DPSPU-89-11-1

SAVANNAH RIVER PLANT
SAVANNAH RIVER LABORATORY

RADIATION EXPOSURE REPORT

Annual Report for 1988
and Exposure Goals for 1989

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Occupational Health Protection, SRL

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January 1989

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT DE-AC09-76SR00001

DPSPU--89-11-1

DE91 005701

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The protection of worker health and safety is of paramount concern at the Savannah River Site. Since the site is one of the largest nuclear sites in the nation, radiation safety is a key element in the protection program.

This report is a compendium of the results in 1988 of the programs at the Savannah River Plant (Chapters 1 - 7) and the Savannah River Laboratory (Chapter 8) to protect the radiological health of employees. By any measure, the radiation protection performance at this site in 1988 was the best since the beginning of operations. This accomplishment was made possible by the commitment and support at all levels of the organizations to reduce radiation exposures to ALARA (As Low As Reasonably Achievable).

The report provides detailed information about the radiation doses received by departments and work groups within these organizations. It also includes exposure data for recent years to allow Plant and Laboratory units to track the effectiveness of their ALARA efforts. Many of the successful practices and methods that reduced radiation exposure are described.

Each year since 1977, radiation protection goals have been developed at the site. These goals set an upper boundary on collective and individual exposures as well as assimilations of radioactive materials. A new goal for personnel contamination cases has been established for 1989. Only through continual and innovative efforts to minimize exposures can the goals be met. The radiation protection goals for 1989 and previous years are included in the report.

1 SRP RADIATION EXPOSURE SUMMARY

Collective and Individual Exposures

In 1988 radiation exposure at the Savannah River Plant (SRP) totaled 844.2 rem, the lowest collective exposure in plant history. Collective exposure for the plant decreased by 6 % while the number of radiation workers increased by 11 % in 1988 as compared to 1987. The plant organizations in the 100, 200, 300, and 400 Areas met their radiation goals in 1988.

The maximum SRP operations employee whole body radiation exposure was 1590 mrem. This is a plant record for Operations employees and is 260 mrem below the 1850 mrem goal. One Construction employee's whole body radiation exposure exceeded goal. This individual's exposure totaled 2040 mrem. The 1988 average annual radiation exposure was 66 mrem per monitored employee and is the lowest since plant startup. This continuing reduction has resulted in a 60 % decrease since 1979. Ninety-seven percent (97%) of Operations personnel received radiation exposures less than 0.5 rem, with 99% less than 1.0 rem. Ninety-nine percent (99%) of Construction personnel received radiation exposures of less than 0.5 rem, with 99.9% less than 1.0 rem.

These achievements demonstrate Operation's and Construction's continued emphasis on and improvement in their ALARA programs.

Assimilations

In 1988 there was one confirmed assimilation above the SRP administrative limit. This matches the previous SRP record which was set in 1987. The assimilation was the result of an uptake of tritium and occurred in 100-K Area. The calculated effective dose equivalent for this assimilation for the first 12 months after the intake was 101 mrem.

1989 Radiation Exposure Goals

The 1989 goals listed in this report were based on the recommendations of the Occupational Health Subcommittee and approved by SRP Management. The 1989 Plant cumulative radiation exposure goal is 1164 rem and the Management Challange is 844 rem. The 1989 maximum individual radiation exposure goal is 1800 mrem, and again, the goal is zero for assimilations.

A plantwide goal for personnel contamination cases has been set for the first time. The goal is to experience no more than 175 cases. Tabulation of the cases will follow criteria established by the Institute of Nuclear Power Operations (INPO).

TABLE 1-1. SRP RADIATION EXPOSURE SUMMARY *

YEAR	GOAL	TOTAL WHOLE BODY EXPOSURE, rem **
1979	1000	1085
1980	1110	1128
1981	1140	1130
1982	1190	1080
1983	1120	1049
1984	1223	1024
1985	1282	1081
1986	1295	1061
1987	1265	896
1988	1215	844
1989	1164	

* Includes SRP and Construction.
** Includes the effective dose equivalent from tritium.
For SRL see TABLE 8-2.
For DOE, SREL, Forestry, Southern Bell, AT&T, NUS, and WSI see TABLE 1-3.

TABLE 1-2. AVERAGE WHOLE BODY RADIATION EXPOSURE PER MONITORED EMPLOYEE *

YEAR	NO. OF PERSONNEL MONITORED	AVERAGE EXPOSURE (mrem)
1979	6,592	164
1980	6,962	162
1981	7,763	146
1982	7,940	136
1983	8,896	118
1984	9,398	109
1985	11,019	98
1986	11,892	89
1987	11,559	78
1988	12,830	66

* Includes SRP and Construction.
For SRL see Table 8-4.

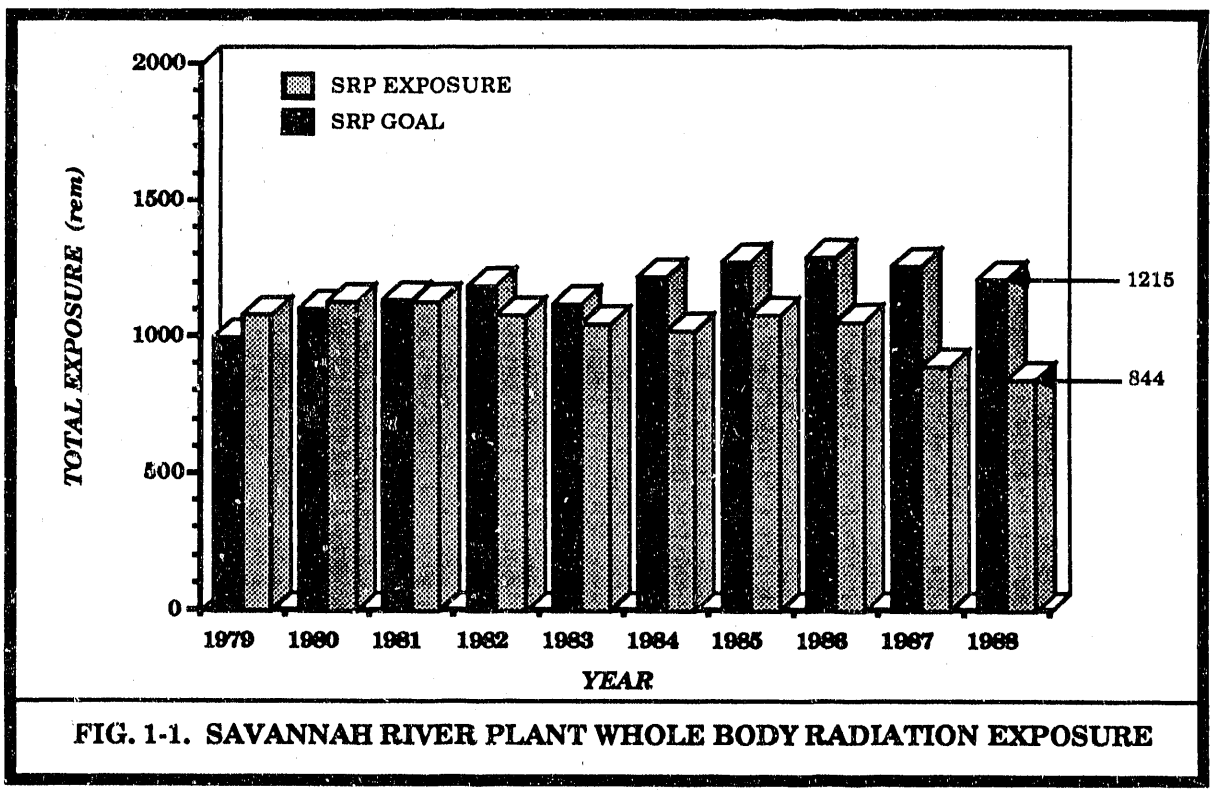


FIG. 1-1. SAVANNAH RIVER PLANT WHOLE BODY RADIATION EXPOSURE

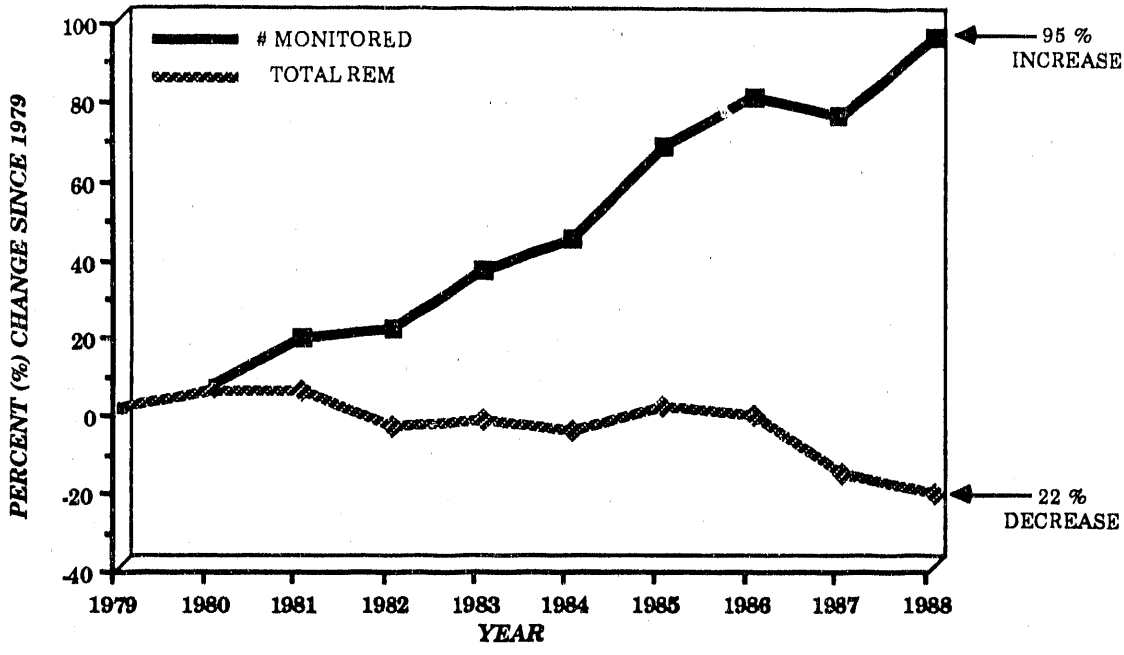


FIG. 1-2. PERCENT CHANGE IN THE NUMBER OF MONITORED EMPLOYEES AND THE TOTAL SRP RADIATION EXPOSURE SINCE 1979

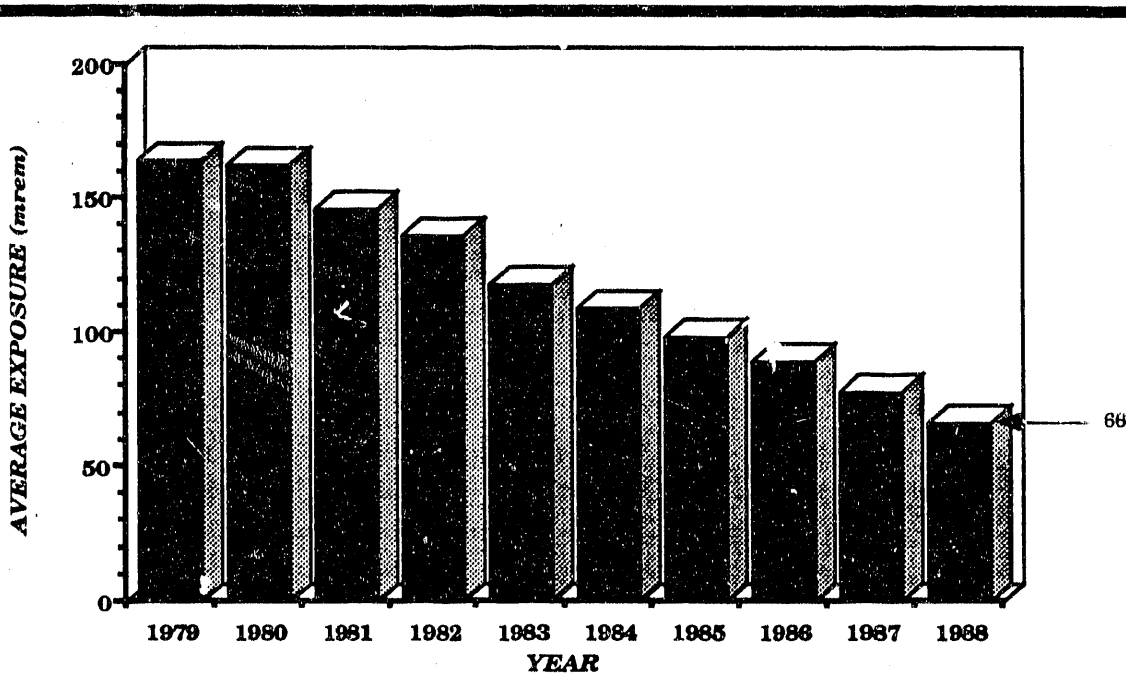


FIG. 1-3. MONITORED EMPLOYEE AVERAGE WHOLE BODY RADIATION EXPOSURE

TABLE 1-3. 1988 RADIATION EXPOSURE SUMMARY OF OTHER ORGANIZATIONS

GROUPS	NO. OF PERSONNEL MONITORED	TOTAL WHOLE BODY EXPOSURE, rem
DOE	282	1.4
SREL	108	0.5
FORESTRY	42	0.4
SOUTHERN BELL	23	0.2
WSI	978	12.3
AT&T	14	0.1
NUS	17	0.03
TOTALS	1464	14.93

TABLE 1-4. AREA RADIATION EXPOSURE AND GOALS, REM

AREAS	1987 EXPOSURE	1988 GOAL	1988 EXPOSURE	1989 GOAL
100	129.0	216.4	125.1	142.5
200	635.1	865.0	620.6	907.6
300	57.0	55.0	49.6	60.0
400	5.4	6.2	1.9	4.2
G	5.5	6.6	5.1	6.2
REST OF PLANT	64.5	65.8	41.9	43.5
TOTAL (SRP)	896.5	1215.0	844.2	1164.0

TABLE 1-5. 1988/89 DEPARTMENT RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1988 GOAL	1988 EXPOSURE	1989 GOAL
CSWE	17.57	12.72	13.8
CONSTRUCTION	320.00	269.45	284.50
HEALTH PROTECTION	95.25	67.06	100.00
HEAVY WATER	0.92	-	-
LABORATORIES	43.85	25.01	36.15
POWER/PT	2.68	2.01	2.56
BUS SERV *	7.40	1.18	3.35
PROJECT	1.62	0.46	1.22
RAW MATERIAL			
OPERATIONS	39.90	39.32	45.46
ENG. & TECH	4.67	2.75	4.15
RM & TQ	-	1 07	1.40
REACTOR			
OPERATIONS	58.33	33.56	36.35
TECHNICAL	2.51	1.61	2.62
WORKS ENGINEERING	28.40	21.68	27.32
PROJ. MTG.	-	0.14	0.40
RESE MTG.	-	0.40	0.60
QUALITY	-	0.91	1.60
SAFEGUARDS & SECURITY	1.34	0.41	0.95
SEPARATIONS			
CANYONS	76.20	61.88	75.00
B-LINES	247.00	143.85	254.00
OUTSIDE FACILITIES	9.00	0.83	2.50
PuFF	1.10	0.07	0.50
RBOF	2.97	2.45	2.80
PROJECT LIAISON	5.00	1.44	4.17
TECHNICAL	2.05	1.15	2.41
WORKS ENGINEERING	41.80	26.35	38.49
QUALITY	-	0.48	1.60
MISC.	-	22.30	-
TRITIUM			
OPERATIONS	4.50	2.95	2.66
TECHNICAL	0.20	0.00	0.30
WORKS ENGINEERING	2.21	1.62	1.86
PROJ. MTG.	-	-	0.10
RTF	-	0.00	0.10
WASTE MANAGEMENT			
OPERATIONS	71.17	56.31	74.12
TECHNICAL	4.55	4.00	4.85
PROJECTS	0.45	0.20	0.55
WORKS ENGINEERING	52.86	34.81	93.83
DEFENSE WASTE	3.30	1.53	6.00
NAVAL FUEL P&WE/TECH	47.10	4.52	12.28
OTHER**	19.10	20.00	20.45
TOTAL	1215.00	844.20	1164.00

* Previously referred to as SSD.
** Does not include organizations listed in TABLE 1-3.

TABLE 1-6. AREA RADIATION EXPOSURE BREAKDOWN TRITIUM, NEUTRON, AND TOTAL, REM

AREA	TRITIUM	NEUTRON	TOTAL WHOLE BODY
100-P	6.5	0.2	29.0
100-K	9.5	0.1	65.8
100-C	1.2	0.04	10.3
100-L	2.6	0.04	20.0
200-F	0.5	118.3	394.6
200-H	1.6	10.2	226.0
300-M	0.0	0.2	49.6
400-D	0.5	0.02	1.9
REST OF PLANT	0.8	4.1	47.0
TOTAL	23.2	133.2	844.2

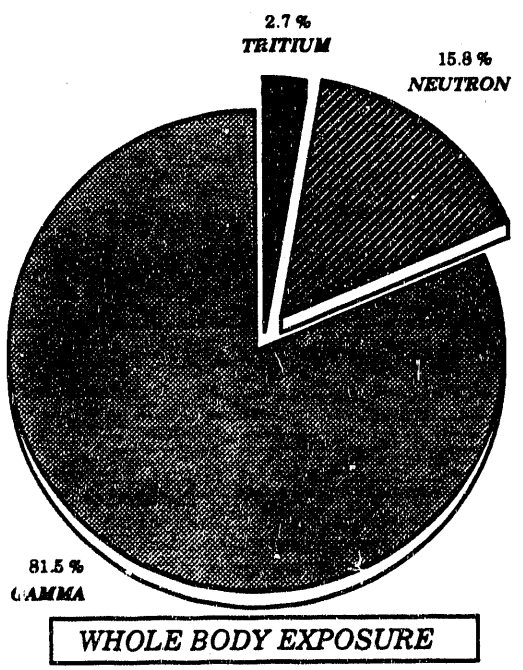


FIG. 1-4. PLANT RADIATION EXPOSURE BREAKDOWN (TRITIUM, NEUTRON, AND GAMMA) AS A PERCENTAGE OF THE PLANT TOTAL

TABLE 1-7. 1988 INDIVIDUAL EMPLOYEE WHOLE BODY RADIATION EXPOSURE DISTRIBUTION

	(Number of Employees)					
DEPARTMENTS	0-0.5 rem	0.5-1.0 rem	1.0-1.5 rem	1.5-2.0 rem	2.0-2.5 rem	>2.5 rem
OPERATIONS						
REACT	518	0	0	0	0	0
RT	103	0	0	0	0	0
RWE	391	6	0	0	0	0
SEP	641	78	37	7	0	0
SEP-T	96	0	0	0	0	0
SWE	338	10	1	0	0	0
SEPJ	46	4	0	0	0	0
FPF	3	0	0	0	0	0
WM WO	174	37	10	1	0	0
WM WT	49	2	0	0	0	0
WMPROJ	48	1	0	0	0	0
WM WE	166	15	9	0	0	0
DWPF	286	1	0	0	0	0
NFP&WE	407	1	0	0	0	0
NFT	122	0	0	0	0	0
RAW MT	200	27	0	0	0	0
RME&T	183	2	0	0	0	0
TRITIUM	251	5	1	0	0	0
TR TECH	10	0	0	0	0	0
RTF	33	0	0	0	0	0
TR WE	67	0	0	0	0	0
OTHER OPER	284	0	0	0		
PLANT FACILITIES AND SERVICES						
HP	416	46	2	0	0	0
LABS	283	10	0	0	0	0
CSWE	842	5	1	0	0	0
PROJ	183	0	0	0	0	0
POWER	290	0	0	0	0	0
POW TEC	48	0	0	0	0	0
DCS	147	0	0	0	0	0
OTHER	632	0	0	0	0	0
TOTAL SRP	7257	250	61	8	0	0
ASSIGNED TO SRP*	587	3	3	1	0	0
CONSTRUCTION	4593	64	2	0	1	0
TOTAL PLANT AND CONST	12437	317	66	9	1	0

* WILMINGTON, DIVERSCO, BECHTEL-NAT, C & R, AIKEN TECH, INS, WESTINGHOUSE, CONST ESCORT, MR/MS TEMPS, INDUSTRIAL PHASES, US ELEVATOR, DNV, DEC, UNITED, JONES, BECHTEL-SR

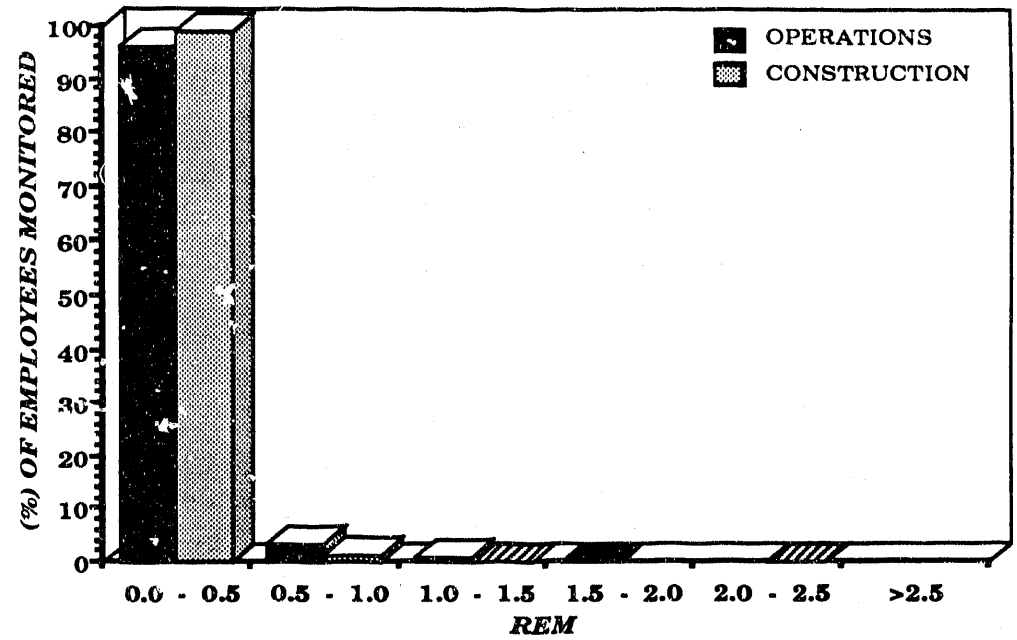


FIG. 1-5. EMPLOYEE WHOLE BODY RADIATION EXPOSURE DISTRIBUTION AS A PERCENT OF THE TOTAL NUMBER OF MONITORED EMPLOYEES

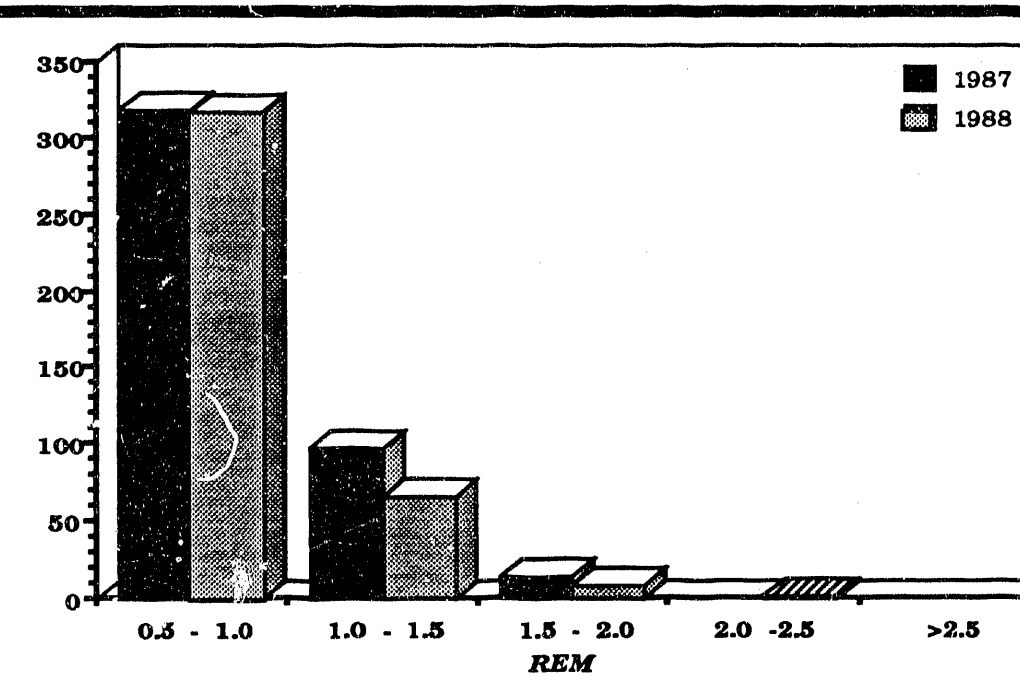


FIG. 1-6. DISTRIBUTION OF 0.5 REM AND GREATER WHOLE BODY RADIATION EXPOSURES FOR OPERATIONS AND CONSTRUCTION EMPLOYEES

TABLE 1-8. EMPLOYEES WITH ANNUAL RADIATION EXPOSURE GREATER THAN 2.0 REM

YEAR	NUMBER	% OF MONITORED EMPLOYEES *
1979	46	0.7
1980	53	0.8
1981	45	0.6
1982	11	0.1
1983	1	0.01
1984	0	0.0
1985	0	0.0
1986	2	0.02
1987	0	0.0
1988	1	0.01

* Employees assigned dosimeters, including Construction.

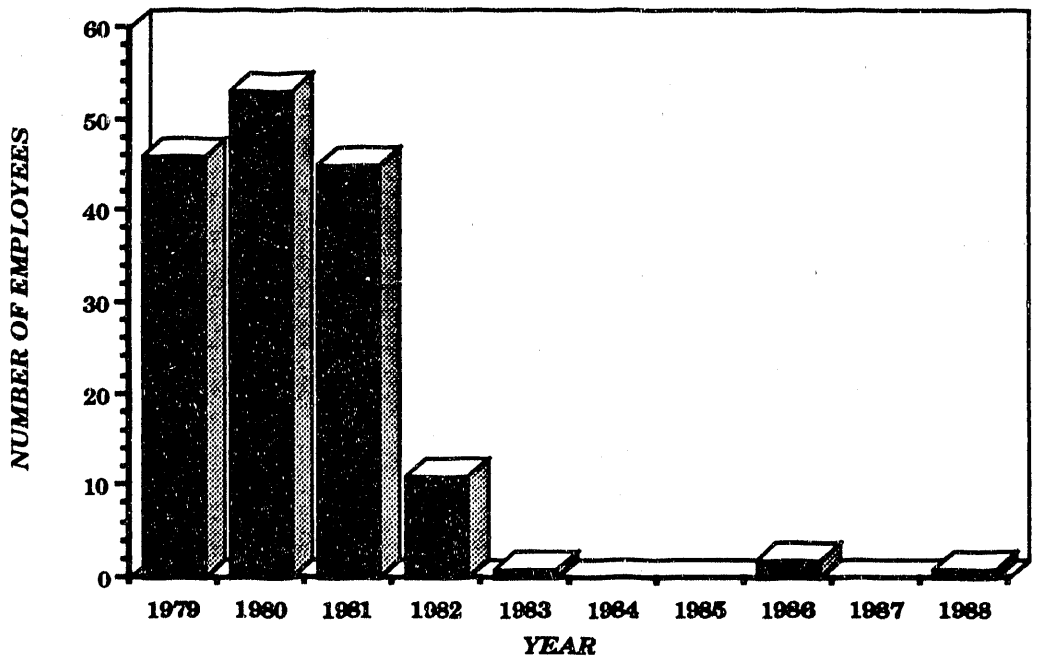


FIG. 1-7. EMPLOYEES WITH ANNUAL RADIATION EXPOSURE GREATER THAN 2.0 REM

TABLE 1-9. HIGHEST 20 SRP INDIVIDUAL WHOLE BODY EXPOSURES - 1988

DEPARTMENT	FACILITY	WHOLE BODY EXPOSURE, mrem
CONSTRUCTION	WM TANK FARM	2040
SEPARATIONS	FB-LINE	1590
SEPARATIONS	FB-LINE	1580
BECHTEL	WM TANK FARM	1560
SEPARATIONS	FB-LINE	1550
SEPARATIONS	FB-LINE	1535
SEPARATIONS	WM TANK FARM	1530
SEPARATIONS	FB-LINE	1525
SEPARATIONS	FB-LINE	1520
SEPARATIONS	FB-LINE	1510
SEPARATIONS	FB-LINE	1485
SEPARATIONS	FB-LINE	1465
BECHTEL	WM TANK FARM	1465
SEPARATIONS	FB-LINE	1460
SEPARATIONS	FB-LINE	1440
SEPARATIONS	FB-LINE	1430
SEPARATIONS	FB-LINE	1420
SEPARATIONS	FB-LINE	1400
SEPARATIONS	FB-LINE	1395
SEPARATIONS	FB-LINE	1390

TABLE 1-10. DEPARTMENT/ORGANIZATION CONTAMINATION CASES AND GOALS

DEPARTMENT	1988 CASES	1989 GOAL
SEPARATIONS	43	37
SWE	14	12
LABORATORY	10	8
RAW MATERIALS	4	4
RME&T	2	2
REACTOR	21	7
RWE	3	3
NF	12	10
HP	3	2
CONSTRUCTION	50	42
WMWE	14	12
WMWO	28	23
DOE	2	2
OTHER	14	11
TOTAL	220	175

All Departments not listed have a goal of zero.
Goals based on Institute of Nuclear Power Operations ("INPO") criteria.

TABLE 1-11. 1988 ASSIMILATIONS BY AREA

AREAS	1988 GOAL	1988 ASSIMILATIONS	1989 GOAL
100	0	1	0
200	0	0	0
300	0	0	0
REST OF PLANT	0	0	0
TOTAL (SRP)	0	1	0

TABLE 1-12. SRP ASSIMILATIONS (DOSE METHOD) *

	PLUTONIUM	FISSION PRODUCTS	AMERICIUM CURIUM	TRITIUM	ENRICHED URANIUM	NATURAL URANIUM	TOTAL	GOALS
1981	4	0	1	4	0	0	9	+
1982	5	0	0	4	0	0	9	12
1983	5	0	0	1	0	0	6	6
1984	3	0	0	3	0	0	6	0
1985	6	0	2	2	0	0	10	0
1986	8	2	0	0	0	0	10	0
1987	1	0	0	0	0	0	1	0
1988	0	0	0	1	0	0	1	0

* Confirmed by the dose method of 100 mrem or greater effective dose equivalent (first 12 months after intake). Data prior to 1981 has not been re-evaluated at this time. A quality factor of 1 was used for tritium calculations. The assimilations reported are subject to change as calculations of intake and thus effective dose equivalents are refined by collection and interpretation of additional bioassay results.

TABLE 1-13. SRP ASSIMILATIONS BY FACILITIES (DOSE METHOD)*

(NUMBER OF CONFIRMED INTAKES)

YEAR	FB LINE	HB LINE	772-F LABS	TRITIUM FACILITY	REACTOR AREAS	241-F&H	F CANYON	H CANYON	235-F
1981	1	0	2	2	2	0	1	0	1
1982	4	0	1	3	1	0	0	0	0
1983	1	1	1	0	1	0	0	2	0
1984	3	0	0	3	0	0	0	0	0
1985	6	0	0	1	1	0	2	0	0
1986	2	1	2	0	0	2	0	1	2
1987	1	0	0	0	0	0	0	0	0
1988	0	0	0	0	1	0	0	0	0

* Confirmed by the dose method of 100 mrem or greater effective dose equivalent (first 12 months after intake). Data prior to 1981 has not been re-evaluated at this time. A quality factor of 1.0 was used for tritium calculations.

TABLE 1-14. SUMMARY OF 1988 ASSIMILATIONS

ASSIMILATION NUMBER	DEPT.	DATE	LOCATION	ISOTOPE	DOSE mrem	INCIDENT SUMMARY
1	Const.	8/26/88	100-K	Tritium	101	Contaminated water was used to cool and flush a core drill rig.

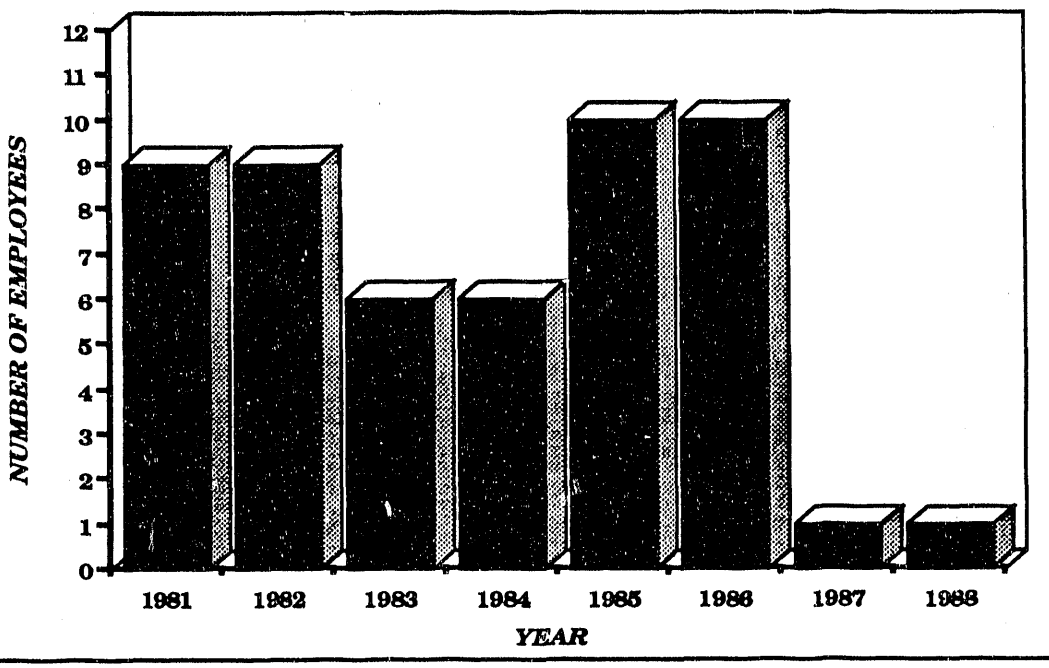


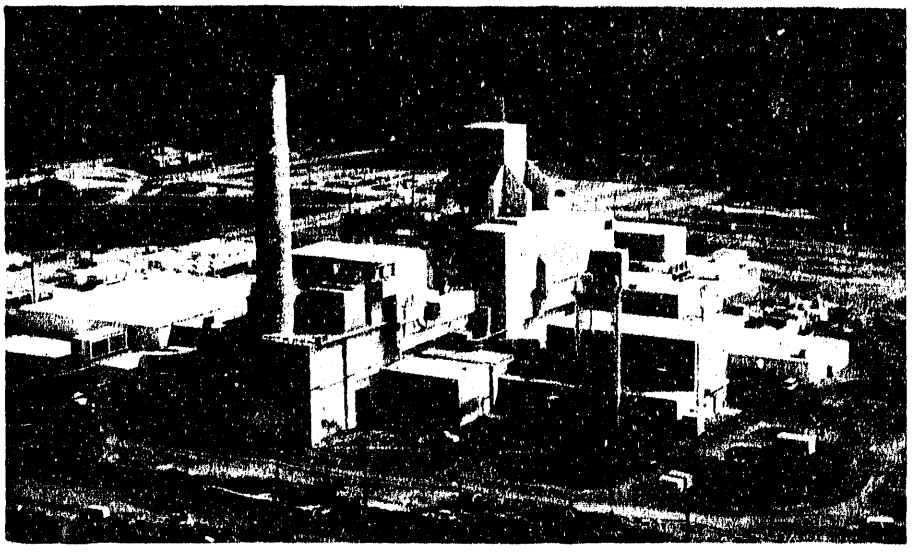
FIG. 1-8. ASSIMILATION OF RADIONUCLIDES ABOVE CONTROL LIMITS

2 100 AREAS

Radiation Exposure

During 1988, radiation exposure for the P,K,C, and L Reactor Areas was 125.1 rem compared to 128.9 rem for 1987. The maximum individual exposure for Operations and Construction personnel was 795 mrem and 1090 mrem respectively.

The average annual Reactor Operator radiation exposure continued to decline and was 90 mrem compared to 120 mrem in 1987. Reactor Works Engineering mechanics received an average radiation exposure of 80 mrem in 1988 as compared to 70 mrem in 1987.



L REACTOR

Major factors which contributed to the 1988 annual radiation exposure performance in the 100 Areas included continued emphasis on ALARA, increased training, and extended area shutdowns (903 Reactor days in 1988 versus 384 Reactor days in 1987).

The tritium contribution to the total radiation dose decreased from 21% in 1987 to 14% in 1988. This decrease can be attributed to continued efforts in the control of work with the potential for tritium exposure and increased construction and sub-contractor personnel radiation and contamination control training.

The Reactor Areas experienced one tritium assimilation above the control limit during the calender year. The assimilation was received by a Construction worker and occurred in K Area. The effective dose equivalent in the first 12 months after intake was 101 mrem.

100 Areas Radiation Reduction Program

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Job plans and operating procedures involving work with a potential for exposure must include a statement on ALARA actions and must be approved by a Health Protection Supervisor.

- Each major radiation job plan requires that a Reactor Department supervisor be present to monitor the containment and cleanup of moderator and to ensure that the provisions of the job plan are completely followed.

- Plastic suits are worn when there is a potential tritium intake rate of 100 uCi/hr or greater for Operations personnel and 50 uCi/hr or greater for Construction personnel or any time an individual's total tritium exposure has the potential to reach 100 uCi per shift.

- Personnel are removed from all tritium work when bioassay sample results are 10 uCi/L of tritium or greater until followup samples indicate a concentration of 2 uCi/L of tritium or less.

- Details of job plans involving potential worker exposure are reviewed in preplan meetings to emphasize specific methods for reducing exposure.

- Verbal notification followed by written notification is provided to department and Health Protection supervision when an individual's exposure exceeds a pro-rated exposure value.

- Approximately 10 new tritium air monitoring systems were installed in each of the P,K, and L Reactor buildings. The systems will provide improved monitoring capability throughout the facilities.

- Trend analysis of radiation exposures and bioassay data are conducted to determine problem areas. These findings are reviewed with appropriate department supervision.

Radiation Exposure Indices

Radiation exposure indices documenting collective exposures are being developed for a variety of 100 Area jobs. The indices will be used to plan and track the effectiveness of future improvements in radiation exposure reduction by comparison of the exposure received during a job to the established index.

Additional indices were developed in 1988. These include the following K-Area jobs: process line inspection, thermal couple replacement, system 2 & 5 suction line removal, 4th emergency cooling water system seismic bracing, system 2 & 3 expansion joint nozzle inspections, number 6 Heat Exchanger expansion joint inspection, and process area painting. These indices and others are listed in Table 2-10.

P-Area

Radiation Exposure:

The P Reactor was shutdown for a total of 267 days in 1988. Total whole body radiation exposure was 28.95 rem as compared to an annual goal of 66.97 rem and a 1987 exposure of 40.0 rem. Tritium accounted for 23 % of the total whole body exposure.

The average annual radiation exposure ranged from 65 mrem for RWE E&I mechanics to 135 mrem for HP inspectors.

There were no confirmed tritium assimilations to P-Area personnel in 1988.

Jobs Contributing to Significant Radiation Exposure:

There were no specific jobs that accounted for a significant portion of the P-Area total exposure.

K-Area

Radiation Exposure:

The K Reactor was shutdown for a total of 265 days in 1988. The total whole body radiation exposure was 65.77 rem as compared to a goal of 69.47 rem and a 1987 radiation exposure of 42.6 rem. Tritium accounted for 14% of the total whole body radiation exposures.

The average annual radiation exposure ranged from 78 mrem for Day Reactor operators to 219 mrem for Construction personnel.

There was one confirmed tritium assimilation in 1988. A Construction worker received a 101 mrem effective dose equivalent for the first 12 months after intake. This was 1 mrem above the 100 mrem confirming level. The assimilation occurred when contaminated water was inadvertently used to cool and flush a core drill rig.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Process Line Inspections	4.0
o System 2 & 5 Suction Line Removal	3.6
o Inspect Expansion Joints on #6 Heat Exchange	1.8
o Process Area Painting	1.7
o Inspect Nozzles on 2 & 3 System Expansion Joints	1.0

C-Area

Radiation Exposure:

The C Reactor continued in a "Cold" standby status. The total whole body radiation exposure was 10.35 rem versus an annual goal of 26.15 rem. As in 1987, reactor outage specialists based in C Area received 40 % (4.1 rem) of the total C Area exposure. This exposure was received while performing work at P, K, and L reactors. Tritium accounted for 12 % of the total whole body exposure.

There were no confirmed tritium assimilations to C Area personnel in 1988.

Jobs Contributing to Significant Radiation Exposure:

There were no specific jobs that accounted for a significant portion of the C-Area total exposure.

L-Area

Radiation Exposure:

The L Reactor continued to process Mark 16B charges in 1988. The reactor was shutdown for a total 191 days. Total whole body radiation exposure was 20.0 rem versus an annual goal of 53.86 rem. Tritium accounted for 13% of the total whole body exposure.

The average annual radiation exposure ranged from 19 mrem for RWE personnel to 71 mrem for HP inspectors.

There were no confirmed tritium assimilations to L-Area personnel in 1988.

Jobs Contributing to Significant Radiation Exposure:

There were no specific jobs that accounted for a significant portion of the L-Area total exposure.

TABLE 2-1. 100-AREAS RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
REACTOR	42.5	62.1	32.48	35.0
PROJ. MTG	-	-	0.12	0.3
RESR. MTG.	-	-	0.40	0.5
QUALITY	-	-	0.91	1.5
HEALTH PROTECTION	5.0	8.6	3.78	7.5
WORKS ENGINEERING (RWE)	21.4	27.0	20.23	27.0
POWER/POWER TECH	0.4	0.4	0.36	0.35
REACTOR TECH	1.6	2.5	1.58	2.5
PROJECT	0.1	0.15	0.12	0.15
BUS SERV *	0.6	0.7	0.48	0.1
CONSTRUCTION	55.8	113.0	61.42	65.0
OTHER	1.5	2.0	3.18	2.6
TOTAL	128.9	216.45	125.06	142.5

* Previously referred to as SSD.

TABLE 2-2. 100-AREAS TRITIUM CONTRIBUTION TO RADIATION EXPOSURE, REM

1987 TOTAL DOSE	1987 TRITIUM DOSE	1988 TOTAL DOSE	1988 TRITIUM DOSE
128.9	27.3	125.1	19.8

TABLE 2-3. 100-AREAS TRITIUM EXPOSURE, MREM

DEPARTMENT	1987	1988
REACTOR	13,480	9,290
PROJ. MTG.	-	15
RESR. MTG.	-	10
QUALITY	-	25
HEALTH PROTECTION	1,230	755
WORKS ENGINEERING (RWE)	4,470	3,210
POWER/POWER TECH	0	40
REACTOR TECH	215	150
PROJECT	5	20
BUS SERV *	150	55
OTHER	80	190
CONSTRUCTION	7,625	6,030
TOTAL	27,255	19,790

* Previously referred to as SSD.

TABLE 2-4. P,K,C and L-AREAS TRITIUM EXPOSURE, MREM

	P-AREA		K-AREA		C-AREA		L-AREA	
DEPARTMENT	1987	1988	1987	1988	1987	1988	1987	1988
REACTOR	5,825	3,320	4,980	4,320	635	750*	2,040	940
HP	450	175	470	440	90	5	220	135
RWE	1,655	1,315	1,700	1,210	460	175	655	510
POWER/POWER TECH	0	0	0	40	0	0	0	0
RT	65	35	55	55	95	50	0	10
PROJECT	0	0	0	0	5	20	0	0
BUS SERV **	100	25	35	30	15	0	0	0
CONSTRUCTION	2,410	1,575	2,485	3,325	950	205	1,780	925
OTHER	15	95	30	50	10	0	25	55
TOTAL	10,520	6,540	9,755	9,470	2,260	1,205	4,720	2,575

* Includes 50 mrem for RX PROJ. MTG., RX RESR. MTG, RX QUALITY.
** Previously referred to as SSD.

TABLE 2-5. P,K,C, and L-AREAS RADIATION EXPOSURE, REM

DEPARTMENT	P-AREA				K-AREA				C-AREA				L-AREA			
	1987 EXP	1988 GOAL	1988 EXP	1989 GOAL	1987 EXP	1988 GOAL	1988 EXP	1989 GOAL	1987 EXP	1988 GOAL	1988 EXP	1989 GOAL	1987 EXP	1988 GOAL	1988 EXP	1989 GOAL
REACTOR	15.4	19.3	8.33	11.6	15.4	21.3	16.36	13.0	3.1	7.5	5.35	4.3	8.6	14.0	3.71	8.4
HP	1.2	3.3	1.0	2.8	2.0	3.3	1.97	2.8	0.4	0.5	0.07	0.4	1.4	1.5	0.74	1.5
RWE	6.1	7.0	5.9	8.0	8.0	7.5	9.34	9.0	4.3	7.0	1.54	3.00	3.0	5.5	3.43	7.0
POWER/PT	0.2	0.15	0.22	0.15	0.3	0.15	0.11	0.15	0.0	0.05	0.02	0.02	0.0	0.05	0.01	0.03
RT	0.1	0.5	0.08	0.5	0.1	0 5	0.19	0.5	1.3	1.3	1.17	1.2	0.1	0.2	0.15	0.3
PROJECT	0.0	0.02	0.0	0.02	0.0	0.02	0.00	0.02	0.1	0.1	0.12	0.1	0.0	0.01	0.00	0.01
BUS SERV *	0.2	0.2	0.04	0.03	0.1	0.2	0.28	0.03	0.2	0.2	0.11	0.03	0.1	0.1	0.05	0.01
CONSTRUCTION	16.7	36.0	13.02	30.0	16.2	36.0	36.09	15.0	7.0	9.0	1.47	5.0	15.9	32.0	10.85	15.0
OTHER	0.1	0.5	0.34	0.65	0.5	0.5	1.43	0.65	0.5	0.5	0.50	0.65	0.4	0.5	1.07	0.65
TOTAL	40.0	66.97	28.95	53.75	42.6	69.47	65.77	41.15	16.9	26.15	10.35	14.7	29.5	53.86	20.01	32.90

* Previously referred to as SSD.

TABLE 2-6. 100-AREAS 1988 AVERAGE EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

AREA	RX DAYS	RX SHIFT	RX MISC	CH*	RPM, RQ & RRM	RWE E&I	RWE MAINT	RWE T&T	RWE MISC	HP	CONST
P	68 (7)	77(28)	78 (30)	126(18)	-	65 (26)	128 (24)	98(3)	36 (2)	135 (7)	79 (50)
L	31 (5)	32(24)	39 (34)	46(12)	-	31 (25)	57 (31)	-	19 (6)	71 (9)	61 (60)
K	78 (6)	149(28)	157 (31)	169(17)	-	94 (33)	142 (30)	-	114 (9)	167(12)	219(104)
C	4 (3)	13 (2)	78 (32)	35 (8)	45(18)	11 (6)	35 (21)	129(1)	73 (2)	156 (1)	19 (26)
MISC	-	-	26 (17)	-	-	16 (12)	91 (7)	-	-	-	-
100	55(21)	84(86)	80(145)	109(56)	45(18)	57(102)	93(113)	108(4)	73 (9)	129(29)	129(240)

* Component Handling personnel, Reactor Department.
( ) - Average number of employees in work group during 1988

TABLE 2-7. REACTOR OPERATOR EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	238	77.1	0.32
1980	244	80.4	0.33
1981*	286	76.5	0.27
1982*	288	75.4	0.26
1983*	289	74.1	0.26
1984*	322	73.5	0.23
1985*	337	72.8	0.22
1986*	328	61.4	0.19
1987*	272	33.4	0.12
1988*	307	26.1	0.09

* Average calculated by new method. See Chapter 9 for details.

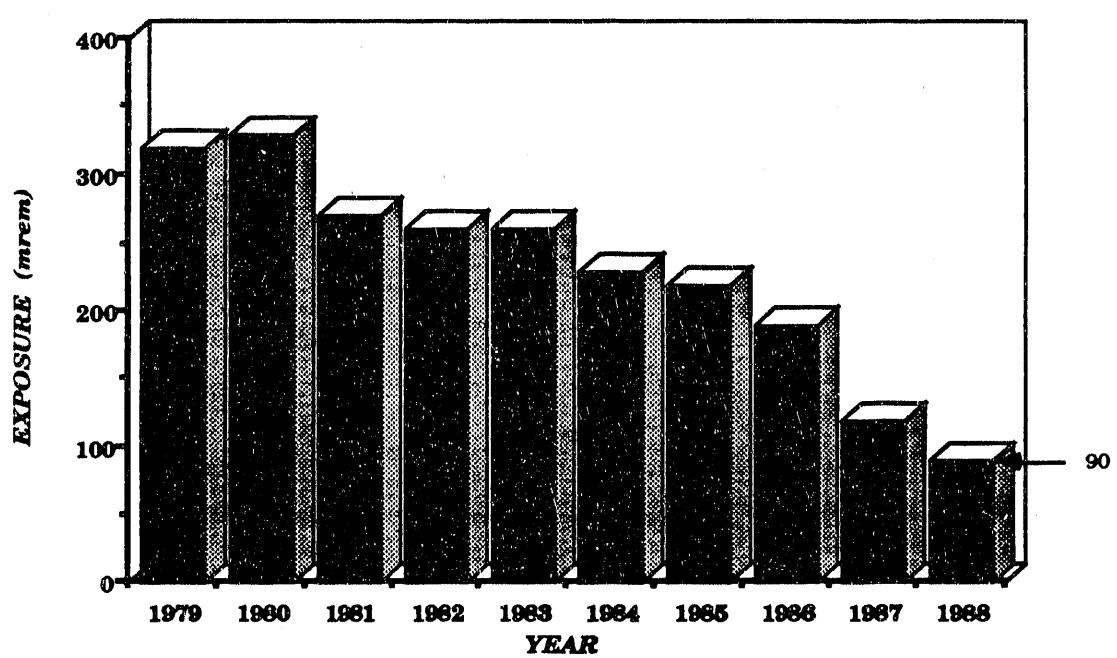


FIG. 2-1. REACTOR OPERATOR AVERAGE EXPOSURE

TABLE 2-8. 100-AREAS HEALTH PROTECTION INSPECTOR EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	22	11	0.50
1980	21	12	0.55
1981*	24	12	0.50
1982*	24	9	0.38
1983*	28	9	0.31
1984*	33	8	0.25
1985*	31	9	0.28
1986*	36	9	0.26
1987*	31	5	0.15
1988*	28	4	0.13

* Average calculated by new method. See Chapter 9 for details.

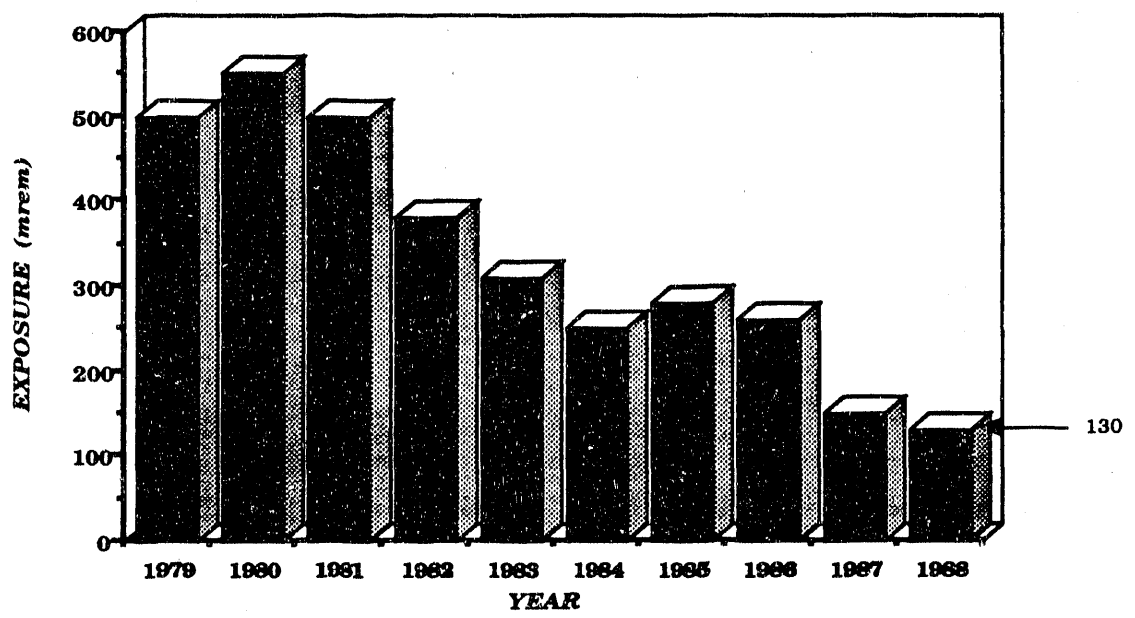


FIG. 2-2. REACTOR AREA HEALTH PROTECTION INSPECTOR AVERAGE RADIATION EXPOSURE

TABLE 2-9. 100-AREAS MECHANIC EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	345	86	0.25
1980	425	89	0.21
1981*	189	35	0.18
1982*	174	36	0.21
1983*	223	37	0.17
1984*	239	32	0.14
1985*	376	35	0.09
1986*	306	29	0.09
1987*	296	19	0.07
1988*	237	18	0.08

* Average calculated by new method. See Chapter 9 for details.
** Includes RWE-E&I, RWE-MAINT, RWE-T&T, and RWE-MISC

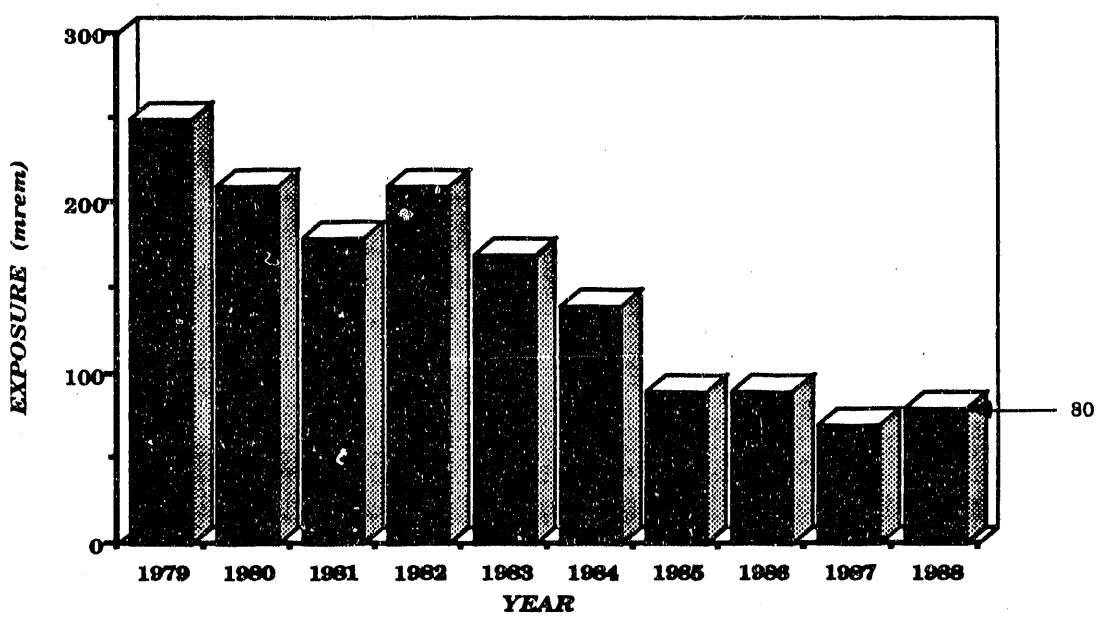


FIG. 2-3. REACTOR AREA MECHANIC AVERAGE RADIATION EXPOSURE

TABLE 2-10. 100-AREAS RADIATION EXPOSURE INDICES

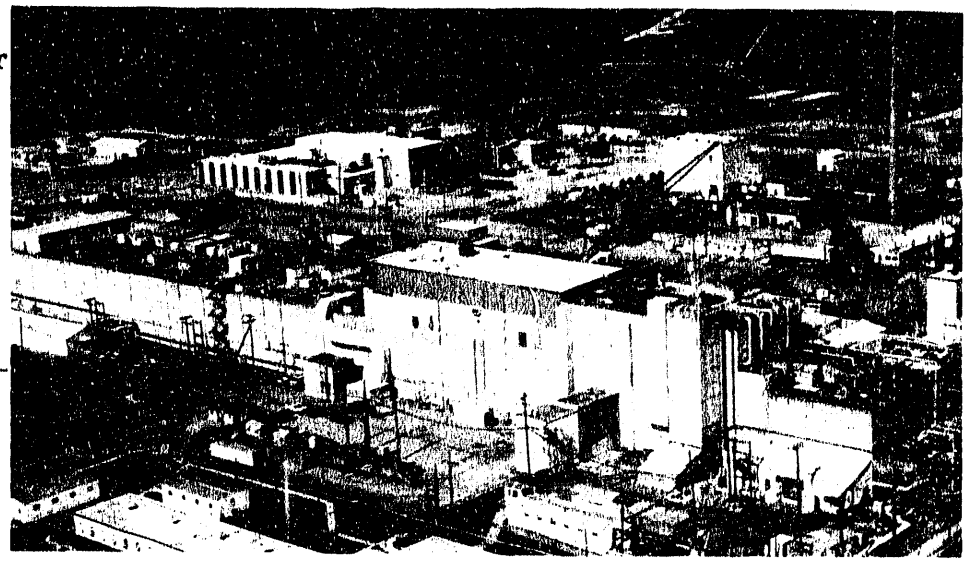
INDICES	DOSE (rem)
o BINGHAM PUMP SEAL REPLACEMENT	0.750
o HEAT EXCHANGER REPLACEMENT	2.500
o HEAT EXCHANGER INHIBITOR GASKET REPLACEMENT	0.150
o HP INSPECTOR/REACTOR OUTAGE DAY	0.022
o HP INSPECTOR/REACTOR OPERATING DAY	0.006
o REMOVE DAMAGED UNIVERSAL SLEEVE HOUSING (USH) FROM REACTOR	4.200
o INSTALL GAS PORT, VACUUM COVERS AND RAISE ACTUATOR (+6 HOURS AFTER SHUTDOWN)	0.015
o TEST EMERGENCY COOLING SYSTEM (ECS)	0.485
o REPLACE O-RINGS ON TOTAL REACTOR SHIELD PLUGS (+5 HOURS AFTER SHUTDOWN)	0.290
o INSPECT AND REPACK ROTOVALVES	1.000
o REPLACE LEAKING CRT PUMP	0.370
o THROTTLE ROTOVALVES (FIVE HOURS AFTER SHUTDOWN)	0.210
o DECONTAMINATE SCRAP CASK	0.055
o CHANGE GASKETS ON HEAT EXCHANGER INHIBITOR LINES	0.050
o PERFORM ROUTINE TANK TOP INSPECTION	0.150
o REPLACE NOSE PLUG	0.800
o INSPECT PUMP NOZZLES	3.900
o REPLACE UNDERWATER D & E RAIL	
P	0.110
K	0.690
C	0.095
o DRAIN AND BLANK TWELVE HEAT EXCHANGERS	3.800
o VACUUM DRY TWELVE HEAT EXCHANGERS.	1.700
o DRAIN SHIELD SYSTEM	0.400
o DRAIN PURIFICATION AND DISTILLATION SYSTEMS	0.200
o DRAIN 3RD SAFETY SYSTEM	0.200
o INSTALLATION OF MODERATOR RECOVERY SYSTEM IN 100-L	7.9
o INSTALLED FOURTH EMERGENCY COOLING WATER SYSTEM IN 100-L	6.7
o INSTALL RAMS HORN ON FOUR HEAT EXCHANGERS	1.1
o 3RD SAFETY SYSTEM REPAIR	2.7
o REPAIR OXALIC ACID FLUSH LINES	3.4
o CHANGEOUT AND REPAIR OF ECW VALVES 58, 48, AND 28	3.5
o BINGHAM PUMP SUCTION LINES AND ELBOW INSPECTIONS	1.3
o PROCESS LINE INSPECTION	4.0 *
o THERMAL COUPLE REPLACEMENT	0.5 *
o SYSTEM 2&5 SUCTION LINE REMOVAL	3.6 *
o FORTH EMERGENCY COOLING WATER SYSTEM SEISMIC BRACING	0.8 *
o SYSTEM 2&3 EXPANSION JOINT NOZZLE INSPECTION	1.0 *
o NUMBER 6 HEAT EXCHANGER EXPANSION JOINT INSPECTION	1.8 *
o PROCESS AREA PAINTING	1.7 *

* Developed in 1988

3 200-F AREA

Radiation Exposure

The 1988 total whole body radiation exposure was 394.6 rem compared to a goal of 597.0 rem and a 1987 total radiation exposure of 416.5 rem. The maximum individual radiation exposure for Operations and Construction was 1590 mrem and 2040 mrem respectively.



F AREA

Radiation exposures for F-Area personnel continued to decline in 1988. The average annual radiation exposure for F-Area operators excluding FB-Line personnel was 450 mrem during 1988 compared to an average of 530 mrem in 1987. Operators in FB-Line received an average radiation exposure of 900 mrem compared to 1,000 mrem in 1987. This value does not include New Special Recovery operators. Health Protection inspectors assigned to F-Area, excluding those assigned to Naval Fuels, received an average radiation exposure of 370 mrem during 1988 compared to an average of 420 mrem in 1987. Mechanics, which include SWE and WMWE E & I, Maintenance, and T & T personnel received a 1988 average radiation exposure of 170 mrem compared to a 1987 average of 260 mrem.

The major factors which contributed to the 1988 annual radiation exposure performance in F-Area included shutdown work in the Canyon and FB-Line facilities, improved decontamination efforts in the Hot Crane Maintenance Area and Sample Aisles, and reduced fan and equipment replacement/repair work in Outside Facilities.

221-F Canyon

Radiation Exposure:

Canyon Separations personnel received a 1988 radiation exposure of 38.4 rem versus a goal of 48.2 rem and a 1987 exposure of 36.3 rem.

The average radiation exposure for local roll personnel assigned to the Canyon ranged from 92 mrem for SWE-E&I personnel to 378 mrem for HP inspectors.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Repair of Hot Canyon Crane and Associated Equipment	12.8
o Hot Canyon Sample Aisle Work	6.2
o Routine Surveillance and Repair Work in the HGVC	2.4
o Warm Canyon Pumps and Six-Pack Repairs	2.7
o Centrifuge Decon and Equipment Repair in Hot Shop and Swimming Pool	1.5
o Decontamination of Section 12 HGVC after removal of the fire-eye	1.3
o Warm Canyon housekeeping and cell cover decontamination work	0.3

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Used robotics and extended tools to remove the Fire-eye junction box in section 12 of the HGVC.

- Used lead shielding in the Hot Crane Maintenance Area to reduce exposure.

- Continued the use of test badges to characterize the radiation exposure received during certain jobs to help identify high exposure jobs and develop exposure indices.

- Continued emphasis on decontamination efforts on canyon pumps and motors prior to rebuilding.

- Used a freon decontamination unit in Section 12 of the HGVC to reduce exposure rates from 100 rad/2.5 R/hr to 12rad/2 R/hr.

- Used a freon decontamination unit in the Hot Crane Maintenance Area to reduce exposure rates. The total estimated exposure for the Hot Crane Maintenance Area decreased from 19.1 rem in 1987 to 12.8 rem in 1988.

- Continued emphasis on comprehensive preplan meetings for all work involving personnel exposure.

FB-Line

Radiation Exposure:

Separations personnel assigned to FB-Line received a 1988 exposure of 129.1 rem compared to a goal of 220.0 rem and a 1987 exposure of 161.3 rem. The difference between the 1988 actual exposure and the 1988 exposure goal was the continuation of a comprehensive radiation control program, extended shutdown time for construction upgrades, and good operating performance for the newly installed C&D precipitators resulting in reduced maintenance work.

The average radiation exposure for local roll personnel assigned to FB-Line ranged from 295 mrem for FB-Line WE to 795 mrem for FB-Line/New Special Recovery operators. The maximum exposure received by an FB-Line operator was 1590 rem. This is the lowest FB-Line maximum exposure in Plant history.

Jobs Contributing to Significant Radiation Exposure:

There were no jobs that accounted for a significant portion of the FB-Line total exposure.

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Good operating performance of the new C & D precipitators installed in 1987 continued to reduce exposure significantly for precipitator operators. The general area exposure rate in the older A & B Precipitator Operating Rooms was 18 mrem/hr. The general area exposure rate in the C & D Precipitator Operating Rooms is <1 mrem/hr.

- Continuation of a comprehensive radiation exposure control program with a goal of maintaining exposures below the monthly prorated guide of 140 mrem/month. Individuals exceeding expected average monthly exposure levels were placed on special personnel monitoring programs to further assist in radiation exposure reduction.

- Continued the program to reduce personnel exposure from TRU cabinet waste by removing waste as it is generated.

- Continued administrative controls for assurance of proper wearing and storage of TLND badges.

- Initiated a program to monitor and change HEPA filters before significant radiation buildup occurs. This results in lower exposure for personnel entering the filter room.

- Continued the comprehensive radiation and contamination training program for all FB-Line operators, FB-Line WE mechanics, and Construction workers.

- Continued the program of changing panels on process cabinets to reduce radiation exposure to personnel.

- Installed additional lighting in the process cabinets promoting more efficient work thus reducing cabinet work time and, therefore, operator exposure.

Outside Facilities (A-Line, 221-F, 292-F)

Radiation Exposure:

Separations personnel assigned to Outside Facilities received a total 1988 radiation exposure of 0.8 rem compared to 2.8 rem in 1987 and the facility goal of 8.0 rem. The average radiation exposure for local roll personnel ranged from 19 mrem for SWE mechanics to 93 mrem for HP inspectors.

A significant factor in the exposure received verses the 1988 goal is good performance by major fans and equipment, minimizing repair and replacement work.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o D&R of A-Line denitrator pots and piping	3.0
o Canyon air tunnel encasement work	0.4
o Clean-up and installation of steel liners in B-2-1 and B-4-1 basins	0.2

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Continued personnel lapel sampling in A-Line to characterize uranium exposure levels in the work area.

- Replaced two A-Line denitrator pots and associated equipment eliminating "gulping" operation in exposure fields of 5 mR/hr.

- Decontamination and installation of steel liners in B-2-1 and B-4-1 basins facilitating future routine decontamination.

235-F Facility

Radiation Exposure:

Separations personnel assigned to 235-F received a 1988 radiation exposure of 70 mrem compared to a 1988 goal of 500 mrem and a 1987 exposure of 40 mrem.

The average radiation exposure for Separations operators and SWE-E&I personnel assigned to 235-F were 20 and 67 mrem respectively.

772-F, 1F Laboratory

Radiation Exposure:

Laboratories personnel received a 1988 radiation exposure of 24.2 rem versus a goal of 42.2 rem and a 1987 exposure of 30.3 rem.

During 1988, the average exposure for technicians was 172 mrem as compared to 248 mrem in 1987. This continued the downward trend in technician exposure that began in 1984. A significant portion of the reduction in 1988 can be attributed to the effectiveness of the radiation exposure reduction design characteristics of 772-1F and to the Laboratory Department's continuing efforts to implement good ALARA practices.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Shielded Area A decontamination and construction work	10.9
o Annual Exposure for Routine Waste Removal	1.3
o Repair work on 772-1F Vessel Vent Line	1.0
o Waste removal and clean-up of 772-F Hot Cells in preparation for removal	0.6

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Initiated major decontamination effort in 772-F Shielded Area A in preparation for extensive renovation work.

- Continued to remove cell waste only once per day. This has increased job efficiency and, therefore, reduced the amount of time and exposure spent on this operation.

- D&R of the Vessel Vent Line in 772-1F reducing radiation exposure rates in the service corridor from 600 mR/ hr to 3 mR/ hr.

- Completed transition of PUREX process support work from 772-F to 772-1F including full utilization of the new remote handling cells in 772-1F.

- Installed copper shielding on 772-F vacuum exhaust lines reducing exposure rates at lines from 4 R/ hr to 50 mR/ hr.

Waste Management

Radiation Exposure:

Waste Management personnel received a 1988 radiation exposure of 17.8 rem compared to a goal of 21.5 rem and a 1987 exposure of 20.0 rem. Waste Management Works Engineering employees received a 1988 exposure of 10.4 rem compared to a goal of 13.2 rem and a 1987 exposure of 12.3 rem.

Annual radiation exposures to personnel working in Waste Management Facilities showed a maximum individual exposure of 590 mrem for WM WE personnel, 1215 mrem for WM operators, and 690 mrem for HP inspectors.

Additional information on Waste Management operations and radiation exposure is contained in Chapter 4 of this report.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Tank 7 decontamination work	7.1
o Tank 44 jet and pump work	3.9
o Installation of lighting ground cables	2.6
o CTS jumper work	1.8
o Tank 25 jumper work	1.9
o Tank 26 - tank and line flush work	1.2
o Tank 28 spray chamber work	1.0
o Tank 33 jumper work	0.5
o DB-2 decontamination and jumper work	0.3

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Established written radiological guidelines for the movement of specific contaminated equipment to the burial ground.

- Designed and fabricated special shipping containers for the movement of contaminated equipment to the burial ground.

- Initiation of a systematic program to reduce exposure rates in infrequintly occupied areas. Emphasis is placed on the change out of tank exhaust HEPA filters when exposure rates reach 500 mR/ hr to maintain lower exposure rates in the filter buildings.

- Additional lead shielding is placed on the bottom end of pipe sleeves during removal. The shielding is removed at the burial ground prior to burial.

- A Xetex Teledose system has been ordered. The system has five dosimeters with a base station that can be set up to monitor five workers up to 100 feet away. The system will be used to provide more efficient exposure control of jobs in high radiation fields leading to reduced exposure.

- Expanded the Waste Management Construction training to include a twenty (20) question quiz at the end of each session.

- Development, by SRL, of a remote overhead video extendable robot (ROVER) to improve the performance of remote handling operations such as the movement of jumpers, equipment replacement, and routine inspections.

Naval Fuel Material Facility

Radiation Exposure:

The newly constructed Naval Fuel Material Facility (247-F) became fully operational in 1988. Approximately 525 employees were monitored for radiation exposure. During 1988, 4.4 rem of radiation exposure was accumulated. This compares to an annual goal of 46 rem, and the 1987 performance of 5.4 rem.

Jobs Contributing to Significant Radiation Exposure:

No significant radiation exposure was incurred during 1988. A major maintenance outage was completed in September and October with no significant radiation exposure and no assimilations.

Radiation Exposure Reductions:

The design of the facility and the nature of the product limit radiation exposure. Nonetheless, continuing efforts to maintain radiation exposure ALARA were made.

- Radiation safety training at the "toolbox" level was carried out.
- Continuous HP coverage was provided to high exposure potential jobs.
- HP reviewed all new and revised facility procedures for radiation exposure considerations.
- Extensive decontamination work on the maintenance aisles was carried out. Contamination levels were significantly reduced as a result of these efforts.

TABLE 3-1. F-AREA RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
SEPARATIONS				
CANYONS	36.3	48.2	38.38	52.0
FB-LINE	161.3	220.0	129.10	224.0
OUTSIDE FACILITIES	2.8	8.0	0.83	2.5
PuFF	0.04	0.5	0.07	0.5
WORKS ENGINEERING	18.5	21.0	11.52	20.0
TECHNOLOGY	0.5	1.1	0.32	0.8
PROJ. LIAISON *	2.0	5.0	1.44	4.0
QUALITY	-	-	0.30	0.5
LABORATORIES	30.3	42.2	24.17	28.6
WASTE MANAGEMENT				
OPERATIONS	20.0	21.5	17.81	21.5
PROJECTS	0.02	0.1	0.12	0.1
WORKS ENGINEERING	12.3	13.15	10.36	22.23
TECHNICAL	-	-	-	0.5
HEALTH PROTECTION	36.8	54.0	35.80	53.5
E & CS PROJECTS	0.3	0.4	0.06	0.4
POWER	0.5	0.6	0.41	0.65
BUS SERV. **	0.2	0.55	0.07	0.1
SAFETY & SECURITY	0.3	0.7	0.10	0.5
NAVAL FUEL	5.4	46.0	4.36	12.0
CONSTRUCTION	84.1	109.0	107.72	115.0
OTHER	4.84	5.0	11.64	5.0
TOTAL	416.5	597.0	394.58	564.38

* Previously referred to as SEPPLF
** Previously referred to as SSD

TABLE 3-2. F-AREA 1988 AVERAGE EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

FACILITY	SEP	NFP	MAINT	E&I	WE MISC	T&T	HP	WM	LAB	CONST
221-F	188 (74)	-	318 (4)	92 (8)	-	-	378 (15)	-	-	-
FB-LINE	795(136)	-	295 (23)	*	-	-	601 (26)	-	-	-
OF	19 (33)	-	19 (4)	19 (3)	-	-	93 (6)	-	-	-
235-F	20 (2)	-	-	67 (4)	-	-	-	-	-	-
WM	-	-	423 (10)	145 (8)	104 (6)	391(13)	269 (13)	283(41)	-	-
772-F	-	-	178 (3)	42 (5)	-	-	184 (7)	-	172(122)	-
247-F	-	15(233)	4 (27)	1(28)	4(28)	-	54 (21)	-	5 (60)	-
MISC	320 (62)	9 (2)	86 (44)	84(25)	84(15)	131 (5)	267 (23)	-	-	80(295)
	464(307)	14(235)	144(115)	56(81)	41(49)	315(18)	306(111)	283(41)	116(182)	80(295)

( ) - Average number of employees in work group during 1988
* Values for FB-LINE E&I Mechanics are included in FB-LINE MAINT.

TABLE 3-3. F-AREA OPERATOR EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	190	121.8	0.64
1980	213	139.8	0.66
1981*	244	175.8	0.72
1982*	216	142.5	0.66
1983*	205	114.6	0.56
1984*	210	132.4	0.63
1985*	260	184.6	0.71
1986*	309	203.3	0.66
1987*	345	182.5	0.53
1988*	338	152.7	0.45

* Average calculated by new method. See Chapter 9 for details.
** Includes only SEP and WM Operators.

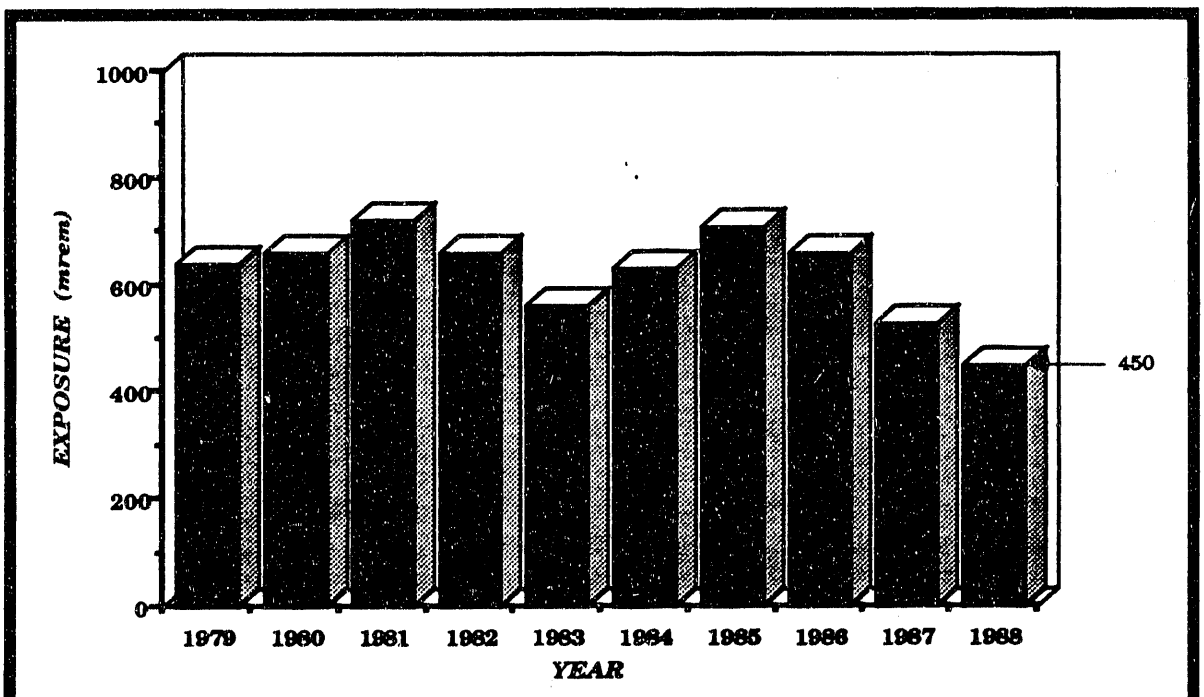


FIG. 3-1. F-AREA OPERATOR AVERAGE RADIATION EXPOSURE

TABLE 3-4. F-AREA HEALTH PROTECTION INSPECTOR EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	46	26	0.56
1980	49	27	0.55
1981*	63	38	0.60
1982*	58	31	0.53
1983*	56	28	0.49
1984*	55	29	0.53
1985*	73	44	0.60
1986*	82	41	0.50
1987*	78	32	0.42
1988*	90	33	0.37

* Average calculated by new method. See Chapter 9 for details.
** Does not include Naval Fuels.

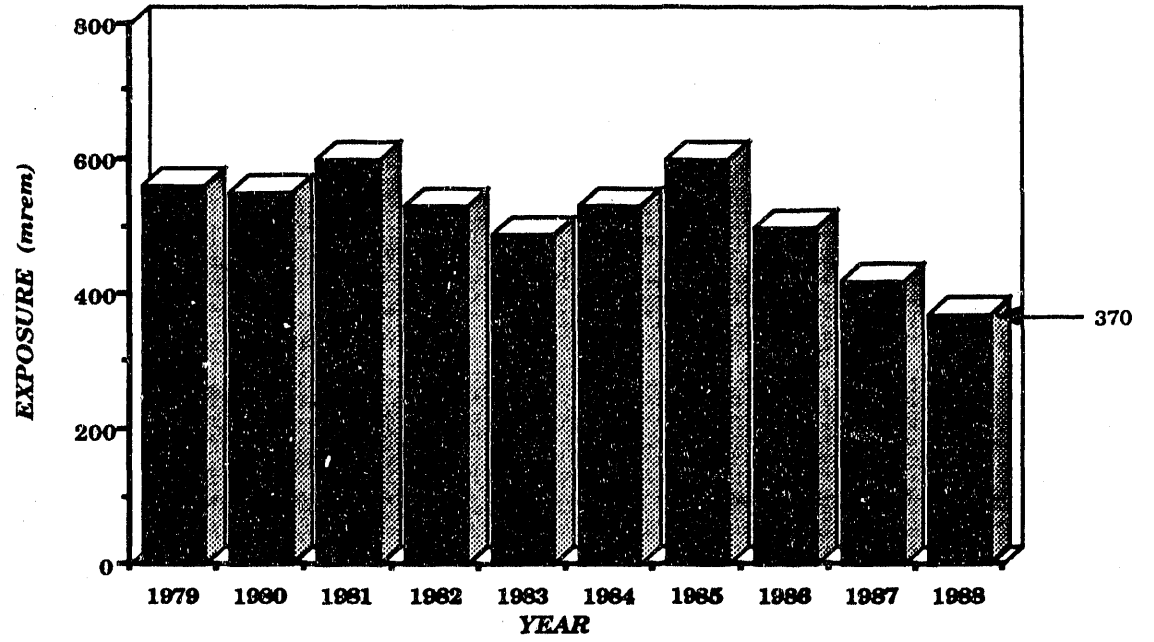


FIG. 3-2. F-AREA HEALTH PROTECTION INSPECTOR AVERAGE EXPOSURE

TABLE 3-5. F-AREA MECHANIC EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	155	58	0.37
1980	166	59	0.35
1981*	167	51	0.30
1982*	151	44	0.29
1983*	145	40	0.28
1984*	129	32	0.25
1985*	156	55	0.36
1986*	127	32	0.26
1987*	132	35	0.26
1988*	165	27	0.17

* Average calculated by new method. See Chapter 9 for details.
** Includes only SWE & WMWE Mechanics.

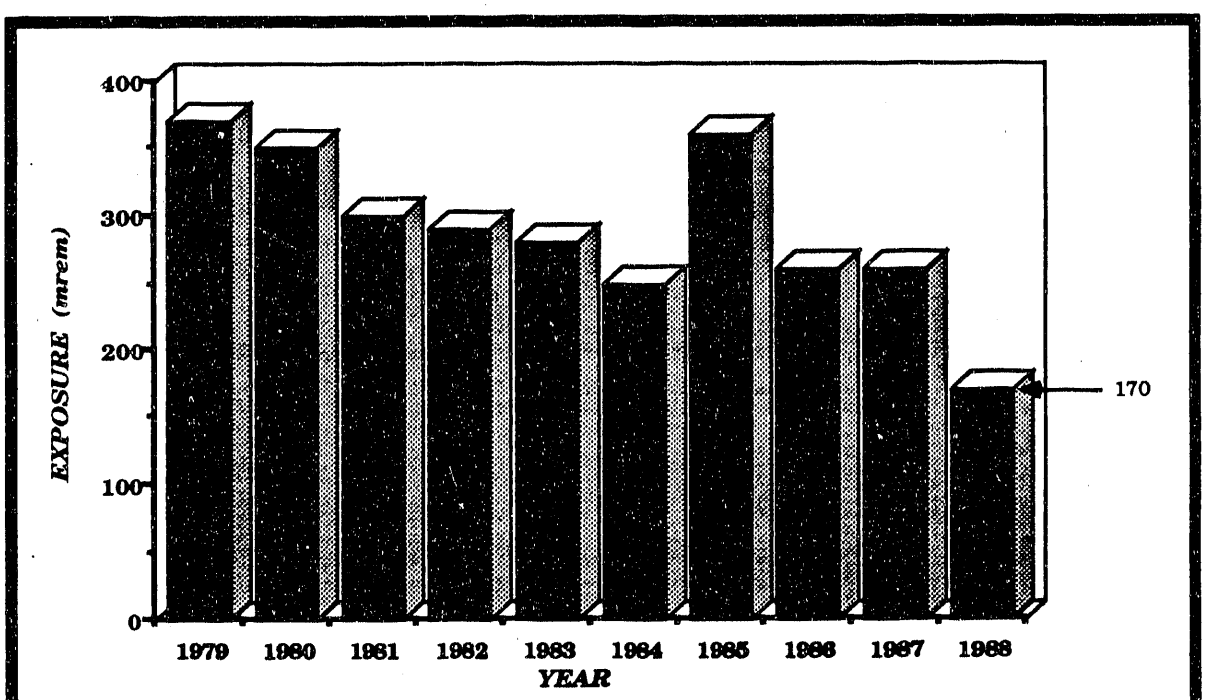


FIG. 3-3. F-AREA MECHANIC AVERAGE RADIATION EXPOSURE

TABLE 3-6. FB-LINE OPERATOR EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	51	60	1.2
1980	67	87	1.3
1981*	76	100	1.3
1982*	63	79	1.2
1983*	62	54	0.9
1984*	73	91	1.2
1985*	98	123	1.3
1986*	121	149	1.2
1987*	122	126	1.0
1988*	114 (135)	107 (108)	0.9 (0.8)

* Average calculated by new method. See Chapter 9 for details.
Values in parentheses ( ) include "New Special Recovery" operators .

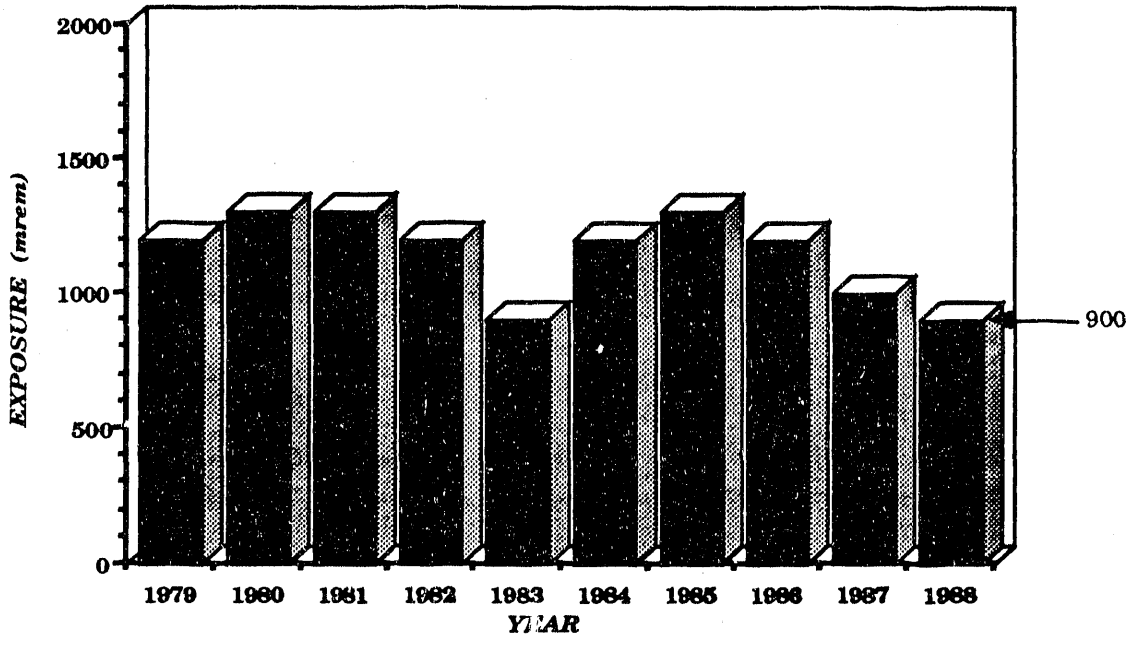


FIG. 3-4. FB-LINE OPERATOR AVERAGE RADIATION EXPOSURE

TABLE 3-7. 772-F/1F LABORATORIES TECHNICIAN EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	109	81	0.74
1980	111	76	0.68
1981*	107	78	0.73
1982*	103	77	0.74
1983*	103	69	0.67
1984*	109	84	0.77
1985*	125	73	0.59
1986*	117	39	0.33
1987*	113	27	0.24
1988*	121	21	0.17

* Average calculated by new method. See Chapter 9 for details.

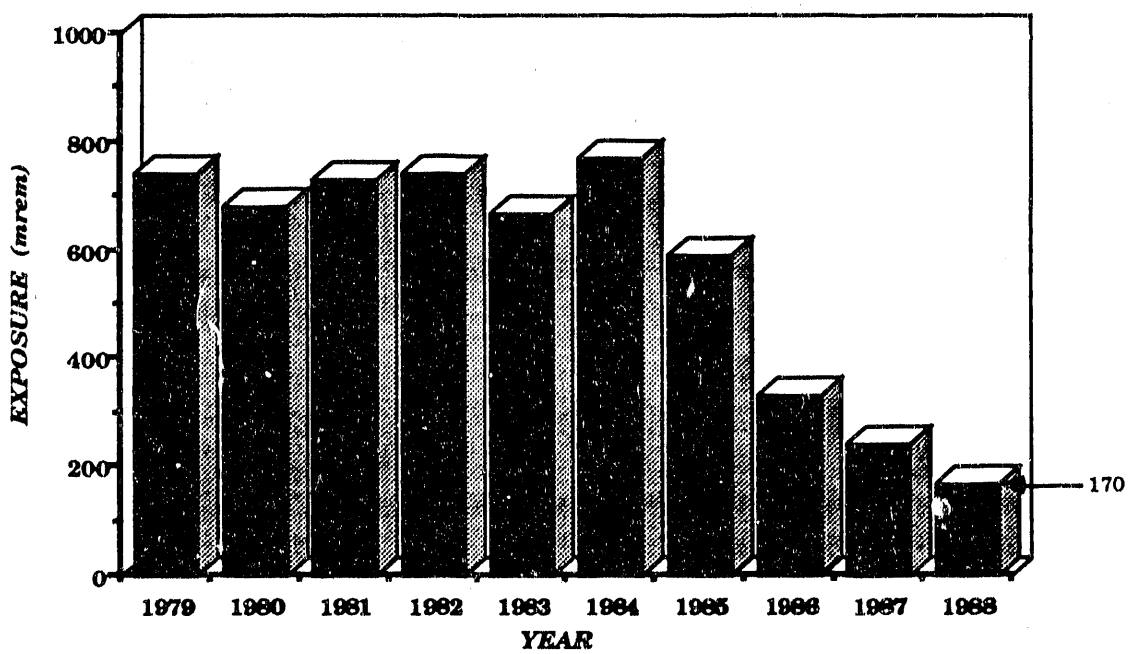


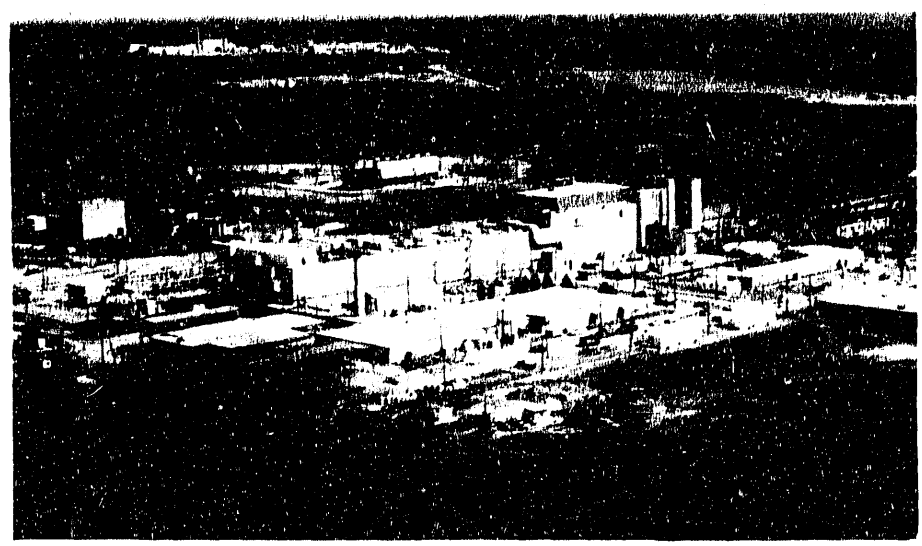
FIG. 3-5. 772-F/1F LABORATORIES TECHNICIAN AVERAGE RADIATION EXPOSURE

4 200-H AREA

Radiation Exposure

The 1988 radiation exposure was 226.0 rem versus a goal of 268.0 rem and 1987 exposure of 218.6 rem. The maximum individual radiation exposure was 1530 and 890 mrems received by a WM WO and a Construction employee respectively. The average annual radiation exposure for H-Area operators was 190 mrem which is a 10 % decrease from 1987.

The 1988 average annual radiation exposure for Health Protection inspectors, excluding those assigned to the Tritium facilities, was 350 mrem. The average annual radiation exposure for Works Engineering mechanics was 160 mrem in 1988 compared to 260 mrem in 1987.



H AREA

221-H Canyon

Radiation Exposure:

Canyon Separations personnel received a 1988 radiation exposure of 23.5 rem compared to a 1988 goal of 28.0 rem and a 1987 exposure of 26.7 rem.

The average annual radiation exposure for local roll personnel assigned to the canyon ranged from 219 mrem for Separations operators to 325 mrem for HP inspectors.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Repair of Hot Canyon Crane and Associated Equipment	14.4
o Decontamination of the Hot Gang Valve Corridor, Section 12	1.3
o Hot Canyon Sample Aisle Work	1.3

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Continued to decontaminate failed process equipment prior to performing repairs.
- Increased frequency for changing out the filter on the recirculated solvent line located on 2nd level to reduce exposure rates in the filter housing area.
- Continued to decontaminate the hot canyon crane and associated equipment, using the high pressure "Freon" system, prior to performing maintenance or repair work on the crane.
- Carried out a systematic program to remove contaminated equipment from the warm and hot canyon samplers.
- Continued use of the "CTF" meeting format for planning high exposure potential jobs.
- Continued to use test badges to characterize the radiation exposure received for specific jobs to assist in future planning of similar work.
- Continued to emphasize the ALARA philosophy in pre-plan meetings, job procedures, and on area message and performance boards.
- Continued the comprehensive radiation and contamination control training program for all Separations operators, WE mechanics, and Construction personnel.
- Continued systematic program of flushing the process feed tanks on 3 rd level Section 12 to reduce radiation levels.

HB-Line

Radiation Exposure:

Separations personnel assigned to HB-Line received a 1988 exposure of 14.8 rem compared to a 1988 goal of 27.0 rem and a 1987 exposure of 13.9 rem.

The average annual radiation exposure for local roll personnel assigned to HB-Line ranged from 35 mrem for E&I mechanics to 522 mrem for HP inspectors.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o D&R of Old HB-Line	7.9
o Building 292-H filter replacement	1.9
o Preparing Material shipments	0.6

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- o Extensive decontamination work on Old HB-Line area and equipment in preparation for D&R work.
- o Extensive decontamination work on Scrubber room.
- o Replacement of the 292-H filters reducing the general area exposure rates from 800 mR/hr to 30 mR/hr.
- o Continued the comprehensive radiation and contamination control training program for all HB-Line operators, WE mechanics, and Construction personnel.
- o Flushed the Phase III process system reducing general area exposure rates from 4 mrad/ 2 mR/ hr to 1 mrad/ 1 mR/ hr.
- o Radiation survey results were utilized to designate low radiation areas for worker locations and a program for immediate waste removal was followed to minimize radiation exposure during D&R of the Old HB-Line .

Tritium Facilities

Radiation Exposure:

Tritium operations personnel received a 1988 radiation exposure of 1.9 rem compared to a 1988 goal of 4.0 rem and 1987 exposure of 3.3 rem. In 1988, 29 % of the total exposure was due to tritium compared to 31% in 1987.

Tritium Works Engineering personnel received a 1988 exposure of 1.5 rem compared to a 1988 goal of 2.2 rem and a 1987 exposure of 2.8 rem. In 1988, 15 % of the total exposure was due to tritium compared to 21% in 1987.

Much of the penetrating (gamma) radiation exposure in 1988 for both Tritium Technology and Works Engineering groups can be attributed primarily to continued Zn-65 migration through the process piping in 232-H. Migration is due to hot furnace flushes and hard pump-downs on the furnaces in an effort to reduce atmospheric tritium losses during furnace charging and discharging operations.

The average annual radiation exposure for local roll personnel assigned to the Tritium facilities ranged from 17 mrem for Tritium operators to 37 mrem for TRWE maintence personnel.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o Hood work, including pump and valve repair, filter changes, and Z bed changeout	0.75
o Changeout bundle rinse tank	0.50

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Continuation of the Zero Assimilation Program (ZAP) to reduce assimilations.

- Continued screening of bioassay reports for persons receiving low-level uptakes and prompt notification of the applicable Production and Service groups. Individuals with bioassay sample results >5.0 uCi/L were not assigned to process area work until their bioassay samples were <5.0 uCi/L.

- Revised bioassay program to require urine samples weekly from individuals assigned to work in process facilities. In addition, a new bioassay delinquent report has been developed. This report is generated monthly and distributed to the appropriate work groups.

- Regular use of the 9-mil tritium plastic suits for all process line breaks in the Tritium facilities. These suits (Saran-CPE suits) are 50 times less permeable by tritium than the 12-mil PVC plastic suit.

- Use of mandatory preplan meetings for all repair and maintenance work on process equipment.

- Quick turn around time for special tritium bioassay results ensured the early identification of potential assimilations. Samples from the day shift are analyzed on the 4-12 shift and the results are telephoned each night. Day workers are then informed of their previous days sample results before they go back on the job.

- Prompt investigation following an incident involving a tritium uptake to determine the cause and take corrective action, e.g. repair equipment or change procedures, in order to prevent future uptakes.

- Development of a Tritium training film covering facility specific radiological hazards and controls for all personnel in the Tritium facilities. An additional HP training film is being developed specific to line break procedures. This film will be used to supplement the general training film.

- Continued use of the float method to change bundle rinse tank water in the Line III Material Handling Room. Approxin ately 320 mrems annual exposure is saved using this method.

- Frequent changing of the outermost pair of gloves during routine plastic suit jobs to reduce the risk of assimilations from potentially contaminated gloves.

- Continue Tritium training for new Construction employees. This training is similar to the training given new Tritium employees and is designed to serve as facility specific training in the HP training program for Construction.

- Continued use of butyl gloves taped to the plastic suit. These gloves are approximately ten times more resistant to tritium permeation than the formally used latex gloves.

- Continued permeation studies on protective clothing (gloves and plastic suits) to identify materials which are highly resistant to permeation by tritium so that more effective protection can be provided against potential assimilations.

- Regular use of heat tape on process lines that have been verified by X-Ray to contain moisture. By removing moisture, the potential for an assimilation while working on process lines or equipment is reduced.

RBOF

Radiation Exposure:

Separations personnel assigned to RBOF received a 1988 radiation exposure of 2.5 rem versus a 1988 goal of 3.0 rem and a 1987 exposure of 2.2 rem.

The difference between the total exposure received during 1988 vs. the goal is primarily due to a reduction in the amount of material received from off site reactors.

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Continued to screen monthly exposure reports for unusual personnel exposures and investigate any exposure results not typical for RBOF employees.
- Continued the use of extended tools, cleaning of failed equipment before repairs and utilization of water shielding to reduce personnel exposures.
- Continued to perform underwater radiation surveys of fuel in order to determine radiation levels prior to bringing the fuel to the surface for shipment.

Waste Management Facility

Radiation Exposure:

Waste Management Operations received a 1988 radiation exposure of 38.5 rem compared to a goal of 49.0 rem and 1987 exposure of 39.4 rem. Approximately 26 rem of the 1988 exposure resulted from decontamination and repair of the 1-H evaporator.

Waste Management Works Engineering received a 1988 radiation exposure of 21.6 rem compared to a goal of 39.2 rem and a 1987 exposure of 23.6 rem.

Annual radiation exposures of personnel assigned to Waste Management Facilities showed a maximum individual exposure of 1530 mrem for WMO, 1210 mrem for WM WE, and 775 mrem for HP inspectors.

Jobs Contributing to Significant Radiation Exposure:

Job	Radiation Exposure, rem
o 1-H Evaporator Repair and Decontamination	26.0
o Tank 13 Decontamination, Feed Pump Replacement, and removal of transfer line	15.7
o 299-H decontamination and equipment repair	11.8
o DB2 installation and removal of jumper	8.8
o H-CTS PIT Jumper Work	3.7
o Removal and installation of Tank 37 jumper and spool piece	1.6
o Decontamination of Tank 7 tank top	1.3

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Established written radiological guidelines for the movement of specific contaminated equipment to the burial ground.
- Designed and fabricated special shipping containers for the movement of contaminated equipment to the burial ground.
- All equipment removed from tanks was pulled into shielded pipe casks, if possible, to reduce radiation exposure rates.
- Continued to utilize extensive flushing of piping, cells, and equipment to reduce both contamination and exposure rates.
- Used lead shielding where possible to reduce radiation exposure.
- Continued to utilize TV cameras with video display in crane cab to perform work remotely or assist in observing work area.
- Continued to utilize the 299-H decon facility to reduce radiation exposure rates.
- Continued to use water in tanks and bottom of diversion boxes for shielding purposes.
- Expanded preplan meetings and placed more emphasis on radiation exposure, contamination controls, and all ALARA considerations for jobs.
- Continued the use of test badges to characterize the radiation exposure received during specific jobs and to assist in the development of exposure indices.
- Expanded the Waste Management Construction training to include a twenty (20) question quiz at the end of each session.
- Development, by SRL, of a remote overhead video extendable robot (ROVER) to improve the performance of remote handling operations such as the movement of jumpers, equipment replacement, and routine inspections.

Effluent Treatment Facility (ETF)

The F/H Area Effluent Treatment Facility (ETF) was constructed in H Area to replace the seepage basins that have been receiving low activity process waste from F and H Area Separations facilities since plant startup. Effluent flow was diverted to the ETF facility for processing in October 1988, approximately three weeks ahead of schedule. The effluent is processed to remove radioactive material and hazardous chemical constituents such as lead. The treated material is assayed then discharged to Upper Three Runs Creek. The concentrated waste is stored in a hold tank prior to incorporation into saltstone.

Waste Management (WM) ETF Operations did not receive any significant radiation exposure during the two months of operation in 1988.

TABLE 4-1. H-AREA RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
SEPARATIONS				
CANYONS	26.7	28.0	23.49	23.0
HB-LINE	13.9	27.0	14.75	30.0
RBOF	2.2	3.0	2.45	2.8
WORKS ENGINEERING	15.2	19.0	14.83	18.0
TECHNOLOGY	0.5	0.9	1.15	1.5
SEP QUALITY	-	-	0.08	1.0
TRITIUM				
OPERATIONS	3.3	4.0	1.9	2.5
WORKS ENGINEERING	2.8	2.15	1.45	1.75
TECHNOLOGY	0.3	0.2	0.0	0.2
PROJECT	-	-	0.0	0.0
RTF	-	-	-	0.0
WASTE MANAGEMENT				
OPERATIONS	39.4	49.0	38.49	52.5
WORKS ENGINEERING*	23.6	39.2	21.56	69.0
TECHNOLOGY	2.6	4.5	3.72	4.25
WM PROJECTS	0.3	0.35	0.08	0.35
LABORATORIES				6.4
HEALTH PROTECTION	20.8	27.5	23.86	35.0
POWER	0.7	0.7	0.54	0.7
BUS SERV *	0.1	0.15	0.04	0.05
PROJECTS	0.1	0.15	0.02	0.15
DWPF	-	-	-	5.8
CONSTRUCTION	61.6	58.0	74.08	84.0
OTHERS	4.5	4.2	3.50	4.2
TOTAL	218.6	268.0	226.0	343.15

* Previously referred to as SSD

TABLE 4-2. H-AREA 1988 AVERAGE RADIATION EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

FACILITY	SEP	MAINT	E&I	WE MISC	T&T	HP	WM	CONST.
221-H	219 (60)	261 (5)	253 (7)	-	-	325(21)	-	-
HB-LINE	328 (36)	100 (1)	35 (3)	-	-	522 (7)	-	-
TRITIUM	17(127)	37(23)	19(26)	-	-	23 (8)	-	-
WM	-	295(23)	155(26)	164 (1)	1042(5)	404(16)	398(66)	-
MISC	208 (17)	124(25)	135(23)	93(18)	324(3)	229(16)	-	139(125)
	128(240)	159(77)	113(85)	117(19)	779(8)	306(68)	398(66)	139(125)

( ) - Average number of employees in work group during 1988

TABLE 4-3. H-AREA OPERATOR EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	214	81.7	0.38
1980	235	97.2	0.41
1981*	269	108.2	0.40
1982*	270	112.4	0.42
1983*	270	98.2	0.36
1984*	299	62.3	0.21
1985*	297	57.3	0.19
1986*	311	64.8	0.21
1987*	303	63.3	0.21
1988*	305	58.0	0.19

* Average calculated by new method. See Chapter 9 for details.
** Includes Separations, Waste Management Operations, and Tritium Operations.

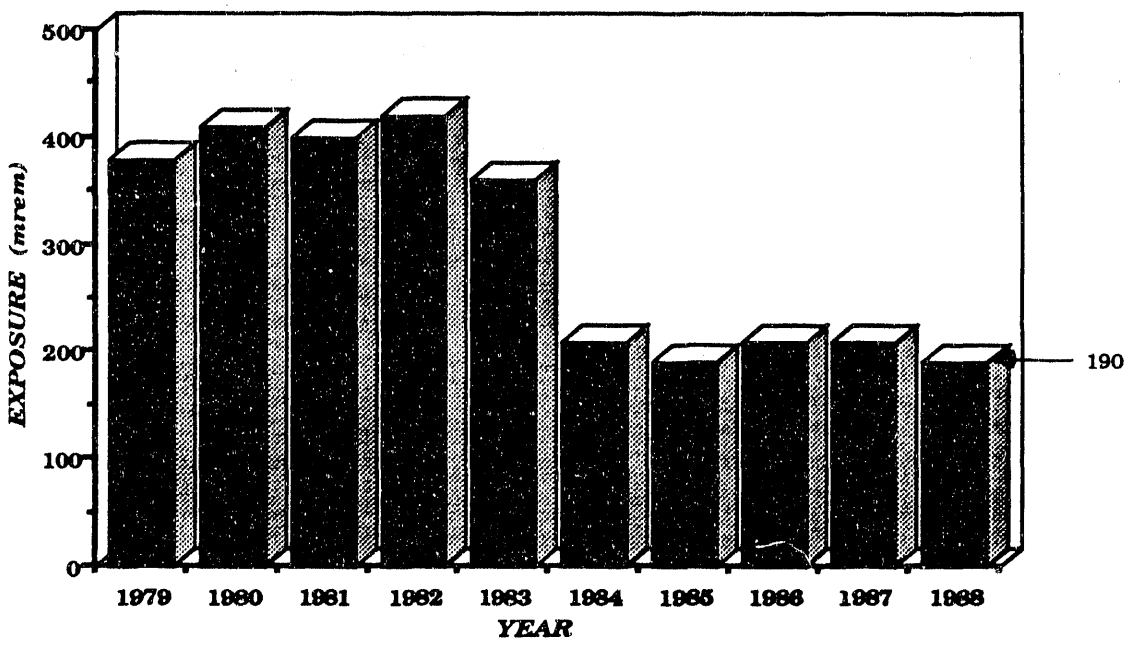


FIG.4-1. H-AREA OPERATOR AVERAGE RADIATION EXPOSURE

TABLE 4-4. H-AREA HEALTH PROTECTION INSPECTOR EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	33	27	0.82
1980	38	27	0.71
1981*	27	19	0.72
1982*	27	24	0.89
1983*	30	22	0.73
1984*	32	18	0.58
1985*	35	17	0.48
1986*	44	18	0.40
1987*	54	19	0.34
1988*	60	21	0.35

* Average calculated by new method. See Chapter 9 for details.
** Does not include personnel assigned to Tritium facilities.

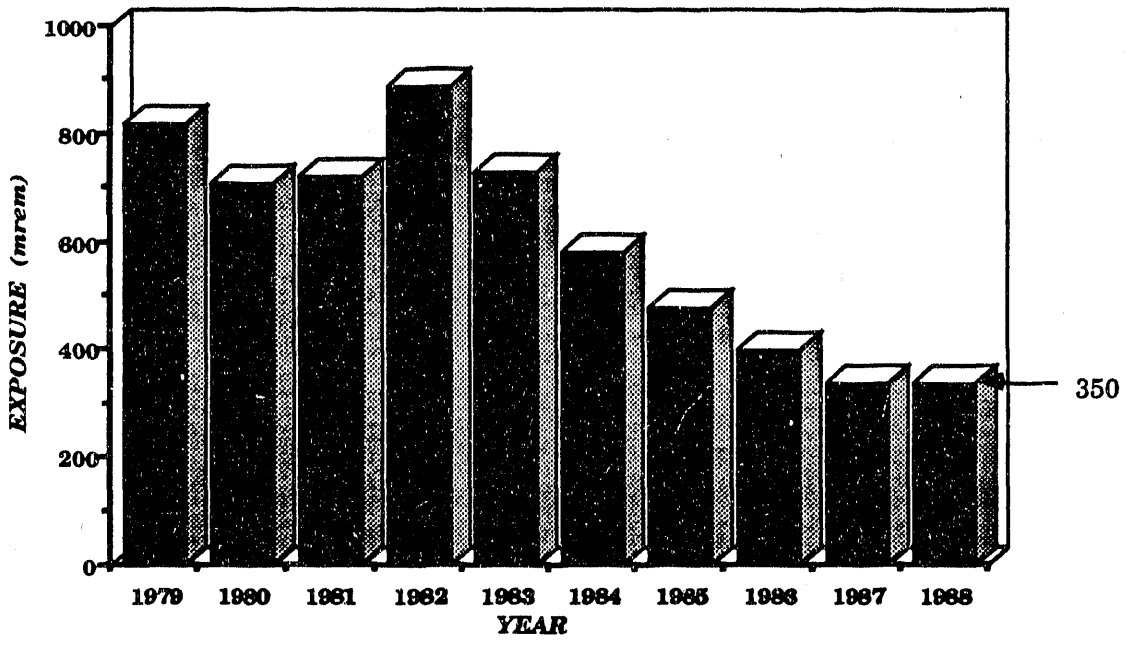


FIG.4-2. H-AREA HEALTH PROTECTION INSPECTOR AVERAGE RADIATION EXPOSURE

TABLE 4-5. H-AREA MECHANIC EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	116	47	0.41
1980	123	48	0.39
1981*	153	36	0.24
1982*	143	34	0.24
1983*	143	43	0.30
1984*	128	26	0.20
1985*	134	35	0.26
1986*	144	35	0.24
1987*	137	35	0.26
1988*	188	30	0.16

* Average calculated by new method. See Chapter 9 for details.
** Includes SWE, WMWE, and TRWE.

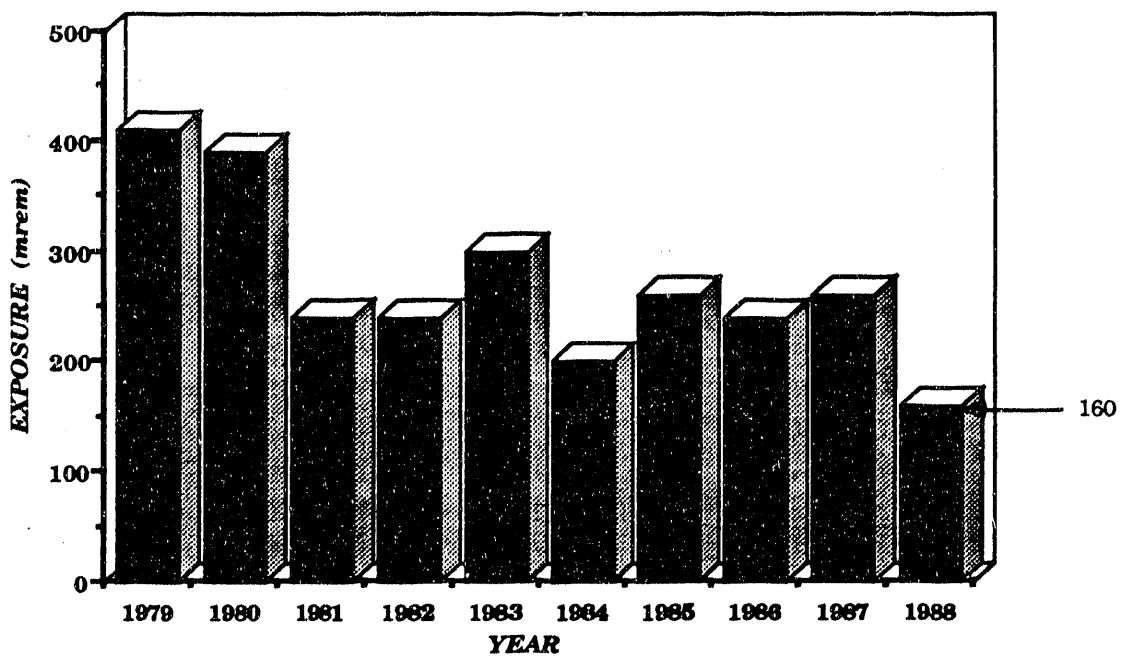


FIG. 4-3. H-AREA MECHANIC AVERAGE RADIATION EXPOSURE

TABLE 4-6. HB-LINE OPERATOR EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	9	19	2.1
1980	24	56	2.3
1981*	29	42	1.4
1982*	29	45	1.5
1983*	27	37	1.4
1984*	28	18	0.6
1985*	24	7	0.3
1986*	32	8	0.3
1987*	34	12	0.4
1988*	36	12	0.3

* Average calculated by new method. See Chapter 9 for details.

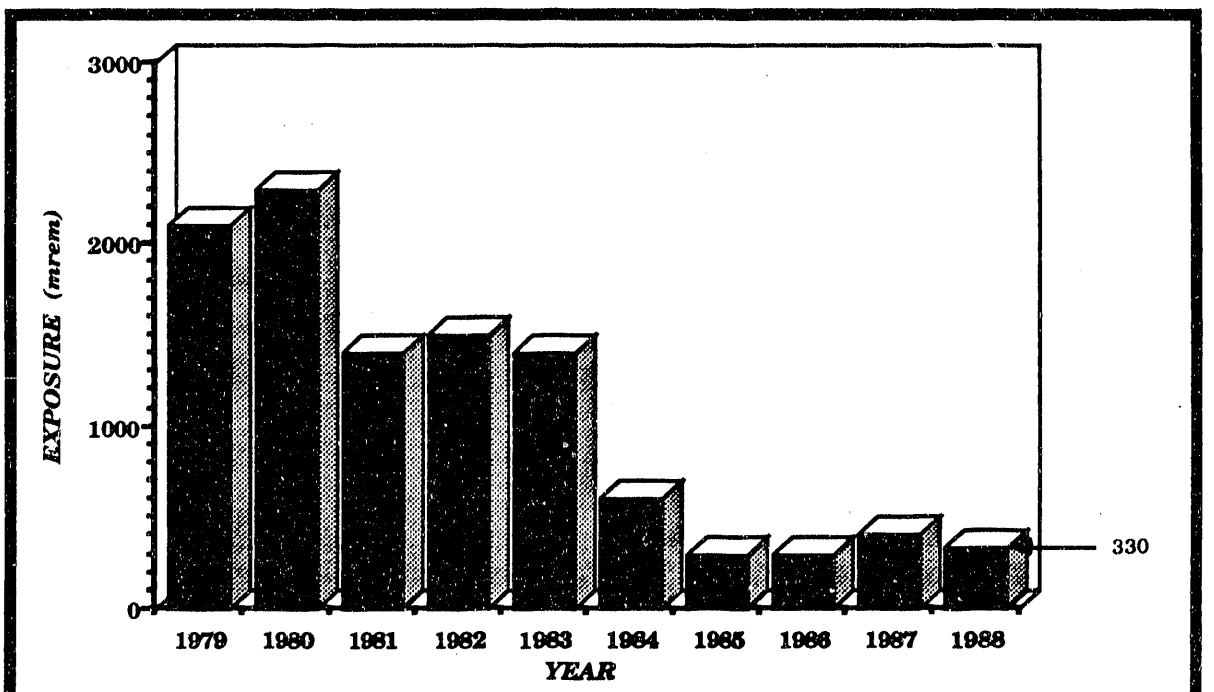


FIG. 4-4. HB-LINE OPERATOR AVERAGE RADIATION EXPOSURE

5 300-M AREA

Radiation Exposure:

Radiation exposure for 300-M Area totaled 49.6 rem in 1988 compared to a goal of 55.0 rem and a 1987 total exposure of 57.0 rem. The maximum individual exposure was 985 mrem for a production casting operator.

The average radiation exposure in 1988 was 547 mrem for 321-M production casting, 460 mrem for 321-M production extrusion, 220 mrem for 313-M production, 521 mrem for 321-M Inspection and Control (I&C) personnel, and 217 mrem for 313-M Inspection and Control (I&C) personnel.

300-M AREA

The overall average radiation exposure for Raw Materials Operators was 250 mrem in 1988 compared to 210 mrem in 1987. This increase resulted from a reduction in the number of Operators in the 300-Area work force. Total exposure for 300-Area operators continued to decrease in 1988 (see FIG. 5-2).

The 300 Area continued the trend of zero uranium assimilations during 1988. There have been no uranium or enriched uranium assimilations since March 1971 and September 1982, respectively.

Major factors contributing to radiation reductions were operations department supervisory involvement in following personnel radiation exposure trends, implementation of appropriate ALARA principles to lower exposure, no processing of neptunium material, and continuing radiation and contamination control training.

Radiation Exposure Reductions:

Following is a list of effective ALARA programs, activities, and actions that were implemented or continued in 1988:

- Continued to use special facility to store unprocessed uranium slugs away from the immediate work area in 313-M.

- Continued to relocate process material in 313-M away from major work locations to reduce exposure.

- Placed lids on wooden slug boxes to reduce personnel radiation exposure rates from 25 mrad/10 mrem/hr at 3" to 5 mrad/3 mrem/hr at 3".

- The final design phase has begun on the "Replace Billet Handling Equipment" project for 321-M. The estimated annual radiation exposure reduction is 3.8 rem.

- Continued to use color coded status boards to alert personnel to the varying exposure rates in 321-M.

- Used extended tongs to transfer Cf-252 neutron sources to maintain a body radiation exposure rate of less than 250 mrem/hr.

- Initiated comprehensive radiation and contamination control training program for all 300-Area work groups. Training includes a thirteen question quiz at the end of each session.

- Completed design and purchased equipment to install an alarming gamma monitor at the 313-M waste compactor loading dock. The unit will provide additional monitoring of waste received for processing at the compactor.

- Developed and implemented a 300/700-Area special bioassay sample computer data base. All special samples are documented and tracked to assure proper followup.

Radiation Exposure Ratios

Special radiation exposure ratios were developed to help characterize exposure trends for specific 300-Area work groups. The values reflect the amount of radiation exposure received per operator per unit of material processed. The 1988 figures are presented in Table 5-4. Background exposure from fuel tubes and uranium slugs continues to be the predominant source of operator exposure.

Increases in the ratios over the past 2 years for 321-M operations (casting and extrusion) can be attributed to increased material inventory and increased storage of material in work areas due to a reduction in the number of tubes assembled and stored in casks for shipment to the reactor areas. Increases in the 313-M ratios in 1988 reflect a sharp reduction in the number of uranium slugs processed and significantly fewer operators. The total inventory of material in 313-M has remained relatively constant during the year. Therefore, operators remaining in the facility to keep equipment operational and assist in D&R work continued to receive some exposure from stored material while few slugs were actually produced. Thus, the ratio of exposure per operator per slug produced increased.

TABLE 5-1. M-AREA RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
RAW MATERIALS				
OPERATIONS	38.8	39.0	38.8	45.0
ENG & TECHNOLOGY	3.9	4.5	2.68	4.0
RM & TQ	-	-	1.01	1.3
HEALTH PROTECTION	0.8	0.7	0.65	1.0
LABORATORIES	0.2	0.3	0.14	0.25
PROJECTS	0.0	0.1	0.0	0.0
SSD	0.3	0.7	0.25	**
CONSTRUCTION	12.3	9.0	5.75	8.0
OTHERS*	0.7	0.65	0.305	0.45
TOTAL	57.0	54.95	49.58	60.0

* Includes Personnel and Safety.
** No goals established for SSD in 1989.

TABLE 5-2. M-AREA 1988 AVERAGE RADIATION EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

DEPARTMENT	AVERAGE NO. OF PERSONNEL	mrem/YEAR
RAW MATERIALS		
PRODUCTION 313-M	14	220
PRODUCTION CASTING 321-M	3	547
PRODUCTION EXTRUSION 321-M	13	460
INSPECTION & CONTROL 321-M	18	521
INSPECTION & CONTROL 313-M	24	217
CTF/DETF	21	11
RM TECH	6	30
RMWE, E&I	16	46
RMWE, MAINT	35	24
RMML	11	4
RM E&T	14	16
HEALTH PROTECTION	8	68
CONSTRUCTION	24	42
MISCELLANEOUS	37	101

TABLE 5-3. RAW MATERIALS OPERATOR EXPOSURE

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1979	142	69.3	0.49
1980	137	66.3	0.48
1981*	160	71.1	0.44
1982*	172	62.7	0.37
1983*	197	73.4	0.37
1984*	230	63.0	0.28
1985*	267	51.8	0.19
1986*	270	54.7	0.20
1987*	168	34.8	0.21
1988*	140	34.3	0.25

* Average calculated by new method. See Chapter 9 for details.

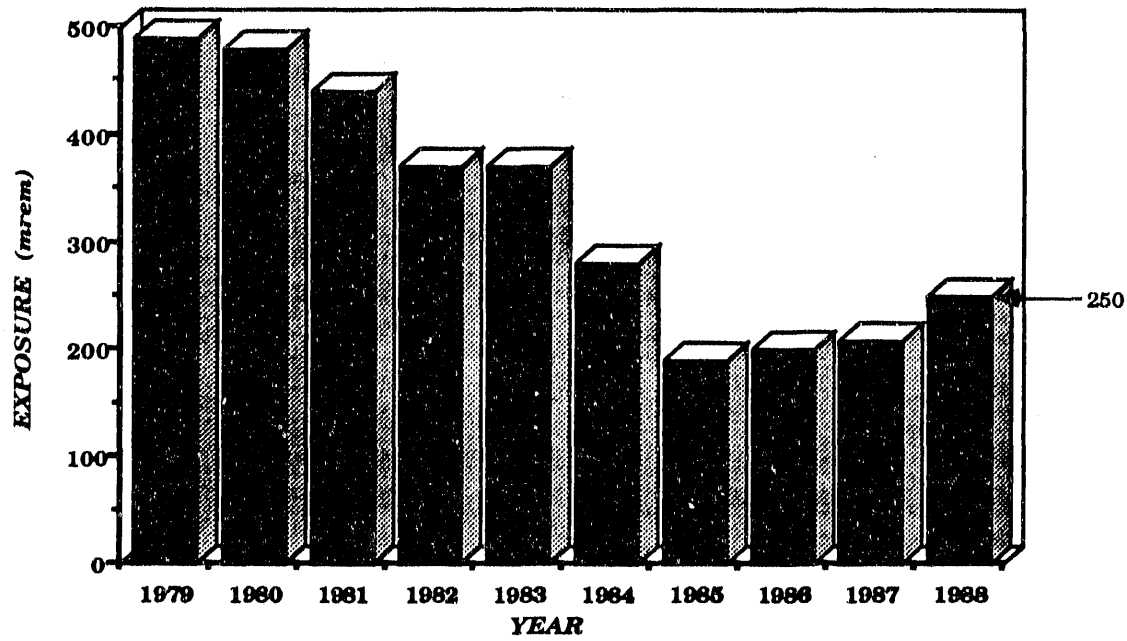


FIG. 5-1. 300-M AREA RAW MATERIALS OPERATOR AVERAGE RADIATION EXPOSURE

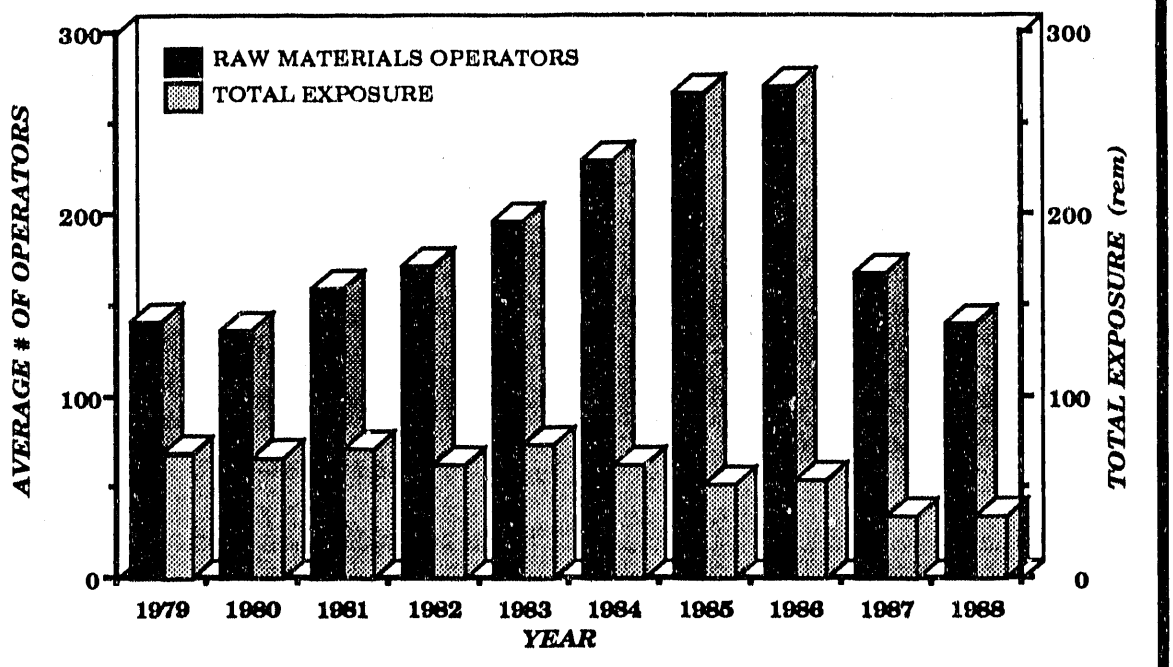


FIG. 5-2. 300-M AREA RAW MATERIAL OPERATOR WORK FORCE AND TOTAL EXPOSURE

TABLE 5-4. M-AREA RADIATION EXPOSURE RATIOS

	1986	1987	1988
RAW MATERIALS OPERATOR, CASTING OF U-Al	0.201 MREM/OPERATOR/CAST	0.554 MREM/OPERATOR/CAST	0.539 MREM/OPERATOR/CAST
RAW MATERIALS OPERATOR, EXTRUSION OF U-Al TUBE	0.056 MREM/OPERATOR/TUBE	0.313 MREM/OPERATOR/TUBE	0.236 MREM/OPERATOR/CAST
RAW MATERIALS I&C OPERATOR, I&C OF EXTRUDED U-Al TUBE	0.082 MREM/OPERATOR/TUBE	0.266 MREM/OPERATOR/TUBE	0.309 MREM/OPERATOR/CAST
RAW MATERIALS OPERATOR, NpO2 TUBE PRODUCTION	*	*	*
HP INSPECTOR	0.026 MREM/OPERATOR/TUBE	0.064 MREM/OPERATOR/TUBE	0.035 MREM/OPERATOR/CAST
RAW MATERIALS OPERATOR, MARK 31B SLUG PRODUCTION	0.012 MREM/OPERATOR/SLUG	0.002 MREM/OPERATOR/SLUG	0.012 MREM/OPERATOR/CAST
RAW MATERIALS OPERATOR, MARK 31B SLUG FINAL INSP.	0.001 MREM/OPERATOR/SLUG	0.003 MREM/OPERATOR/SLUG	0.176 MREM/OPERATOR/CAST

* No Np02 Tubes were fabricated in 1986, 1987, 1988.
Increases in the 313-M indices in 1988 were the result of significant decreases in the number of slugs processed due to 313-M standby status. The total exposure received by 313-M operators is thus greater per slug.

6 400-D AREA

Radiation Exposure:

D-Area facilities with a potential for radiation exposure include the Heavy Water Re-work Facility and 772-D Laboratory.

Radiation exposure for 1988 totaled 1.9 rem as compared to a goal of 6.2 rem and 1987 exposure of 5.4 rem. The decrease in exposure can be attributed to increased emphasis on ALARA practices, a reduction in the volume of waste moderator handling campaign and a decrease in the amount of moderator processed. Construction Department work contributed 0.63 rem versus 2.3 rem in 1987.

The average radiation exposure in 1988 was 33 mrem for Health Protection Inspectors, 8 mrem for Laboratories technicians, and 9 mrem for CSWE personnel. Construction personnel averaged 25 mrem of exposure.

Radiation Exposure Reductions:

- Moderator handling personnel continued to implement Reactor Areas ALARA Program.

TABLE 6-1. D-AREA RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
REACTOR	-	-	-	0.75
CS WE	-	1.48	0.38	*
HEALTH PROTECTION	0.1	0.20	0.07	0.2
LABORATORIES	0.4	0.65	0.11	0.65
POWER/POWER TECH	0.02	0.02	0.02	0.03
CONSTRUCTION	2.2	2.70	0.63	2.0
OTHERS	0.58	0.30	0.64	0.56
TOTAL	5.4	6.20	1.85	4.19

* No goal established for CSWE in 1989.

TABLE 6-2. D-AREA 1988 AVERAGE RADIATION EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

DEPARTMENT	AVERAGE NO. OF PERSONNEL	mrem/YEAR
CSWE	39	9
HEALTH PROTECTION	2	33
LABORATORIES	12	8
POWER	11	2
CONSTRUCTION	22	25

7 G AREA

Radiation Exposure:

G-Area radiation exposure totaled 5.1 rem in 1988 as compared to a goal of 6.6 rem and a 1987 exposure of 5.5 rem. The CSWE Department received 3.5 rem of G-Area's total radiation exposure. This exposure can be attributed to high radiation exposure work in Waste Management by G-Area riggers and crane operators.

The average radiation exposure in 1988 was 91 mrem for RWE mechanics and 26 mrem for CSWE personnel.

TABLE 7-1. G-AREA RADIATION EXPOSURE AND GOALS, REM

DEPARTMENT	1987 ACTUAL	1988 GOAL	1988 ACTUAL	1989 GOAL
CONSTRUCTION	0.0	0.90	0.00	0.50
CS WE	3.4	3.96	3.47	3.96
POWER	0.04	0.04	0.01	0.05
OTHERS	1.92	1.70	1.57	1.73
TOTAL	5.5	6.60	5.05	6.24

TABLE 7-2. G-AREA 1988 AVERAGE RADIATION EXPOSURE PER MONITORED LOCAL ROLL EMPLOYEE, MREM

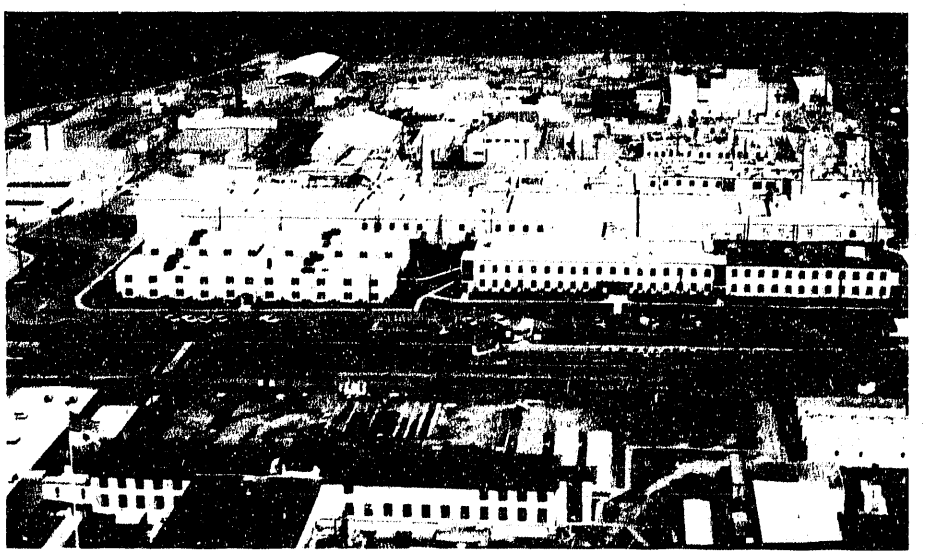
DEPARTMENT	AVERAGE NO. OF PERSONNEL	mrem/YEAR
RWE, E&I	8	18
RWE, MAINT	2	91
CONSTRUCTION	0	0
CSWE	127	26
OTHER*	1	5

* Includes Power Department.

8 SAVANNAH RIVER LABORATORY

Radiation Exposure

In 1988 personnel in the Savannah River Laboratory (SRL) received a total whole body radiation exposure of 20.4 rem, 46 % below the 1988 goal of 38 rem and 40 % below the Management Expectation Goal of 34 rem. Whole body radiation exposure of 20.4 rem represents the lowest annual exposure since full Laboratory operations. Management continued to emphasize the reduction of radiation exposure to "As Low As Reasonably Achievable" (ALARA) by establishing radiation exposure goals for each division/group. A progress report was presented to management at each monthly Central Safety Meeting concerning the cumulative radiation exposure and the status of the ALARA program.



SAVANNAH RIVER LABORATORY

During 1988 one SRL employee (about 0.1% of badged employees) received whole body exposures greater than one rem as compared to three in 1987. Only five SRL employees exceeded a whole body exposure of 0.5 rem. Greater than 99.5% of SRL badged employees received less than 0.5 rem in 1988. The maximum individual exposure for 1988 was 1015 mrems, 44 % less than the goal of 1800 mrem. SRL whole body neutron exposure for 1988 was 7.4 rem and reflects a 15 % decline from the 8.7rem neutron exposure received in 1987. This reduction is due to reduced work load in the californium source fabrication facility. SRL 1988 whole body gamma exposure of 13.0 rems reflects a 21 % decrease relative to the 16.5 rem received in 1987. Most of the decrease in gamma exposure is due to changing R & D programs and increased emphasis in the ALARA program.

Average radiation exposure per badged employee decreased each year during the past ten years with the exception of 1986. Average radiation exposure during 1988 continues this declining trend with a decrease to 19 mrem, about 30 % below the 27 mrem in 1987. Average radiation exposure of 19 mrem represents the lowest average radiation exposure since full laboratory operations.

Assimilations

There have been no assimilations (above the control limits) of radioactive materials by SRL employees in the past four years and only one assimilation (1984) since 1980.

1989 Radiation Exposure Goals

The 1989 SRL Whole body radiation exposure goal is 30 rem, with a management expectation goal of 27 rem.

The maximum annual individual radiation exposure goal is 1800 mrem.

The 1989 goal for assimilations of radionuclides is zero, the same as has been established for the past six years.

The 1989 radiation control goals established above reflect the excellent performance in 1988 but anticipates additional radiation exposure from the following programs:

- Anticipated cleanup and decontamination of the Californium Processing Facility (CPF).
- Increased work in the reactor areas by EED.
- Startup of the old Plutonium Experimental Facility in 235-F.

1989 Radiation Exposure Reduction Program

The major elements of the 1989 SRL exposure reduction program are:

- Practice of ALARA principles in all laboratory activities that involve radiation.
- Maximum use of robotics to assist in removal of waste from CPF.
- Continued emphasis on preplan meetings with operations and construction personnel before jobs with significant radiological hazard potential.

TABLE 8-1. SAVANNAH RIVER LABORATORY
1988 RADIATION EXPOSURE, REM

LABORATORY DIVISION/GROUP	1987 EXPOSURE	1988 GOAL	1988 EXPOSURE	1989 GOAL
LS - ENGINEERING*	0.19	0.20	0.20	0.25
LS - DEVELOPMENT*	0.13	0.16	0.10	0.15
LS - MAINTENANCE*	2.62	3.20	2.17	3.00
LS - SHIELDED CELLS*	6.70	12.50	3.77	8.00
LS - AREA SERVICES & OPERATIONS*	0.30	0.65	0.89	1.10
LS - OCCUPATIONAL HEALTH PROTECTION*	3.61	4.00	2.51	3.20
TNX - OPERATIONS	0.08	0.10	0.08	0.10
INTERIM WASTE TECHNOLOGY	0.84	0.80	0.61	0.65
DEFENSE WASTE PROCESSING TECHNOLOGY	0.11	0.14	0.35	0.30
EQUIPMENT ENGINEERING	3.64	7.00	3.31	4.20
NUCLEAR ENGINEERING	0.27	0.95	0.35	0.75
ROBOTICS & FABRICATION TECHNOLOGY**	0.54	-	-	-
[HYDROGEN TECHNOLOGY]	1.14	1.00	1.73	1.40
[NAVAL FUELS TECHNOLOGY]***	-	0.35	0.07	0.35
ACTINIDE TECHNOLOGY	2.37	3.84	1.80	3.40
ANALYTICAL DEVELOPMENT	1.55	1.50	1.50	1.60
ENVIRONMENTAL SCIENCE	0.09	0.20	0.04	0.10
ENVIRONMENTAL TECHNOLOGY	0.10	0.13	0.18	0.20
REST OF SRL	0.92	1.42	0.78	1.25
TOTAL	25.2	38.0	20.4	30.0

* LS - Laboratory Services
** Division eliminated in reorganization
*** Division created in 1987

TABLE 8-2. SAVANNAH RIVER LABORATORY
RADIATION EXPOSURE SUMMARY

YEAR	GOAL	TOTAL WHOLE BODY EXPOSURE, rem
1979	90	79
1980	80	76
1981	80	70
1982	70	62
1983	60	58
1984	60	33
1985	45	28
1986	35	30
1987	42	25
1988	38	20
1989	30	

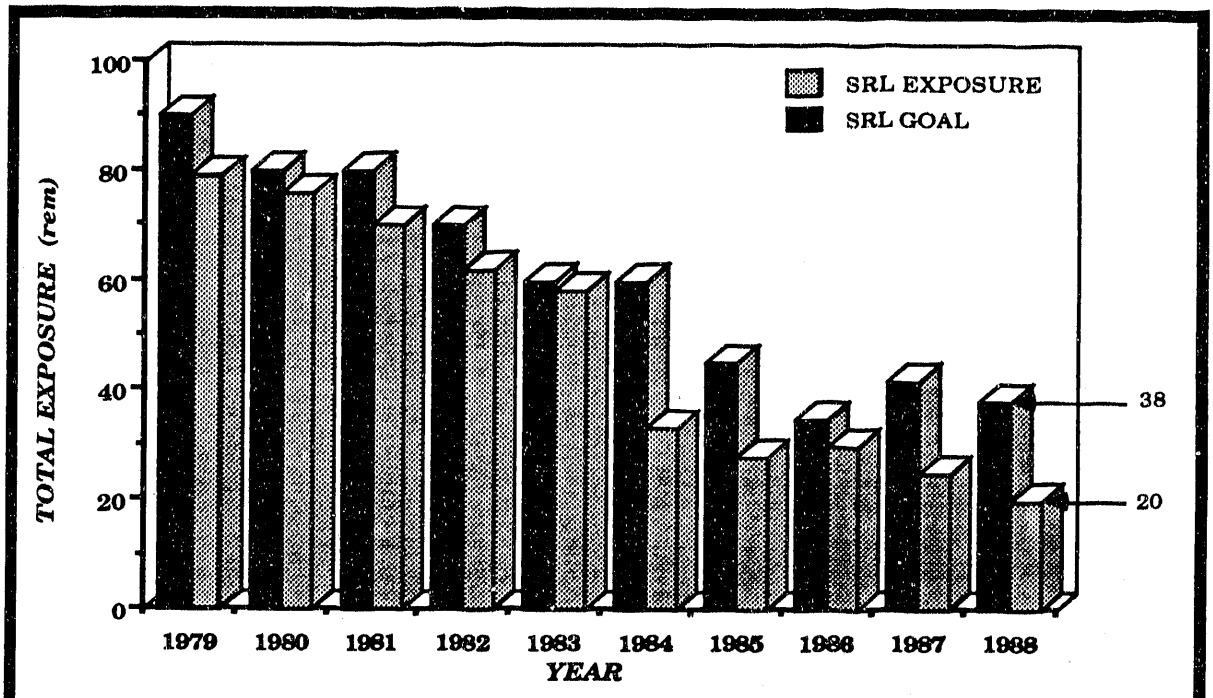


FIG. 8-1. SAVANNAH RIVER LABORATORY WHOLE BODY RADIATION EXPOSURE

TABLE 8-3. SAVANNAH RIVER LABORATORY INDIVIDUAL WHOLE BODY RADIATION EXPOSURE DISTRIBUTION

	(Number of Employees)				
YEAR	0 - 0.5 Rem	0.5 - 1 Rem	1 - 1.5 Rems	1.5 - 2 Rems	2 - 3 Rems
1986	858	10	4	2	0
1987	1014	6	3	0	0
1988	1063	4	1	0	0

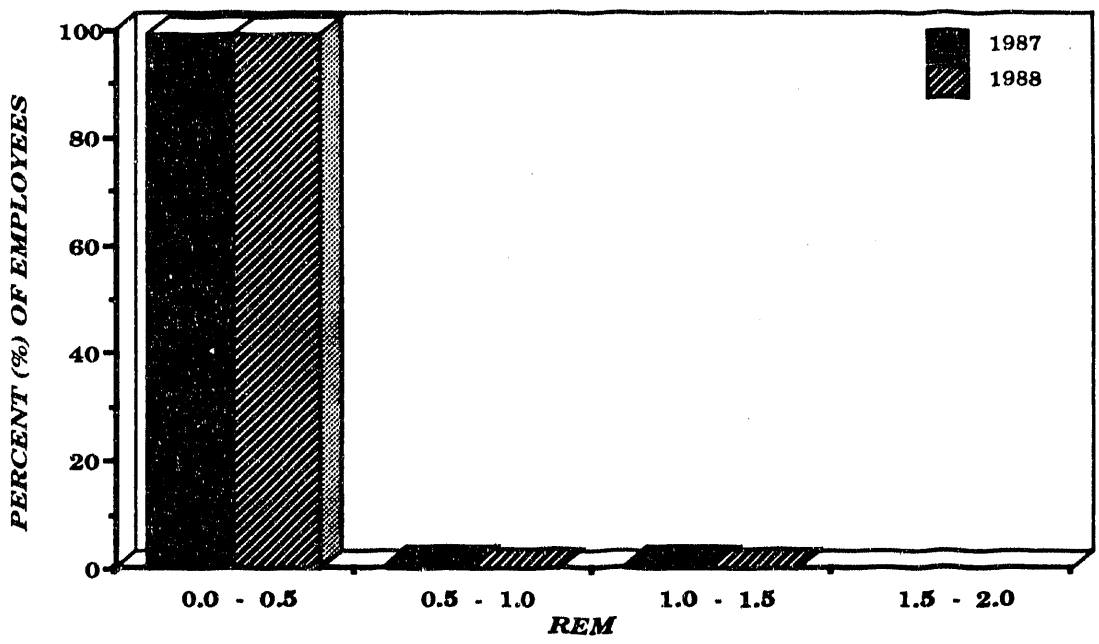


FIG. 8-2. SAVANNAH RIVER LABORATORY WHOLE BODY RADIATION EXPOSURE DISTRIBUTION AS A PERCENTAGE OF THE TOTAL NUMBER OF EMPLOYEES MONITORED

TABLE 8-4. SAVANNAH RIVER LABORATORY AVERAGE WHOLE BODY RADIATION EXPOSURE PER MONITORED EMPLOYEE AND MAXIMUM INDIVIDUAL EXPOSURE

YEAR	NO. OF PERSONNEL MONITORED	AVERAGE EXPOSURE (mrem)	MAXIMUM INDIVIDUAL EXPOSURE (mrem)
1979	816	97	2045
1980	864	88	1970
1981	872	80	1480
1982	872	71	1850
1983	982	59	1800
1984	966	34	1255
1985	905	31	1355
1986	872	35	1650
1987	1026	25	1270
1988	1068	19	1015

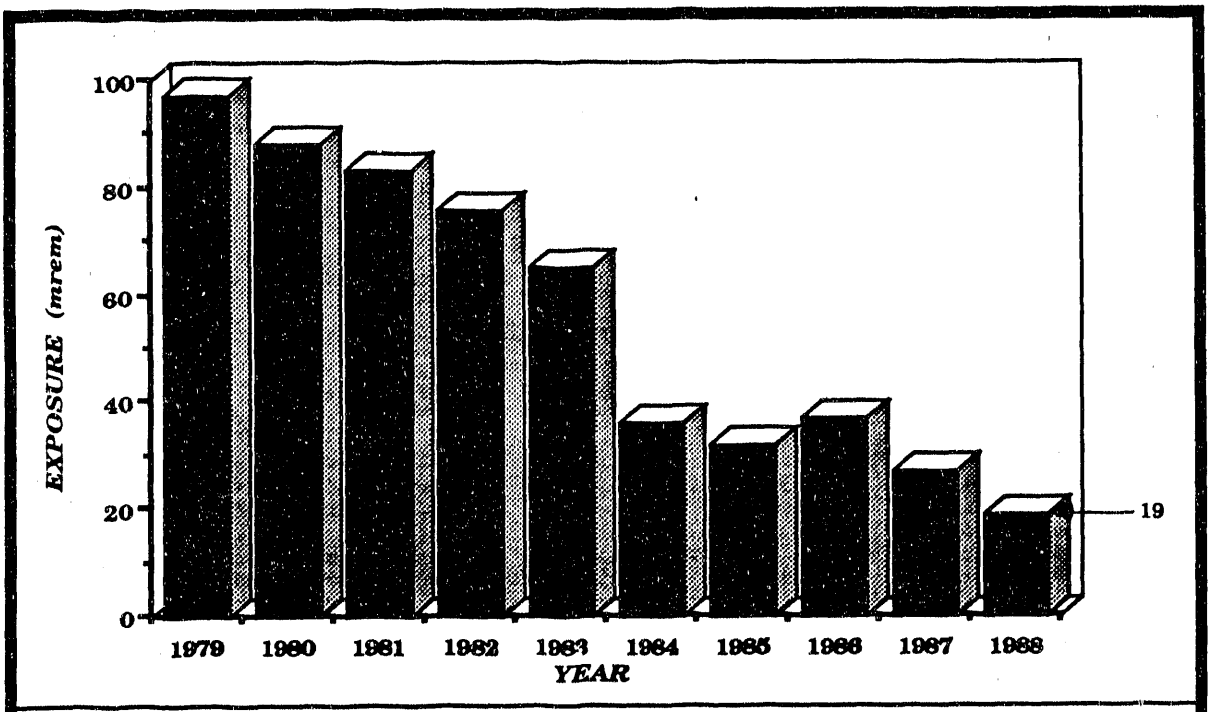


FIG. 8-3. SAVANNAH RIVER LABORATORY MONITORED EMPLOYEE AVERAGE WHOLE BODY RADIATION EXPOSURE

TABLE 8-5. SAVANNAH RIVER LABORATORY INDIVIDUAL EXPOSURE GREATER THAN 1000 MREM

NUMBER	DIVISION/GROUP	MREM
1	Occupational Health Protection	1015

TABLE 8-6. SRL ASSIMILATIONS

YEAR	AMERICIUM PLUTONIUM	CURIUM	TOTALS	GOALS
1978	0	2	2	*
1979	0	1	1	*
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	0	0	0	0
1984	0	1	1	0
1985	0	0	0	0
1986	0	0	0	0
1987	0	0	0	0
1988	0	0	0	0

* No formal goals established prior to 1980.

9
APPENDIX

1988 Reference Information

- The Savannah River Plant external dosimetry program completed the final phase of the DOE-LAP accreditation process in December 1988. Notification of accreditation by DOELAP is anticipated in the first quarter of 1989 and will make the SRP program only the fourth DOE complex to receive accreditation.

- Construction completed seismic bracing on the forth Emergency Cooling Water System in K Reactor.

- The 221-H Canyon facility was shut down from October 28, 1988 to December 20, 1988 for repairs to steam lines, to prepare for filter flushes, for cooling water outage for the ETF facility, and various facility upgrades.

- The new 221-H Canyon Warm Crane installation began on December 2, 1988. Scheduled completion date is April 1989.

- The new HB-Line facility completed the DOE phase II Operational Readiness Review in October 1988. The facility is currently in a"Cold Run" checkout phase with startup approval anticipated for the first quarter of 1989.

- The Tritium facilities reached a commendable milestone of 1000 days without an assimilation in July of 1988. This performance has continued through the end of December 1988.

- The Replacement Tritium Facility (RTF) is 95 % complete. Mechanical completion by construction is scheduled in May 1989.

- The 221-F Canyon facility was shut down from October 24, 1988 to December 18, 1988 for instrument tie-ins, repair of steam lines, re-routing of FB-Line power, completion of PRC-Process and various facility upgrades.

- The FB-Line was shut down from May 23 to July 4, and October 24 to December 16, 1988 for installation of new furnace equipment and waste neutralization tanks, tie-ins of vacuum and cooling water lines, and cabinet panel replacements.

- The new 221-F Canyon Warm Crane installation and testing was completed in 1988.

- The new PUREX support laboratory 772-1F was placed into full operation in 1988.

- The Naval Fuels Material facility 247-F qualified to provide finished product to DOD in 1988. The facility is now fully operational.

- The H-Area Effluent Treatment Facility (ETF) began processing F and H Area low activity process waste in October 1988. The facility processes waste that previously went to the F and H Area seepage basins. The clean portion of the treated waste is returned to Upper Three Runs Creek and the concentrated waste will be incorporated in saltstone and placed in Z-Area.

1988 REFERENCE INFORMATION (Continued)

- The Z-Area Saltstone Facility was completed in March 1988. The facility is currently in "Cold Run" checkout and anticipates startup approval in the first quarter of 1989.
- Discharge of effluents to seepage basins in F and H Area was discontinued in November 1988.
- The Operations force was 7074 employees on December 31,1987 and 8726 on December 31, 1988.
- The Construction force was 4485 employees on December 31,1987 and 5899 on December 31, 1988.

REPORTING METHODS

Method for Calculating Work Group Averages:

The calculation of the annual average exposure of comparatively small work groups continues to be an important means of providing information on the effectiveness of ALARA programs.

Individual work group average annual radiation exposures for 1988 were calculated by a method which utilizes the Health Protection Department's computerized personnel exposure data base. Each specific work group is assigned a unique Health Protection Department (HPD) code. Individual's exposure is then assigned to their corresponding work group on a month-by-month basis. This allows for the easy summation of the total exposure accumulated by each work group. In addition, the total number of man-months accumulated in the work group can also be calculated. The total number of man-months divided by 12 gives the number of man-years accumulated. The number of man-years represents the average number of personnel in a work group during the year. Thus the average annual exposure is calculated by dividing the total exposure accumulated in a work group by the average number of personnel in the work group during the year.

The data arrangement prior to 1981 makes the application of this method impractical for those years. Therefore, work group averages documented in this report for the years prior to 1981 were determined by another method. This older method utilized only those personnel in the work group at the end of the year to determine the average exposure.

Assimilations:

In 1985, a new method for establishing control limits for radioactive assimilations, based on dose, was adopted. Prior to 1985 assimilations were confirmed if results from bioassay measurements were above the control guide established for the specific radioactive isotope. Confirmation of the assimilation was not dependent on the actual dose calculated from the assessment of the bioassay data. This was referred to as the bioassay method.

The new method (hereafter referred to as the dose method) is a more logical approach. By using the effective dose equivalent, the actual significance of the assimilation in terms of dose is the factor which determines if the assimilation is confirmed or not. In addition, the effective dose equivalent provides a basis for comparison of all types of internal and external radiation exposure. A control limit of 100 mrem effective dose equivalent during the first 12 months after the assimilation was set for the intake of radionuclides. The intake of any radioactive material that results in an effective dose equivalent equal to or greater than this limit is documented as a confirmed assimilation.

In keeping with the recommendations of the International Commission on Radiological Protection (ICRP) Report 30, SRP reduced the Quality Factor (QF) for tritium from 1.7 to 1 and adopted the ICRP's dosimetric method in 1986. This change reduces the dose from a tritium intake by 61% compared to the method previously used.

Contamination Cases:

A new goal for personnel contamination cases has been established for 1989. Contamination cases will be classified as skin, personal effects, nasal, or wound.

Skin and personal effects cases will be tabulated if the contamination exceeds 100 counts per minute over background on a portable instrument sensitive to beta - gamma radiation or if any activity is detected using a portable alpha instrument. Cases involving inert gases (radon and reactor blanket gases) will not be tabulated. All nasal and wound cased will be tabulated. An incident which causes more than one class of contamination of one individual will be tabulated as one contamination case. This program is based on criteria established by the Institute of Nuclear Power Operations (INPO).

Monitored Employees:

Values listed in this report for the number of individuals monitored and for the exposures accumulated by areas, departments, and work groups represent the data for Operations, and Construction personnel who are assigned a permanent dosimeter or who sign out a temporary dosimeter. Sub-contractor employees who have been placed in the HP Master File and are assigned a permanent dosimeters or who sign out a temporary dosimeter are also are included. Data from dosimeters assigned to visitors and temporary dosimeters singed out by Sub-contractor employees not placed in the HP Master File are not included.

TABLE 9-1. 1988 Special Hazards Investigations

Number	Date	Title and Description
470	6/25/87	772-F LABORATORY 126 RADIOBENCH INCIDENT: A Laboratories technician received nasal and saliva contamination while disposing standard solutions in a Lab radiobench. Bioassay results indicated that the first year effective dose equivalent from this uptake is 20 mrem.
471	1/28/88	LOSS OF NEUTRON POISON FOR NAVAL FUEL LAB GLASS VESSEL: The minimum Technical Standard and OSR Limiting Control Setting for areal density of boron in borosilicate glass vessels was exceeded in the Naval Fuel Laboratory's High Level Waste system.
472	1/23/88	TRITIUM ASSIMILATIONS IN P-AREA CRANE WASH AREA: Two Reactor Department Senior Components Handling Reactor Operators and one Reactor Works Engineering Maintenance mechanic received tritium exposures of 7 (25 mrem), 15 (55 mrem), and 18 (60 mrem) uCi/L respectively while connecting the discharge machine water recovery hose.
473	12/14/87	FB-LINE SKIN AND NASAL CONTAMINATION INCIDENT: An FB-Line operator received skin and nasal contamination when a cabinet glove at the D-1 dissolver failed during routine charging of the dissolver. Bioassay results indicated that the first year effective dose equivalent from this uptake is 280 mrem thus making it a confirmed assimilation in 1987.
474	1/15/88	772-F STACK RELEASE: During the routine change-out of a HEPA filter in 772-F Shielded Area "A", 0.167 mCi of Pu-238 was released through the exhaust stack to the environment. No personnel contamination cases or assimilations resulted from the release. Areas effected by the deposition of the material were successfully decontaminated.
475	1/29/88	TRITIUM EXPOSURE - 105-P: Twenty two employees received tritium exposure > 5uCi/L while working in the Purification area of the 105-P Building between 1/24 and 1/29/88. The maximum exposure received was 21.6 uCi/L by a RWE E&I mechanic. No specific source of the tritium could be determined.
476	8/26/88	TRITIUM EXPOSURE - 105-K: Five Construction personnel received tritium exposures greater than 5 uCi/L while working on a core drilling job in the -20 level heat exchanger bay. The maximum first year effective dose equivalent for all individuals was 101 mrem resulting in one confirmed assimilation from the incident. Contaminated water used to cool and flush the core drill was identified as the source of the tritium.
477	3/10/88	FB-LINE SKIN AND NASAL CONTAMINATION INCIDENT: An FB-Line operator received skin and nasal contamination when a cabinet glove failed in the Dissolver Cabinet during routine work. Bioassay results indicated that the first year effective dose equivalent from this uptake is 65 mrem and thus is not a confirmed assimilation.

TABLE 9-1. 1988 Special Hazards Investigations (Continued):

Number	Date	Title and Description
478	3/18/88	300-M AREA TECHNICAL STANDARD VIOLATION: Two cans of enriched uranium scrap material were improperly stored in the 321-M Casting Area. One can was placed less than 18 cm's from the next closest can of enriched uranium scrap material and thus was in violation of the 300-M Area technical Standard Limits.
479	5/23/88	HIGH EXPOSURE IN 241-F TANK FARM: Two Miller Dunn Electric Company employees received exposure exceeding the monthly guide of 600 mrem during the installation of lightning rod grounding cables on the H&V enclosures for tanks 25-25 and 44-47.
480	6/14/88	IMPROPER CONTROL OF REGULATED TOOLS BY P-AREA SUBCONTRACTORS: Vendor hand tools, which had entered a radiation zone, were transported off-site without authorization. The tools were used by the vendor to install a new air conditioner in a P-Reactor radiation zone. The tools were surveyed for contamination by a Reactor Operator prior to the vendor transporting them off-site. A follow-up survey of the tools and vendor vehicle by Health Protection revealed no contamination.
481	7/8/88	CONTAMINATION RELEASE TO FOUR MILE CREEK: The 281-8H retention basin was was pumped to Four Mile Creek at the same time the basin was receiving contaminated cooling water from the Separations segregated cooling water system. About 21 millicuries of Cs-137 from this incident has been detected in four Mile Creek.
482	7/18/88	CONTAMINATION OF H-AREA ROADWAYS: Roadways from 221-H truckwell to Gate 10 of the burial ground were contaminated when beta-gamma activity was released from a jumper transfer box during its shipment from 221-H. Eleven employees' shoes, five personnel vehicles, and two government vehicles were contaminated as a result of the release. There were no assimilations from this incident.
483	9/9/88	GLOVE BREAK, PLUTONIUM EXPERIMENTAL FACILITY, 235-F: Four SRL employees were exposed to airborne radioactive contamination following a glove rupture and the release of Pu-238 into the maintenance area of PEF. Bioassay results indicated that the maximum first year effective dose equivalent for these individuals was 50 mrem, the remaining cases were below 10 mrem. There were, therefore, no confirmed assimilations as a result of this incident.
484	10/26/88 TO 11/5/88	772-F STACK RELEASE: Particulate emissions were released from the 772-F 75 foot stack as a result of the opening of a diversion valve during process ventilation tests. Fourteen employees shoes and one private vehicle were contaminated as a result of the release. All contamination was confined to a 200 foot radius of the stack. An estimate of the total amount of plutonium detected in the environment was 0.001 mCi.

Dosimetry Codes

The Dosimetry Codes in this section reflect a systematic organization of SRP, SRL and Construction Departments and Subcontractors which are reported in a monthly Health Protection Dosimetry Exposure Report S6090.

TABLE 9-2. S6090 ORGANIZATION, 1988

GROUP	HPD CODE	FUNCTION/LOCATION
REACTORS (PMT)		
REACT		
REACT-100	100	SUPPORT
REACT-102	102	
REACT-103	103	DAY RELIEF
REACT-104	104	COMPONENT HANDLING
REACT-105	105	SHIFT OPERATION
REACT-106	106	MISC
RT	503	
RWE		
RWE-161	161	AREA E&I
RWE-161	162	AREA MAINT
RWE-163	163	MAG E&I
RWE-164	164	MAG MAINTENANCE
RWE-165	165	TR & T
RWE-166	166	MISC
RPM	170	REACTOR PROJ MGNT
RRM	175	REACTOR RESOURCE MGNT
H W	400	
SEPARATIONS (PMT)		
SEP		
SEP-200	200	F-CANYONS (221-F)
F B-LINE-201	201	B B-LINE PRODUCTION
F B-LINE-850	850	F B-LINE PROJECT LIAISON
F B-LINE-851	851	F B-LINE NEW SPECIAL RECOVERY
F B-LINE-852	852	F B-LINE TECHNICAL
F B-LINE-853	853	F B-LINE ENGINEERING SERVICES
F B-LINE-861	861	F B-LINE WORKS ENGINEERING
SEP-202	202	F OUTSIDE
SEP-203	203	H CANYONS (221-H)
SEP-204	204	MISC
SEP-205	205	F 234-(PUFF)
SEP-208	208	244-H3H (ROBF)
SEP-209	209	H B-LINE
ST	504	SEP TECH

TABLE 9-2. S6090 ORGANIZATION, 1988 (Continued)

GROUP	HPD CODE	FUNCTION/LOCATION
SWE		SEP WORKS ENG
SWE-261	261	LAUNDRY E&I
SWE-261	261	LAUNDRY MAINT.
SWE-263	263	CANYON PROCESS E&I
SWE-264	264	CANYON MAINT
SWE-265	265	B-LINE E&I
SWE-266	266	B-LINE MAINT
SWE-267	267	A-LINE E&I (211)
SWE-268	268	A-LINE MAINT (211)
SWE-269	269	PUFF E&I (GEN, 235-F, POWER)
SWE-270	270	PUFF MAINT (GEN, 235-F)
SWE-271	271	LAB E&I
SWE-272	272	LAB MAINT
SWE-273	273	POWER MAINT
SWE-274	274	717-F MAINT
SWE-275	275	TR & T
SWE-276	276	MISC. & ADMIN.
SWE-277	277	SAFEGUARDS E&I
SWE-278	278	CANYON SUPPORT E&I
SEPPJ	280	
FPF	320	FUEL PROD FACILITY
SEPSQ	871	SEPARATIONS QUALITY
WASTE MANAGEMENT & NF (PMT)		
WM WO		
WM WO-212	212	WM WO (F)
WM WO-214	214	WM WO (H)
WM WT		
WM WT-210	210	WM WT (F)
WM WT-211	211	WM WT (H)
WMPROJ	610	
WMPETF	611	
WM WE		
WM WE-E&I	661	
WM WE -MAINT	662	
WM-WE-TR & T	663	
WM WE-MISC	664	
DWPFP	710	DWPF PRODUCTION
DWPFT	715	DWPF TECHNICAL
DWPFWE		
DWPFWE-E&I	761	
DWPFWE-MAINT	762	
DWPFWE-TR & T	763	
DWPFWE-MISC	764	
DWPFSF	215	SAN FRANSISCO
DWPFMD	216	MARYLAND

TABLE 9-2. S6090 ORGANIZATION, 1988 (Continued)

GROUP	HPD CODE	FUNCTION/LOCATION
NAV FUEL PROD & WE		
NFP-MISC	220	
NFP-WETCHEM	221	
NFP-FINISH	222	
NF WE-MISC	230	
NF WE-E&I	231	
NF-WE-MAINT	232	
NAVEL FUEL TECH		
NFT-MISC	225	
NFT-LAB	226	
NFT-TECH	227	
WMPQ	872	WASTE MNGT & NF QUALITY
RAW MATERIAL & TRITIUM (PMT)		
RAW MT		
RAW MT-300	300	MISC (320-M)
RAW MT-301	301	PROD (313-M)
RAW MT-302	302	PROD CAST (321-M)
RAW MT-303	303	PROD EXTRUSION (321-M)
RAW MT-304	304	INSP/CONTR (321-M)
RAW MT-305	305	INSP/CONTR (313-M)
RAW MT-306	306	ENVIRONMENTAL
RAW MT-307	307	MISC
RAW MT ENG & TECH		
RME&T-MISC	314	
RMML	309	MET LAB
RMT	315	RAW MT TECH
RAW MT WE-E&I	361	
RAW MT WE-MAINT	362	
RAW MT WE-TR & T	363	
TRITIUM		
TR-MISC	419	
TRIT	420	
TRITIUM TECH & ENG		
TR T&E-MISC	414	
TRTECH	415	
TR WE-E&I	461	
TR WE-MAINT	462	
TR WE-TR & T	463	
REPLACEMENT TRIT FAC		
RTF	425	
RM&TQ	873	RAW MT & TRITIUM QUALITY
LR PLANNING & BC		
LRP&BC	507	
SAFEGUARDS & SECURITY		
SG&SEC	508	
EMPLOYEE RELATIONS		

TABLE 9-2. S6090 ORGANIZATION, 1988 (Continued)

GROUP	HPD CODE	FUNCTION/LOCATION
PERSNL	801	PERSONNEL
MED	802	MEDICAL
SAFETY & FIRE	800	SAFETY
CONF	803	
PUBAFF	804	
BUSINESS SERVICES		
A & BA	900	ACCOUNTING & BA
SSD	700	SITE SERVICE DIV.
ASQ	874	ADMINISTRATION QUALITY
INFORMATION SYSTEMS		
CSD	820	
CMPPJ	821	
CTM	825	
ENG & CENT SERV		
INVENG	620	INVESTMENT ENGINEERING
CS WE		
CS WE-601	601	CS WE-E&I/MAINT POOL
CS WE-605	605	CS WE-T&T POOL
CS WE-606	606	CS WE-MISC
CS WE-607	607	CS WE-ENG & TRAINING
CS WE-608	608	CS WE-DIGITAL SYSTEMS
CS WE-609	609	CS WE-COMPUTER/RADIO
DIGITAL CONT & SYSTEMS		
DCS	615	
PROJ	604	PROJECTS
POWER	603	
POWTEC	502	
E&CSQ	876	ENG & CENT SERV QUALITY
TECHNICAL OPERATIONS (PMT)		
LABS		
LABS-501	501	MISC
LABS-570	570	SEP. CONTROL
LABS-571	571	PRODUCT ANALYSIS
LABS-572	572	NON DESTRUCTIVE ASSAY
LABS-573	573	NOT DESIGNATED
LABS-574	574	NOT DESIGNATED
LABS-575	575	NOT DESIGNATED
HP		
HP-500	500	MISC
HP-520	520	CANYON
HP-521	521	B-LINE
HP-522	522	A-LINE (211)
HP-523	523	PUFF (299-H)
HP-524	524	LABS
HP-525	525	WM
HP-526	526	NAVAL FUELS
ENV&EG	515	

TABLE 3-2. S6090 ORGANIZATION, 1988 (Continued)

GROUP	HPD CODE	FUNCTION/LOCATION
NEPA	830	
TECHQ	875	TECHNICAL QUALITY
SITE QUALITY		
SQ	902	
MANAGEMENT	905	STAFF
CONSTRUCTION	040	CONSTRUCTION
SRL		
TECH-921	921	MISC
TECH-950	950	STAFF (TSTAFF)
TECH-951	951	BUDGET AND PLANNING (T-B&L)
TECH-952	052	SCIENTIFIC COMPUTATIONS (T COMP)
TECH-953	953	LS - ENGINEERING (T LABS)
TECH-954	954	LS - DEVELOPMENT (T LABS)
TECH-955	955	LS - MAINTENANCE (T LABS)
TECH-956	956	LS - SHIELDED CELLS (T LABS)
TECH-957	957	LS - BUILDING SERVICES (T LABS)
TECH-958	958	TNX (T TNXO)
TECH-959	959	PERSONNEL - SAFETY (T PERS)
TECH-960	960	OCCUPATIONAL HP (T LABS)
TECH-961	961	QUALITY (T QUAL)
TECH-962	962	DEF. WASTE PROC. TECH (T DWPT) (T DWFT)
TECH-963	963	INTERIM WASTE TECH (T IWT)
TECH-964	964	WASTE TECH COORDINATION (T WTC)
TECH-965	965	REACTOR SAFETY RESEARCH (T RSR)
TECH-966	966	NUC. ENG. (T NUCE)
TECH-967	967	NON REACT. SAFETY EVAL. (T NRSE)
TECH-968	968	REACT. SAFETY EVAL. (T RES)
TECH-969	969	ACTINIDE TECH (T ACTT)
TECH-970	970	HYDROGEN TECHNOLOGY (T HT)
TECH-971	971	NAVAL FUEL TECHNOLOGY (T NFT)
TECH-972	972	ANALYTICAL DEVELOPMENT (T ANLD)
TECH-973	973	ENVIRONMENTAL TECHNOLOGY (T ENVS)
TECH-974	974	EE (T EED)
TECH-975	975	ENVIRONMENTAL SCIENCE (T ENVS)
TECH-976	976	MATERIALS TECHNOLOGY (T MT)
TECH-977	977	REACT. QUAL. ADMIN.&PLAN.(T RQAP)
OTHERS		
DOE	050	
SREL	051	
FORESTRY	052	
SOU BELL	055	
WILMINGTON	053	
U OF CA	054	
DIVERSCO	056	
WSI	057	

TABLE 9-2. S6090 ORGANIZATION, 1988-G (Continued)

GROUP	HPD CODE	FUNCTION/LOCATION
BECHTEL	058	
C&R	059	
AIKEN TECH	060	
INS	061	
WESTINGHOUSE	062	
ESCORTS-CONST	063	
TEMPS	064	
INDUST PHASES	065	
AT&T	066	
NUS	067	
SCDEHEC	068	
US EL	090	
DNV	091	
DEC	092	
UNITED	093	
JONES	094	

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Historical Summary of SRP and SRL Radiation Exposures

TABLE 9-4. HISTORICAL SUMMARY EXPOSURE DISTRIBUTION OF ANNUAL SRP AND SRL W HOLE BODY RADIATION DOSE EQUIVALENTS

	MONITORED EMPLOYEES IN EACH DOSE RANGE					TOTAL MONITORED
YEAR	0-1 rem	1 rem-2 rem	2 rem-3 rem	3 rem-4 rem	>4rem	EMPLOYEES
1952	1130	-	-	-	-	1130
1953	4097	3	-	-	-	4100
1954	7848	2	-	-	-	7850
1955	8357	142	23	4	-	8526
1956	7332	242	52	1	1(1)	7628
1957	8185	403	112	3	-	8703
1958	7640	365	44	-	-	8049

(1) One employee with whole body dose equivalent of 10.5 rem from a tritium assimilation.

TABLE 9-5. HISTORICAL SUMMARY - SRP AND SRL WHOLE BODY RADIATION DOSE EQUIVALENTS

	SRP			SRL		
YEAR	TOTAL (rem)	MONITORED EMPLOYEES	AVERAGE (mrem)	TOTAL (rem)	MONITORED EMPLOYEES	AVERAGE (mrem)
1959	1407	4992	281.9	280	764	366.5
1960	2794.5	4909	569.3	262.7	761	345.2
1961	1939.5	5113	379.3	178.6	706	253.0
1962	2092.3	5548	377.1	172.7	684	252.5
1963	2088.1	5558	375.7	164.8	661	249.3
1964	2680.3	4858	551.7	256.6	640	400.9
1965	2084.2	4457	467.6	284.8	520	547.7
1966	1848.6	4466	413.9	279.0	566	492.9
1967	2316.1	4422	523.8	355.0	620	572.6
1968	2057.6	4228	486.7	361.9	647	559.4
1969	2021.3	4070	496.6	768.3	635	1209.9
1970	1863.2	4506	413.5	526.6	718	733.4
1971	1988.6	4109	484.0	412.2	747	551.8
1972	1361.5	3888	350.2	349.3	849	411.4
1973	1293.3	4682	276.2	194.4	799	243.3
1974	1203.7	4692	256.5	163.3	745	219.2
1975	1031.2	5122	201.3	129.4	742	174.4
1976	1052.1	5276	199.4	117.0	755	155.0
1977	1055.2	5743	183.7	110.8	782	140.0
1978	1041	6659	156	91	835	109

* Prior to 1973 the number of SRP monitored employees was equal to the number of employees monitored in December. For 1973 and after, the number of SRP monitored employees represents a cumulative total. Employees monitored for any period during the year are added to the total.

TABLE 9-6. HISTORICAL SUMMARY SRP AND SRL WHOLE BODY RADIATION DOSE EQUIVALENTS *

YEAR	GAMMA (REM)	NEUTRONS (REM)	TRITIUM (REM) **	TOTAL (REM)	MONITORED EMPLOYEES	AVERAGE MONITORED EMPLOYEE ANNUAL DOSE (mrem)
1959	1635.3	0.7	51	1687	5756	293.1
1960	2943.2	8.0	106	3057	5670	539.2
1961	1974.2	0.9	143.0	2118	5819	364.0
1962	2113.5	1.8	149.7	2265	6232	363.4
1963	2143.7	8.1	101.0	2253	6219	362.2
1964	2761.4	30.6	144.9	2937	5498	534.2
1965	2242.6	30.5	95.9	2369	4977	476.0
1966	2013.2	46.1	68.3	2128	5032	422.8
1967	2582.6	54.3	34.3	2671	5042	529.8
1968	2289.1	81.6	48.8	2420	4875	496.3
1969	2526.7	195.0	67.9	2790	4705	592.9
1970	2173.0	154.4	62.4	2390	5224	457.5
1971	2130.8	170.0	100.0	2401	4856	494.4
1972	1449.9	155.3	114.6	1711	4737	361.2
1973	1291.9	95.0	100.8	1488	5481	271.4
1974	1162.2	108.2	96.6	1367	5437	250.9
1975	968.4	87.1	105.1	1161	5864	197.9
1976	961.9	106.1	101.1	1169	6031	193.8
1977	951.7	105.1	109.2	1166	6525	178.7
1978	958.1	88.8	94.7	1132	6475	176.3
1979	977.0	112.4	83.1	1164	7035	166.7
1980	975.9	157.6	76.6	1204	7424	163.0
1981	965.8	165.8	93.2	1200	8635	141.8
1982	938.4	126.6	71.4	1142	8812	129.0
1983	940.5	114.2	53.9	1107	9878	112.2
1984	861.5	127.7	79.0	1057	10368	103.0
1985	876.3	194.4	55.5	1109	11924	94.4
1986	838.2	252.5	30.5	1091	12764	87.8
1987	730.0	186.9	34.2	921	12585	75.6

* Prior to 1973 the number of SRP monitored employees was equal to the number of employees monitored in December. For 1973 and after, the number of SRP monitored employees represents a cumulative total. Employees monitored for any period during the year are added to the total.

** Tritium exposures prior to 1986 are calculated using a quality factor of 1.7 and a total body water content of 42 kg.

TABLE 9-7. CONSTRUCTION WHOLE BODY RADIATION EXPOSURE **

YEAR	AVERAGE NO. OF PERSONNEL	TOTAL REM	AVERAGE EXPOSURE REM/YEAR
1978	-	-	-
1979	-	-	-
1980	-	-	-
1981	-	-	-
1982*	1789	184	103
1983*	2184	231	105
1984*	2754	296	107
1985*	3566	285	80
1986*	3868	307	79
1987*	3546	239	68
1988*	3919	269	69

* Average calculated by new method. See Chapter 9 for details.
** Data for years prior to 1982 not formatted in the computer data base.

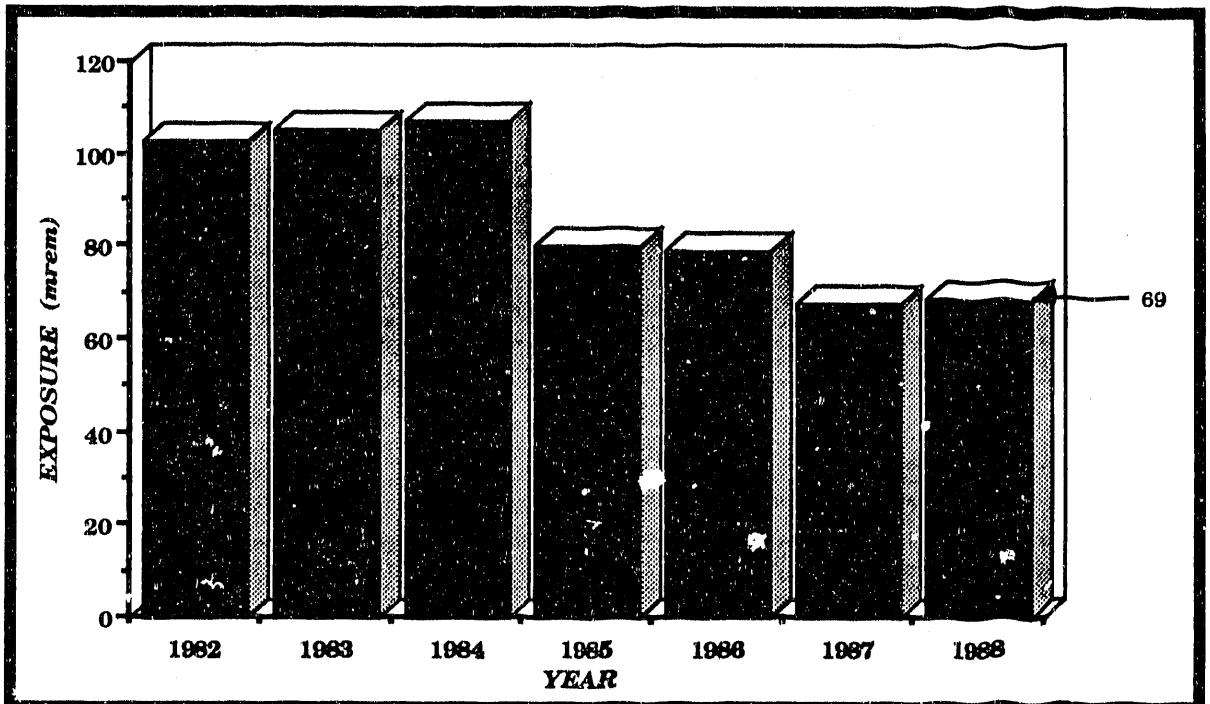

FIG. 9-2. SRP CONSTRUCTION PERSONNEL AVERAGE WHOLE BODY RADIATION EXPOSURE

END

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