.6
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1983

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	
Goodyear Atomic Corp.																	
Employees	280	256	33	3	1												20
Visitors																	
Total	280	256	33	3	1												20
National Lead of Ohio																	
Employees	5	54	91	131	26	2	1										87
Visitors																	
Total	5	54	91	131	26	2	1										87
Oak Ridge Assoc. Univ.																	
Employees	107	83	3	1	3	1											8
Visitors																	
Total	107	83	3	1	3	1											8
Puerto Rico Nuclear Ctr.																	
Employees	64	3															
Visitors																	
Total	64	3															
RMI Company																	
Employees	32	39	32	15													13
Visitors																	
Total	32	39	32	15													13
Rust Engineering Co.																	
Employees	808	35	34	10													11
Visitors																	
Total	808	35	34	10													11

TABLE B.6 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
OAK RIDGE FIELD ORGANIZATION
1983

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
Union Carbide/ORGDP																	
Employees	470	54	12	1													5
Visitors																	
Total	470	54	12	1													5
Union Carbide/Y-12																	
Employees	94	116	110	38	9	1											46
Visitors																	
Total	94	116	110	38	9	1											46
Union Carbide/ORNL																	
Employees	29	31	35	86	55	24	35	4									158
Visitors	479	30	15	8	3	3											12
Total	508	61	50	94	58	27	35	4									170
Union Carbide/Paducah																	
Employees	16	7	16	6													5
Visitors																	
Total	16	7	16	6													5
Woven Structures, Inc.																	
Employees	6	13	1	5	1	2											5
Visitors																	
Total	6	13	1	5	1	2											5
TOTAL OAK RIDGE	2,390	721	382	304	98	33	36	4									370

TABLE B.7
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
PITTSBURGH NAVAL REACTOR FIELD ORGANIZATION
1983

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	
Duquesne Light Co.																	
Employees	5	228	66	70													49
Visitors	36	55															3
Total	41	283	66	70													52
Westinghouse Electric/BAPL																	
Employees	192	838	36	19	9	10	6										79
Visitors	158	36															2
Total	350	874	36	19	9	10	6										81
Westinghouse Electric/NRF																	
Employees	93	572	169	61	3		1										84
Visitors	56	6															
Total	149	578	169	61	3		1										84
Westinghouse Plant Appa.																	
Employees	117	23															1
Visitors																	
Total	117	23															1
TOTAL PITTSBURGH	657	1,758	271	150	12	10	7										218

TABLE B.8
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1983

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	
Pacific Northwest Laboratory																	
Employees	502	403	75	47	26	21	38	6	2								165
Visitors	241	16															1
Total	743	419	75	47	26	21	38	6	2								166
BCS Richland Inc.																	
Employees	5	10	1	3													2
Visitors																	
Total	5	10	1	3													2
Hanford Eng. Dev. Lab.																	
Employees	476	352	64	41	13	4	8										68
Visitors	169	18															1
Total	645	370	64	41	13	4	8										69
Hanford Environ. Health Found.																	
Employees	11	9															
Visitors	3																
Total	14	9															
J. A. Jones Const. Co.																	
Employees	510	370	92	156	77	61	101	22									401
Visitors	27	3															
Total	537	373	92	156	77	61	101	22									401
Kaiser Engineers-Hanford																	
Employees	219	132	8	9	3		1										15
Visitors	11	1															
Total	230	133	8	9	3		1										15

TABLE B.8 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
RICHLAND FIELD ORGANIZATION
1983

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 Hanford Oper.																	
Employees	1,426	1,420	370	204	97	48	78	11									459
Visitors	839	86		1													5
Total	2,265	1,506	370	205	97	48	78	11									464
United Nuclear Ind. Inc.																	
Employees	601	579	397	343	176	145	292	169	2								1,331
Visitors	287	43	9		3	1											6
Total	888	622	406	343	179	146	292	169	2								1,337
TOTAL RICHLAND	5,327	3,442	1,016	804	395	280	518	208	4								2,454

TABLE B.9
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1983

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	308	249	8	5	4	5	13	8	2	17							146
Visitors	313	25															1
Total	621	274	8	5	4	5	13	8	2	17							147
Stanford Linear Accel. Ctr.																	
Employees	157	28	5	3													3
Visitors																	
Total	157	28	5	3													3
University of California/LBL																	
Employees	810	441	20	1													26
Visitors																	
Total	810	441	20	1													26
University of California/LLNL																	
Employees	8,098	562	62	24	13	4	6	1									71
Visitors	9,857	136	11	1													9
Total	17,955	698	73	25	13	4	6	1									80
University of California/LEHR																	
Employees	58	46															2
Visitors																	
Total	58	46															2

TABLE B.9 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
SAN FRANCISCO FIELD ORGANIZATION
1983

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
University of California/LNM																	
Employees	56	3	1	1	1	1	2										5
Visitors																	
Total	56	3	1	1	1	1	2										5
University of California/MC																	
Employees	30																
Visitors																	
Total	30																
University of California/NTS																	
Employees	105	6	3	4													2
Visitors	1,288	8		1													1
Total	1,393	14	3	5													3
TOTAL SAN FRANCISCO	21,080	1,504	110	40	18	10	21	9	2	17							266

TABLE B.10
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
SAVANNAH RIVER FIELD ORGANIZATION
1983

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	3,179	3,016	700	575	294	132	147										1,009
Visitors	6,975	27	10	2													4
Total	10,154	3,043	710	577	294	132	147										1,013
E. I. Du Pont/SRP-Const.																	
Employees	1,329	1,518	474	208	33	9	6	1									277
Visitors																	
Total	1,329	1,518	474	208	33	9	6	1									277
Savannah River Ecol. Lab.																	
Employees	47	21	1														1
Visitors																	
Total	47	21	1														1
Southern Bell Tel.																	
Employees	25	14															1
Visitors																	
Total	25	14															1
U. S. Forest Service																	
Employees	21	1															
Visitors																	
Total	21	1															
TOTAL SAVANNAH RIVER	11,576	4,597	1,185	785	327	141	153	1									1,292

TABLE B.11
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES BY CONTRACTOR
SCHENECTADY NAVAL REACTOR FIELD ORGANIZATION
1983

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 Company																	
Employees	831	1,369	142	95	33	10	38										215
Visitors																	
Total	831	1,369	142	95	33	10	38										215
General Electric/MAO																	
Employees	21	17	1														1
Visitors																	
Total	21	17	1														1
TOTAL SCHENECTADY	852	1,386	143	95	33	10	38										216

APPENDIX C

DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION, 1983

TABLE C.1
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1983

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	244	170	1														9
Amarillo Area Office	38	1															
Dayton Area Office		27															1
Kansas City Area Office	22																
Los Alamos Area Office	84	45	4	1													3
Pinellas Area Office	5	7															
Rocky Flats Area Office		55	6	3													5
UMTRA Project Office	7																
TOTAL	400	305	11	4													18
Chicago Operations	22	2															
Environmental Meas. Lab.	33	3															
New Brunswick Lab.	59	7	3	2													2
TOTAL	114	12	3	2													2
Energy Tech. Centers Morgantown	7																
TOTAL	7																

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1982

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	
Idaho Operations	111	53	2														3
West Valley Nuclear	2	1															
TOTAL	113	54	2														3
Nevada Operations	7,351	44	9	6													6
TOTAL	7,351	44	9	6													6
Oak Ridge Operations	1																
TOTAL	1																
Pittsburgh Naval Reactors	11	40	2														2
TOTAL	11	40	2														2
Richland Operations	375	50	3														3
TOTAL	375	50	3														3

TABLE C.1 (Continued)
DISTRIBUTION OF ANNUAL WHOLE-BODY EXPOSURES FOR DOE GOVERNMENT EMPLOYEES AND VISITORS BY DOE FIELD ORGANIZATION
1982

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	
San Francisco Operations	65	3															
TOTAL	65	3															
Savannah River Operations	255	41															2
TOTAL	255	41															2
Schenectady Naval Reactor	11	13															1
West Milton Field Office		2	1														
TOTAL	11	15	1														1

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