
**Area Monitoring Dosimeter Program
for the Pacific Northwest National
Laboratory: Results for CY 1993
and CY 1994**

S. R. Bivins
G. A. Stoetzel

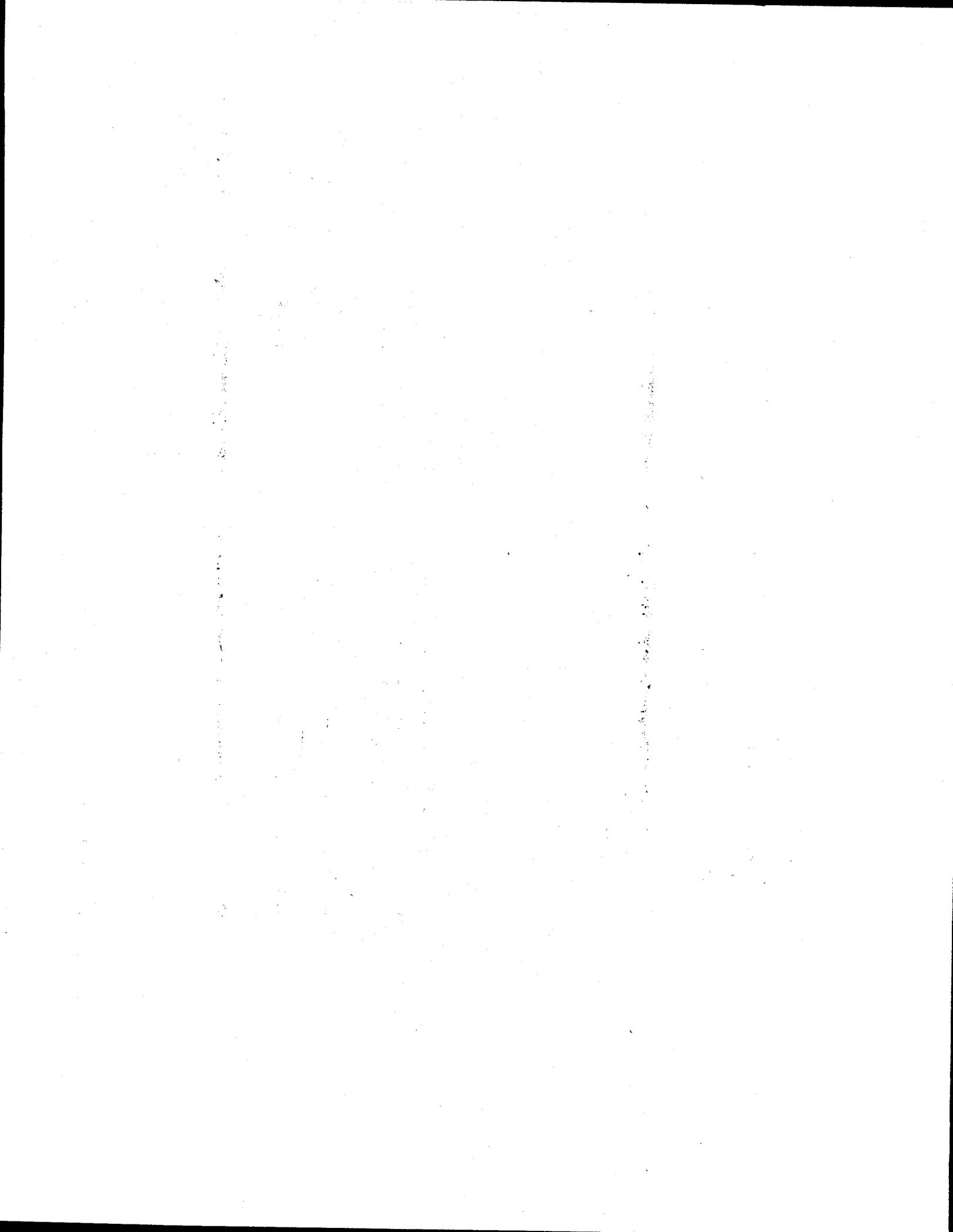
March 1996

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest National Laboratory
Operated for the U.S. Department of Energy
by Battelle



PNNL-11088



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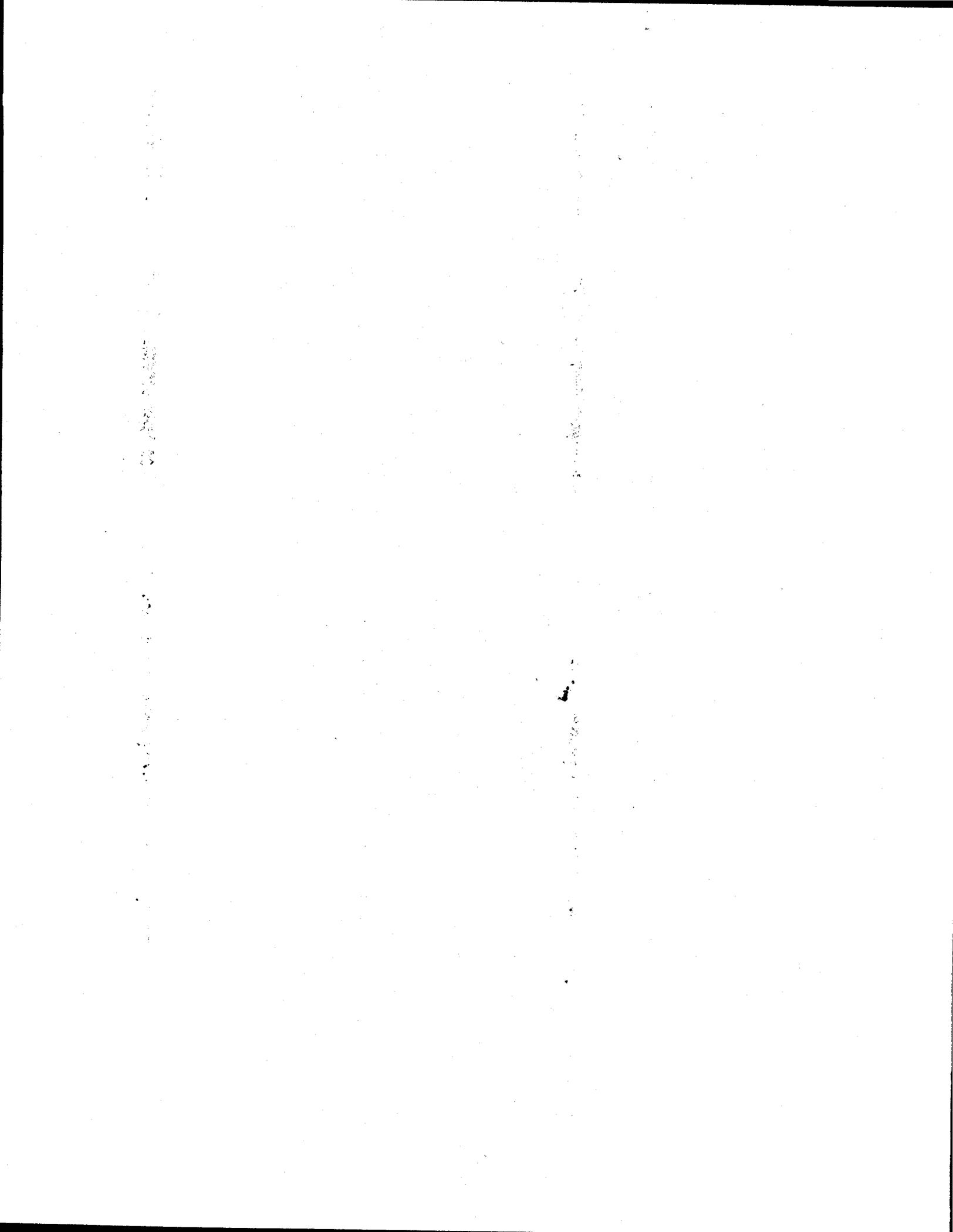
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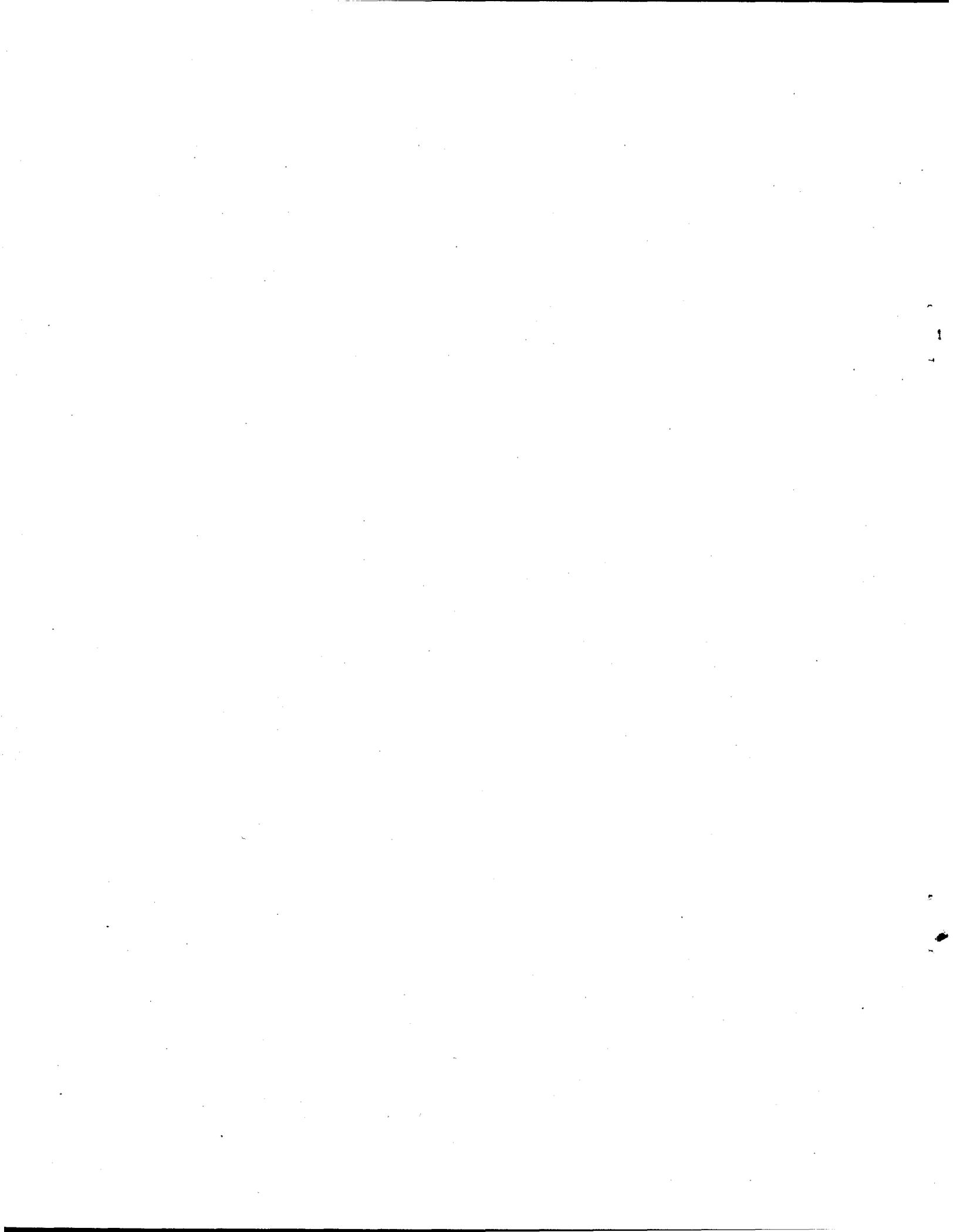
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Pacific Northwest National Laboratory
Richland, Washington 99352

MASTER



Summary

In January 1993, Pacific Northwest National Laboratory (PNNL) established an area monitoring dosimeter program in accordance with Article 514 of the Department of Energy (DOE) Radiological Control Manual (RCM)(DOE 1994). The purpose of the program was to minimize the number of areas requiring issuance of personnel dosimeters and to demonstrate that doses outside Radiological Buffer Areas are negligible. Article 511.1a of the RCM requires issuance of personnel dosimeters if individuals are likely to receive a dose of at least 100 mrem annually.

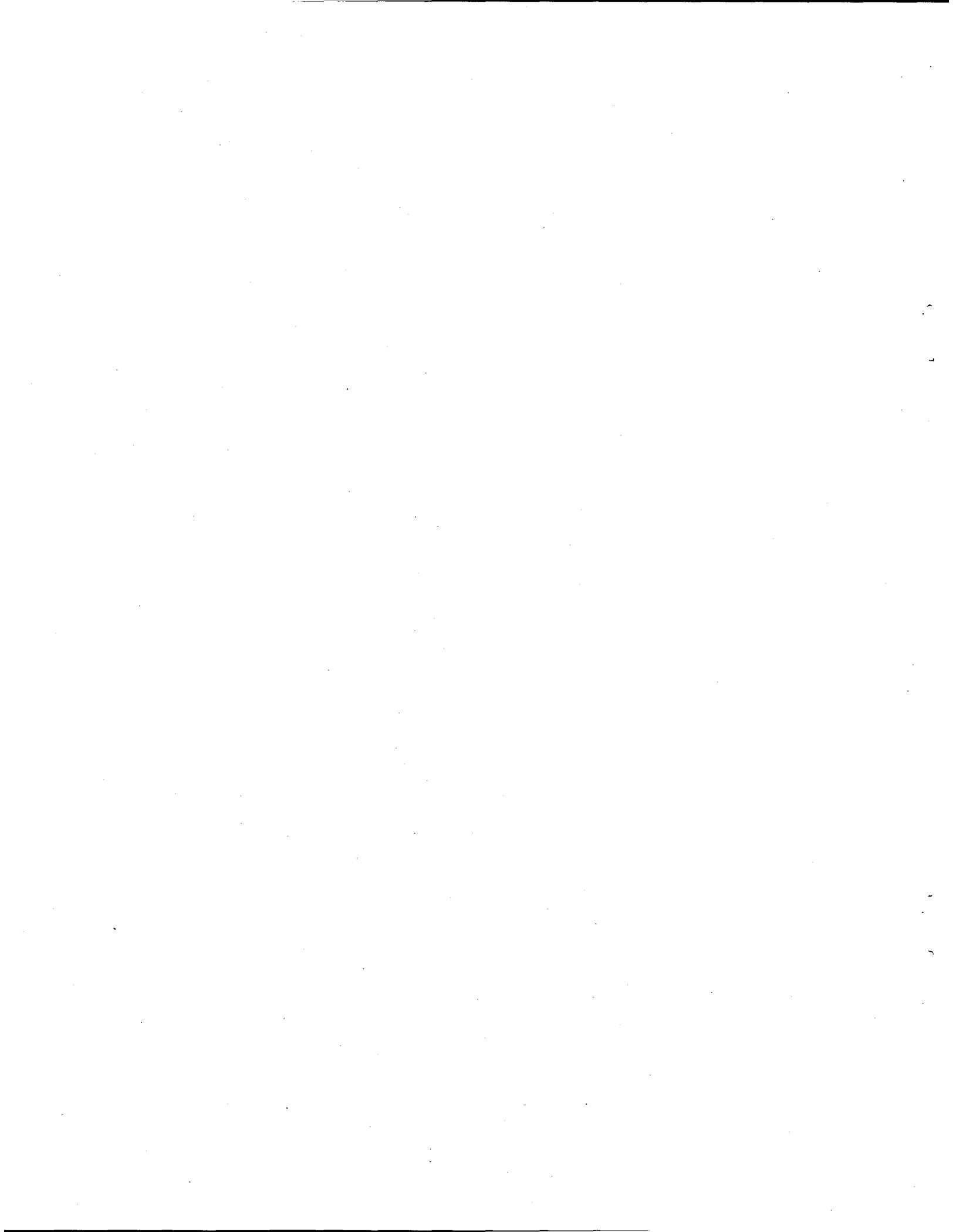
Area thermoluminescent dosimeters (TLDs) were placed in PNNL facilities in accordance with the following guidelines:

- in all 300 Area PNNL facilities where staff work at least eight hours per month
- in all PNNL facilities where staff conduct radiological work (i.e., have a current Radiological Work Permit)
- in all PNNL facilities that are located within 15 m (~50 ft) of another facility (including those of other contractors) that contains a radiological area, or an outdoor radiological area.

A total of 115 area TLDs were placed in PNNL facilities during CY 1993, and 118 area TLDs were placed during CY 1994. The TLDs were exchanged and analyzed quarterly with the exception of the second quarter TLDs for CY 1994, which were left in the field for six months through the end of the third quarter.

The area monitoring TLD program was a useful tool in determining exposure trends in work areas located outside of radiological areas. In several situations, the information obtained from this program was used to relocate staff or radioactive material resulting in potential dose reductions for staff.

All routine area monitoring TLD results were less than 50 mrem annually after correcting for worker occupancy. The results support the conclusion that personnel dosimeters are not necessary for staff in these monitored areas.



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1.0 Introduction

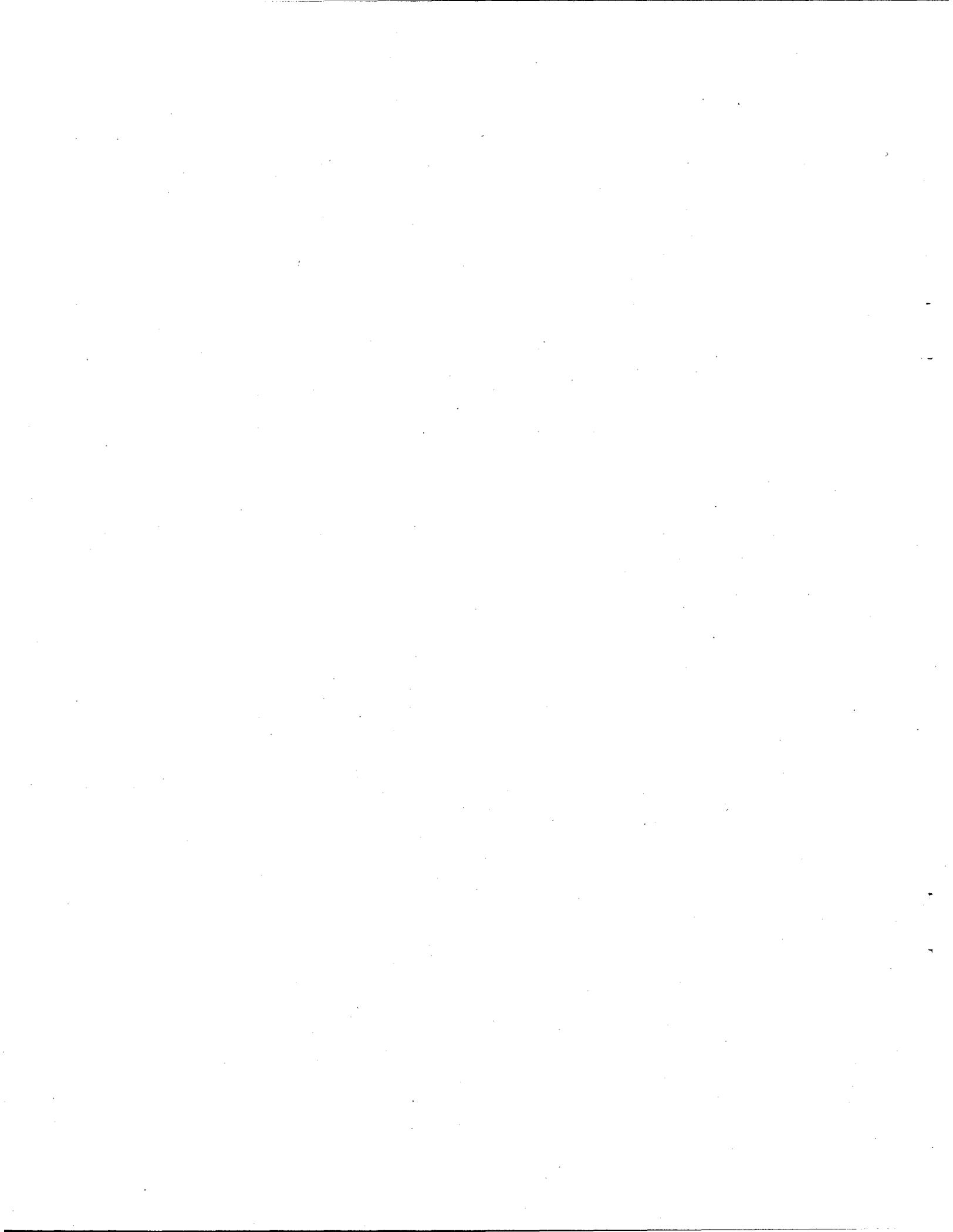
The Department of Energy (DOE) Radiological Control Manual (RCM)(DOE 1994), first issued in 1992, establishes practices for radiological control activities at DOE facilities. Article 514 of the RCM discusses the establishment and maintenance of a comprehensive area dosimeter monitoring program to minimize the number of areas requiring issuance of personnel dosimeters and to demonstrate that doses outside of Radiological Buffer Areas are negligible. As discussed in Article 514, area monitoring dosimeters

- shall be used to record and document radiation levels in routinely occupied areas adjacent to areas where radiation or operations with radiation exist (not applicable when the radiation arises solely from low-energy beta sources such as ^{14}C or ^3H)
- should be used in Radiologically Controlled Areas to supplement existing monitoring programs and to provide data in the event of an emergency
- should be used to support dosimetry investigations where personnel express concern about their work environment and exposure to ionizing radiation.

In January 1993, Pacific Northwest National Laboratory (PNNL)^(a) established an area monitoring thermoluminescent dosimeter (TLD) program in accordance with Article 514 of the RCM. The program was conducted as outlined by Bivins^(b) during calendar years 1993 (CY 1993) and 1994 (CY 1994). The program is now implemented according to RCP-5.1.04, "Area Monitoring TLD Program," issued in PNL-MA-26, *PNL Radiological Control Implementing Procedures*, in November 1995. Data from the program were also used to support the PNNL As Low As Reasonably Achievable (ALARA) program. The materials and methods used in collecting area monitoring TLD data and program results for CY 1993 and CY 1994 are presented in this report.

(a) The Pacific Northwest National Laboratory is operated for the U.S. Department of Energy by Battelle under Contract DE-AC06-76RLO 1830. Battelle also owns and operates private facilities near the Hanford Site.

(b) Bivins, S. R. February 24, 1993. Letter Report to D. P. Higby, "Area Monitoring Dosimeter." Pacific Northwest Laboratory, Richland, Washington.



2.0 Materials and Methods

The Hanford Basic TLD was used as the dosimeter for this program during CY 1993 and CY 1994. The TLD was accredited by the DOE Laboratory Accreditation Program (DOELAP) and consisted of a single TLD-700 chip suspended in a plastic card made of gray Noryl[®] thermoplastic resin through the use of Teflon[®] films. The TLDs were read for deep dose and were corrected for naturally occurring environmental radiation. A brief description of TLD processing, calibration, and the dose algorithm used in determining doses can be found in Appendix A. A more detailed description can be found in PNL-MA-568, *Hanford External Dosimetry Program Manual* (October 1989 issue). PNL-MA-568 was reissued in October 1994. This revision described the area TLDs that were used in the field starting the third quarter of CY 1995.

2.1 Placement of Area TLDs

Area TLDs were placed in the following PNNL facilities whether DOE-owned, DOE-leased, or Battelle private:

- all 300 Area PNNL facilities where staff worked at least eight hours per month
- all PNNL facilities where staff conduct radiological work (i.e., have a current Radiological Work Permit)
- all PNNL facilities that were located within 15 m (~50 ft) of another facility (including those of other Hanford Site contractors) containing a radiological area (indoors or outdoor).

TLDs positioned as discussed above are referred to as "routine" area TLDs in this report. Area TLDs were also positioned in facilities as approved by the Radiological Control organization for special situations such as ALARA evaluations. In this report, these are referred to as "special" area TLDs.

A list of routine and special area TLD locations is included as Appendix B. The number of area TLDs in each facility was determined according to the following criteria:

- at least one area TLD per facility
- one additional area TLD for every 25 staff members for facilities that require area TLDs but do not contain a Radiologically Controlled Area or a radiological area
- one additional area TLD for every 15 staff members for facilities that require area TLDs and contain a Radiologically Controlled Area or a radiological area.

[®] Noryl is a registered trademark of the General Electric Corporation, Selkirk, New York.

[®] Teflon is a registered trademark of E. I. du Pont de Nemours Co., Inc., Wilmington, Delaware.

Additional area TLDs were positioned as determined by the Radiological Control organization.

Each area TLD was positioned facing the potential source of exposure. If the potential source of exposure was from within the facility, then the area TLD was placed on the wall opposite the potential source. If the potential source of exposure was located outside the facility, then the area TLD was placed inside of the exterior wall facing the potential source. The TLDs were placed 1 to 2 m (3 to 6 ft) from the floor, depending on whether staff in the area would be standing or seated.

Each area TLD was identified with an attached bar code label containing a facility ID (e.g., 337 LOC.5) and a TLD identification number beginning with the letter "A" to denote an area TLD followed by a four-digit number (e.g., A3014). When placed in the facility, each TLD was sealed in a plastic bag and put in a plastic dosimeter holder.

2.2 Frequency of Area TLD Exchange

All area TLDs were scheduled to be exchanged and analyzed on a quarterly schedule. During CY 1994, the second quarter TLDs were left in the field through the end of the third quarter. The area monitoring TLD procedure (Bivins 1993) allows for a facility manager to request a special exchange for any TLD in his/her facility. The Radiological Control Manager may also request a special exchange for area TLDs in any facility. Any area TLD changed out was immediately replaced with another area TLD unless the area TLD location was being discontinued.

2.3 Data Review

Any area TLD result greater than 75 mrem in a quarter was investigated. This action level was based on ensuring that an individual would not likely receive greater than 100 mrem annually (the trigger level for requiring personnel monitoring). The investigation level of 75 mrem per quarter was derived by dividing the 100 mrem annual limit by four and adjusting for worker occupancy. The area TLDs were exposed for approximately 8736 hours annually while individual occupancy was assumed to be 2000 hours (8 h/d, 5 d/wk, and 50 wk/yr). Therefore, the occupancy-corrected quarterly limit is as follows:

$$\text{Quarterly limit} = (100 \text{ mrem}/4)(8760 \text{ h}/2000 \text{ h}) = 110 \text{ mrem}$$

The 110-mrem calculated quarterly limit was reduced to 75 mrem to allow for such factors as processing time, processing errors, the potential for individuals being present more than 2000 h annually, and the potential for maximum exposure rates occurring during occupancy hours.

3.0 Results and Discussion

Table 3.1 summarizes area monitoring TLD results for CY 1993 and CY 1994. Quarterly area monitoring TLD results are grouped into dose ranges (i.e., ≤ 10 mrem; > 10 mrem but < 75 mrem; ≥ 75 mrem). None of the quarterly area monitoring TLD results for routine locations exceeded the quarterly investigation level of 75 mrem. The results support the conclusion that personnel dosimeters are not necessary for staff in the areas monitored by the area TLDs.

Table 3.1. Summary of Area Monitoring TLD Results

	CY 1993	CY 1994
Routine Area TLDs		
• Number of Area TLD Locations	115	118
• Total Number of Area TLDs Analyzed	430 ^(a)	354 ^(b)
• Area TLD Results by Dose Range		
- ≤ 10 mrem	409	333
- > 10 mrem but < 75 mrem	21	21
- ≥ 75 mrem ^(c)	0	0
Special Area TLDs		
• Number of Area TLD Locations	1	1
• Total Number of Area TLD Analyzed	2	3
• Area TLD Results by Dose Range		
- ≤ 10 mrem	0	0
- > 10 mrem but < 75 mrem	0	0
- ≥ 75 mrem ^(c)	2	3
<p>(a) The totals do not equal 460 (four times the number of TLD locations) because the 30 locations outside of the 300 Area were initiated in the second quarter of CY 1993.</p> <p>(b) The totals do not equal 472 (four times the number of TLD locations) because the second quarter CY 1994 TLDs were left in the field through the end of the third quarter.</p> <p>(c) The quarterly investigation level was 75 mrem.</p>		

Individual area monitoring TLD results for each quarter as well as annual totals are presented in Appendix C (CY 1993) and Appendix D (CY 1994). The results in Appendices C and D are not corrected for worker occupancy. Assuming workers to be present 2000 h per year, results should be multiplied by 0.23 to correct for worker occupancy.

3.1 Routine Area TLD Results

Quarterly area monitoring TLD results for facilities located outside of the 300 Area (622R, 747A Trl, ESB, LSL-II, PSL, RTL, 1944 Saint, 2400 Stevens, and ALE) were at background levels (0 mrem). The 21 quarterly results for each year in the "> 10 mrem but < 75 mrem" range from Table 3.1 were from locations in the 300 Area. Although results were less than the "75 mrem" investigation level, a review was performed on values at the upper end of this range (≥ 50 mrem) to evaluate trends and the need for repositioning of the area TLDs. The four locations that fell into this range are discussed below (unless noted otherwise, doses are uncorrected for worker occupancy):

- TLD ID# A3007, located in the 3718-B Building, measured exposure from the 340 Building (a Westinghouse Hanford waste storage facility). Total measured doses for CY 1993 and CY 1994 at this location were 130 mrem and 120 mrem, respectively, with a maximum quarterly dose of 50 mrem. Workers were estimated to be in this location only 1% of their work time, and most of their work time was spent in the 3718-A Building. The area TLD located in the 3718-A Building (A3006) measured total doses of only 30 mrem (CY 1993) and 70 mrem (CY 1994).
- TLD ID# A3049, located in the main entrance to the 3730 Building, measured exposure from the ^{60}Co source located in Room 2 of the 3730 Building. Total measured doses for the year at this location were 210 mrem for CY 1993 and 120 mrem for CY 1994 with a maximum quarterly dose of 70 mrem. During CY 1993 and first quarter of CY 1994, the area TLD was located in the hallway directly outside of the ^{60}Co exposure room where the workers spent a small fraction of their time. The area TLD location was repositioned the second quarter of CY 1994 to an area more representative of dose received by personnel assigned to the facility. In the new location, the total dose for the last three quarters of CY 1994 was only 40 mrem.
- TLD ID# A3070, located in the 327 Building front office, measured exposure from the canyon area. Total measured doses for CY 1993 and CY 1994 were 70 mrem and 130 mrem, respectively. The area TLD for the first quarter of CY 1994 had a reading of 50 mrem. Since clerical staff occupied this room full-time during their work day (i.e., ~ 2000 h/yr), the recommendation was made to make this location a Radiological Buffer Area. This would require any occupants to wear personnel dosimeters.
- TLD ID# A3074 was located in the north-south hallway outside Room 2 of the 329 Building. Total measured doses for CY 1993 and CY 1994 were 30 mrem and 120 mrem, respectively. During CY 1993, modifications were made to laboratories adjacent to the area TLD location. Modifications, completed in early CY 1994, established a radioactive material storage area in Room 2. This storage area was the cause of the increased TLD readings in CY 1994. A recommendation was made to relocate the radioactive material storage area.

3.2 Special Area TLD Results

One special area TLD location was used during CY 1993 and CY 1994. This area TLD was located in Room 504 of the 325 Building and referred to as A3112 during CY 1993 and A3104 during CY 1994. Room 504 is located within the Radiological Buffer Area of the 325 Building. Facility management requested the area TLD in order to evaluate the cause of an elevated personnel dosimeter reading for a worker who had an office in the room. Total measured dose for the last three quarters of CY 1993 was 830 mrem and for the entire CY 1994 was 930 mrem. Corrected for worker occupancy (2000 h/yr), a worker could have received approximately 190 mrem (CY 1993) and 215 mrem (CY 1994). Based on the area TLD results, the worker's office was moved out of Room 504.



4.0 Conclusions

The area monitoring TLD program for CY 1993 and CY 1994 was a useful tool in determining exposure trends in work areas located outside radiological areas. In several situations, the information obtained from this program was used to relocate staff or radioactive material, resulting in potential dose reductions for staff.

All routine area monitoring TLD results were less than 50 mrem annually after correcting for worker occupancy. The results support the conclusion that personnel dosimeters are not necessary for staff in these monitored areas.



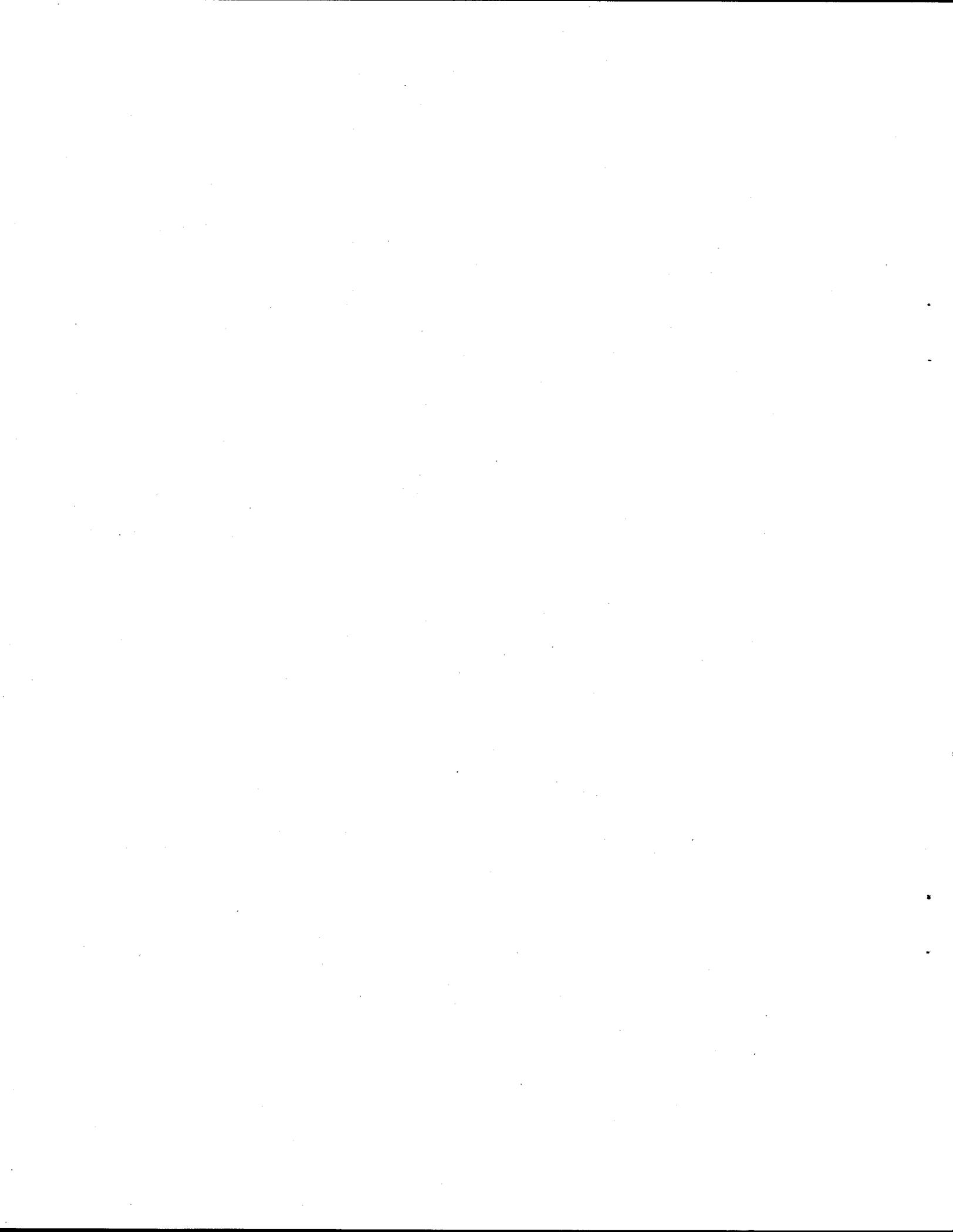
5.0 References

U.S. Department of Energy (DOE). 1994. *Radiological Control Manual*. DOE/EH-0256T, Rev. 1, Washington, D.C.



Appendix A

TLD Processing, Calibration, and Dose Assessment



Appendix A

TLD Processing, Calibration, and Dose Assessment

Processing

Area TLDs were annealed at 80°C for 16 hours before being issued to improve long-term consistency between TLDs. They were cleaned in two ultrasonic cleaning baths before processing to remove oils and mineral deposits that might affect the readout process. After cleaning, TLDs were annealed for 30 minutes at 80°C to ensure that they were dry and to volatilize any residues.

Area TLD processing (readout) was done using the Hanford automated reader system. The system heater was maintained at ~300°C. Glow curves were recorded for all TLDs processed.

Calibration

Area TLDs were calibrated using sources that were traceable to the National Institute of Standards and Technology (NIST). The primary calibration was the deep dose from an on-phantom ¹³⁷Cs exposure.

Dose Assessment

The contribution to the area TLD from naturally occurring environmental radiation was determined using the following equation:

$$\text{ENV.FAC} = \frac{0.18 (1 - e^{-0.00078(Y1)})}{0.00078}$$

where ENV.FAC = environmental dose based on the number of days elapsed between previous and current dosimeter processing

0.18 = the expected dose in mrem/day from environmental radiation in the Hanford environs

Y1 = the number of days between the previous and current TLD processing

0.00078 = a factor to compensate for the fade of the thermoluminescent signal.

The deep dose for area TLDs was calculated as follows:

$$\text{Dose} = \frac{C_o * (R - 2TA) * \text{RSF} * \text{CSF}}{\text{PSF}} - \text{ENV.FAC}$$

where

C_o = the conversion factor for converting chip response to mrem for area TLD

R = raw chip count before any adjustments

2TA = the average for the basic background control dosimeters

RSF = the reader sensitivity factor

CSF = the chip sensitivity factor for position 1 for the reader

PSF = the position sensitivity factor for position 1 for the reader

ENV.FAC = environmental dose based on the number of days elapsed between previous and current dosimeter processing.

For the area TLDs, the shallow dose is set equal to the deep dose.

Appendix B

Locations of Area Monitoring TLDs



Appendix B

Locations of Area Monitoring TLDs

TLD ID #	BLDG	Location ID #	Description of Location
		Routine TLDs	
A-3000	303-J	LOC. 1	Lunch room, west wall, bulletin board
A-3001	305-B	LOC. 1	Main entrance, hallway, bulletin board
A-3002	3760	TRL. 1	Bulletin board, corridor
A-3003	3760	TRL. 3	Bulletin board, corridor
A-3004	350	LOC. 1	Bulletin board in copy area
A-3005	350	LOC. 2	Inside Room 156
A-3006	3718-A	LOC. 1	Main office
A-3007	3718-B	LOC. 1	Above phone on north wall
A-3008	3731-A	LOC. 1	Bulletin board in lunchroom
A-3009	3760	LOC. 1	Lobby
A-3010	3760	LOC. 2	Second floor corridor on bulletin board
A-3011	3760	LOC. 3	Second floor - copying room
A-3012	3762	LOC. 1	First floor near fire extinguisher sign
A-3013	3762	LOC. 2	Second floor in copy room
A-3014	3762	LOC. 3	Bulletin board in Room 214
A-3015	3764	LOC. 1	Main entrance - bulletin board in corridor
A-3016	3764	LOC. 2	Second floor - bulletin board at top of stairs
A-3017	306-W	TRL. 2	South end, bulletin board
A-3018	306-W	TRL. 4	South end, bulletin board
A-3019	306-W	TRL. 5	South end, bulletin board
A-3020	306-W	TRL. 6	West hallway
A-3021	318	TRL. 2	Main entrance, bulletin board, corridor
A-3022	318	TRL. 4	Bulletin board on the north wall (main entrance)
A-3023	318	TRL. 5	Bulletin board
A-3024	320	NE TRL	South door
A-3025	320	SE TRL	Northwest bulletin board (Westinghouse)
A-3026	324	TRL. 1	Bulletin board in corridor

TLD ID #	BLDG	Location ID #	Description of Location
A-3027	324	TRL. 2	Bulletin board in corridor
A-3028	326	TRL. 1	Bulletin board, center corridor
A-3029	326	TRL. 2	Bulletin board, center corridor
A-3030	329	TRL. 1	Southwest entrance - north wall
A-3031	329	TRL. 2	Inside of Room 2
A-3032	3765	TRL. 1	Bulletin board in main entrance
A-3033	3765	TRL. 2	Main entrance - bulletin board in corridor
A-3034	306-W	LOC. 1	Main entrance on first bulletin board
A-3035	306-W	LOC. 2	Second floor - bulletin board in Room 223
A-3036	306-W	LOC. 3	Second floor - bulletin board near copy machine
A-3037	314	LOC. 1	Hallway near rear entrance across from Room 5
A-3038	314	LOC. 2	East-west hallway across from Room 17
A-3039	318	LOC. 1	Front lobby
A-3040	318	LOC. 2	Main corridor of second floor
A-3041	318	LOC. 3	Main corridor outside instrument receiving
A-3042	320	LOC. 1	Lobby
A-3043	320	LOC. 2	Down west stairs through south door - Room B62
A-3044	331	LOC. 1	First floor lobby on east wall
A-3045	331	LOC. 2	Second floor hallway on bulletin board outside of Room 25
A-3046	331	LOC. 3	Third floor hallway on bulletin board outside of Room 66
A-3047	3720	LOC. 1	North and south corridor across from Room 221
A-3048	3720	LOC. 2	Bulletin board in lunchroom
A-3049	3730	LOC. 1	Main entrance, bulletin board, east wall
A-3050	3745	LOC. 1	Counting Laboratory bulletin board
A-3051	3745-A	LOC. 1	Bulletin board on west wall
A-3052	3745-B	LOC. 1	Bulletin board in main entrance
A-3053	3746	LOC. 1	Last office on left as one enters (Room 3)
A-3054	3746-A	LOC. 1	Main corridor outside of Room 14
A-3055	3708	LOC. 1	Corridor
A-3056	324	LOC. 1	Bulletin board outside of lunchroom
A-3057	324	LOC. 2	Second floor, in corridor outside of Room 218
A-3058	324	LOC. 3	Second floor, in corridor outside of Room 208
A-3059	324	LOC. 4	Second floor, inside of Room 279
A-3060	324	LOC. 5	Inside Room 185
A-3061	325	LOC. 1	Main lobby near north door
A-3062	325	LOC. 2	Mezzanine, Room 5, pipe above north door

TLD ID #	BLDG	Location ID #	Description of Location
A-3063	325	LOC. 3	Second floor by elevator
A-3064	326	LOC. 1	Lobby
A-3065	326	LOC. 2	First floor - in front of exit door to basement
A-3066	326	LOC. 3	First floor - in corridor across from Room 48-B
A-3067	326	LOC. 4	Second floor - lunchroom bulletin board
A-3068	326	LOC. 5	Second floor - corridor near Room 40-C
A-3069	327	LOC. 1	Lobby
A-3070	327	LOC. 2	Secretary's office
A-3071	329	LOC. 1	Lobby
A-3072	329	LOC. 2	Electrician's office
A-3073	329 (CY 93)	LOC. 3	Northwest hallway bulletin board
	336-1 (CY 94)	LOC. 1	New lobby near fire alarm
A-3074	329	LOC. 4	North-south hallway (Room 2)
A-3075	329	LOC. 5	North-south hallway (Room 5C-1)
A-3076	3760	TRL. 2	Bulletin board - corridor
A-3077	329	TRL. 4	Bulletin board - corridor
A-3078	329	TRL. 5	Bulletin board - corridor
A-3079	329	TRL. 6	Bulletin board - corridor
A-3080	337	LOC. 1	First floor (basement) - south
A-3081	337	LOC. 2	First floor (basement) - north
A-3082	337	LOC. 3	Second floor (south) above drinking fountain
A-3083	337	LOC. 4	Second floor (north) above drinking fountain
A-3084	337	LOC. 5	Third floor (south) on picture board
A-3085	337	LOC. 6	Third floor (north) above drinking fountain
A-3086	622-R	LOC. 1	Corridor by weather station room
A-3087	622-R	LOC. 2	Exit sign in front of men's room
A-3088	747-A	LOC. 1	Bulletin board on west wall by scale
A-3089	747-A	TRL. 1, LOC. 1	Bulletin board by south door
A-3090	747-A	TRL. 1, LOC. 2	South door bulletin board
A-3091	ESB	LOC. 1	Inside of Room 14
A-3092	ESB	LOC. 2	Entry way to Room 31
A-3093	LSL-II	LOC. 1	Lunchroom
A-3094	LSL-II	LOC. 2	Corridor outside of Lab 1404
A-3095	LSL-II	LOC. 3	Lab 1508

TLD ID #	BLDG	Location ID #	Description of Location
A-3096	LSL-II	LOC. 4	Lab 1419
A-3097	LSL-II	LOC. 5	Office 1224
A-3098	LSL-II	LOC. 6	Lab 1335
A-3099	PSL	LOC. 1	Bulletin board in Lab 1607
A-3100	PSL	LOC. 2	Bulletin board in Lab 1508
A-3101	PSL	LOC. 3	East entrance on secretary's desk
A-3102	PSL	LOC. 4	Bulletin board in Lab 1304
A-3103	PSL	LOC. 5	Corridor outside of Lab 315
A-3105	RTL	LOC. 1	Lab 428
A-3106	RTL	LOC. 2	Lab 328
A-3107	RTL	LOC. 3	Lab 218
A-3108	RTL	LOC. 4	Outside of Lab 132
A-3109	RTL	LOC. 5	Canteen above fire extinguisher
A-3110	RTL	LOC. 6	Bulletin board in Room 21-A
A-3111	SAINT	LOC. 1	High-bay near analytical scale
A-3113	2400	LOC. 1	Secretary's desk located in main entrance
A-3114	2400	LOC. 2	Bulletin board in entry way to Room 1414
A-3115	2400	LOC. 3	High-bay bulletin board in entry to Lab 1445
A-3116	2400	LOC. 4	Second floor on bulletin board outside of Room 2428
A-3117	ALE	LOC. 1	Room 109
A-3118	ALE	LOC. 2	Lunchroom
A-3119	3718-G	LOC. 1	North wall of warehouse office
		Special	
A-3112 (CY 93)	325	LOC. 4	Room 504
A-3014 (CY 94)			

Appendix C

Area Monitoring TLD Results for CY 1993



Appendix C
Area Monitoring TLD Results for CY 1993^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual	
		Deep Dose (mrem)									
		RoutineArea TLDs									
A3000	303J LOC.1	40	0	0	0	0	0	0	0	0	40
A3001	305B LOC.1	30	0	0	0	0	0	0	0	0	30
A3002	3760 TRL.1	10	0	0	0	0	0	0	0	0	10
A3003	3760 TRL.3	10	0	0	0	0	0	0	0	0	10
A3004	350 LOC.1	10	0	0	0	0	0	0	0	0	10
A3005	350 LOC.2	0	0	0	0	0	0	0	0	0	0
A3006	3718A LOC.1	20	10	10	0	0	0	0	0	0	30
A3007	3718B LOC.1	50	30	30	30	30	30	20	20	130	130
A3008	3731A LOC.1	10	0	0	0	0	0	0	0	0	10
A3009	3760 LOC.1	0	0	0	0	0	0	0	0	0	0
A3010	3760 LOC.2	0	0	0	0	0	0	0	0	0	0
A3011	3760 LOC.3	0	0	0	0	0	0	0	0	0	0
A3012	3762 LOC.1	0	0	0	0	0	0	0	0	0	0
A3013	3762 LOC.2	20	10	10	10	0	0	0	0	0	30
A3014	3762 LOC.3	20	20	20	20	0	0	20	20	60	60
A3015	3764 LOC.1	0	0	0	0	0	0	0	0	0	0
A3016	3764 LOC.2	0	0	0	0	0	0	0	0	0	0
A3017	306W TRL.2	10	0	0	0	0	0	0	0	0	10
A3018	306W TRL.4	10	0	0	0	0	0	0	0	0	10
A3019	306W TRL.5	20	10	10	10	10	10	0	0	40	40
A3020	306W TRL.6	10	0	0	0	0	0	0	0	0	10
A3021	318 TRL.2	0	0	0	0	0	0	0	0	0	0
A3022	318 TRL.4	0	0	0	0	0	0	0	0	0	0
A3023	318 TRL.5	10	0	0	0	0	0	0	0	0	10
A3024	320 NE.TRL	0	0	0	0	0	0	0	0	0	0
A3025	320 SE.TRL	0	0	0	0	0	0	0	0	0	0
A3026	324 TRL.1	0	0	0	0	0	0	0	0	0	0
A3027	324 TRL.2	0	0	0	0	0	0	0	0	0	0
A3028	326 TRL.1	20	0	0	0	0	0	0	0	0	20
A3029	326 TRL.2	0	0	0	0	0	0	0	0	0	0
A3030	329 TRL.1	0	0	0	0	0	0	0	0	0	0
A3031	329 TRL.2	0	0	0	0	0	0	0	0	0	0
A3032	3765 TRL.1	0	0	0	0	0	0	0	0	0	0
A3033	3765 TRL.2	10	0	0	0	0	0	0	0	0	10

Appendix C
Area Monitoring TLD Results for CY 1993^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual Deep Dose (mrem)
		Deep Dose (mrem)		Deep Dose (mrem)		Deep Dose (mrem)		Deep Dose (mrem)		
A3034	306W LOC.1	10		0		0		0		10
A3035	306W LOC.2	10		0		0		0		10
A3036	306W LOC.3	10		0		0		0		10
A3037	314 LOC.1	10		0		0		0		10
A3038	314 LOC.2	10		0		0		0		10
A3039	318 LOC.1	0		0		0		0		0
A3040	318 LOC.2	0		0		0		0		0
A3041	318 LOC.3	0		0		0		0		0
A3042	320 LOC.1	0		0		0		0		0
A3043	320 LOC.2	10		0		0		0		10
A3044	331 LOC.1	0		0		0		0		0
A3045	331 LOC.2	0		0		0		0		0
A3046	331 LOC.3	0		0		0		0		0
A3047	3720 LOC.1	0		0		0		0		0
A3048	3720 LOC.2	0		0		0		0		0
A3049	3730 LOC.1	50		40		60		30		30
A3050	3745 LOC.1	0		0		0		0		0
A3051	3745A LOC.1	10		0		0		0		10
A3052	3745B LOC.1	0		0		0		0		0
A3053	3746 LOC.1	0		0		0		0		0
A3054	3746A LOC.1	10		0		0		0		10
A3055	3708 LOC.1	10		0		0		0		10
A3056	324 LOC.1	0		0		0		0		0
A3057	324 LOC.2	0		0		0		0		0
A3058	324 LOC.3	10		0		0		0		10
A3059	324 LOC.4	0		0		0		0		0
A3060	324 LOC.5	0		0		0		0		0
A3061	325 LOC.1	0		0		0		0		0
A3062	325 LOC.2	10		0		10		10		30
A3063	325 LOC.3	0		0		0		0		0
A3064	326 LOC.1	10		0		0		0		10
A3065	326 LOC.2	10		0		0		0		10
A3066	326 LOC.3	0		0		0		0		0
A3068	326 LOC.5	0		0		0		0		0
A3069	327 LOC.1	10		0		0		0		10

Appendix C
Area Monitoring TLD Results for CY 1993^(a)

TLD ID#	TLD Location	1st Quarter				2nd Quarter				3rd Quarter				4th Quarter				Annual	
		Deep Dose (mrem)																	
A3070	327 LOC.2	30				10				0				0				30	70
A3071	329 LOC.1	0				0				0				0				0	0
A3072	329 LOC.2	0				0				0				0				0	0
A3073	329 LOC.3	10				0				0				0				10	10
A3074	329 LOC.4	10				0				0				0			20	30	30
A3075	329 LOC.5	0				0				0				0			0	0	0
A3076	3760 TRL.2	0				0				0				0			0	0	0
A3077	329 TRL.4	0				0				0				0			0	0	0
A3078	329 TRL.5	0				0				0				0			0	0	0
A3079	329 TRL.6	0				0				0				0			0	0	0
A3080	337 LOC.1	10				0				0				0			0	10	10
A3081	337 LOC.2	10				0				0				0			0	10	10
A3082	337 LOC.3	10				0				0				0			0	10	10
A3083	337 LOC.4	10				0				0				0			0	10	10
A3084	337 LOC.5	10				0				0				0			0	10	10
A3085	337 LOC.6	10				0				0				0			0	10	10
A3086	622R LOC.1	(b)				0				0				0			0	0	0
A3087	622R LOC.2	(b)				0				0				0			0	0	0
A3088	747A LOC.1	(b)				0				0				0			0	0	0
A3089	747A Tr LOC.1	(b)				0				0				0			0	0	0
A3090	747A Tr LOC.2	(b)				0				0				0			0	0	0
A3091	ESB LOC.1	(b)				0				0				0			0	0	0
A3092	ESB LOC.2	(b)				0				0				0			0	0	0
A3093	LSL-II LOC.1	(b)				0				0				0			0	0	0
A3094	LSL-II LOC.2	(b)				0				0				0			0	0	0
A3095	LSL-II LOC.3	(b)				0				0				0			0	0	0
A3096	LSL-II LOC.4	(b)				0				0				0			0	0	0
A3097	LSL-II LOC.5	(b)				0				0				0			0	0	0
A3098	LSL-II LOC.6	(b)				0				0				0			0	0	0
A3099	PSL LOC.1	(b)				0				0				0			0	0	0
A3100	PSL LOC.2	(b)				0				0				0			0	0	0
A3101	PSL LOC.3	(b)				0				0				0			0	0	0
A3102	PSL LOC.4	(b)				0				0				0			0	0	0
A3103	PSL LOC.5	(b)				0				0				0			0	0	0
A3105	RTL LOC.1	(b)				0				0				0			0	0	0

Appendix C
Area Monitoring TLD Results for CY 1993^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual			
		Deep Dose (mrem)	(b)	Deep Dose (mrem)	0								
A3106	RTL LOC.2	(b)		0		0		0		0		0	
A3107	RTL LOC.3	(b)		0		0		0		0		0	
A3108	RTL LOC.4	(b)		0		0		0		0		0	
A3109	RTL LOC.5	(b)		0		0		0		0		0	
A3110	RTL LOC.6	(b)		0		0		0		0		0	
A3111	Saint LOC.1	(b)		0		0		0		0		0	
A3113	2400 LOC.1	(b)		0		0		0		0		0	
A3114	2400 LOC.2	(b)		0		0		0		0		0	
A3115	2400 LOC.3	(b)		0		0		0		0		0	
A3116	2400 LOC.4	(b)		0		0		0		0		0	
Special Area TLDs													
A3112 ^(c)	325 LOC.4	(d)		(d)		340		490		830			
(a) Multiply area TLD results by 0.23 to obtain dose estimate corrected for worker occupancy.													
(b) Not initiated until second quarter of CY 1993.													
(c) During CY 1994, the area TLD at 325 LOC. 4 was designated as A3104.													
(d) Not initiated until third quarter of CY 1993.													

Appendix D

Area Monitoring TLD Results for CY 1994



Appendix D
Area Monitoring TLD Results for CY 1994^(a)

TLD ID#	TLD Location	Routine Area TLDs			
		1st Quarter Deep Dose (mrem)	2nd/3rd Quarters Deep Dose (mrem)	4th Quarters Deep Dose (mrem)	Annual Deep Dose (mrem)
A3000	303J LOC.1	0	0	0	0
A3001	305B LOC.1	0	0	0	0
A3002	3760 TRL.1	0	0	0	0
A3003	3760 TRL.3	0	0	0	0
A3004	350 LOC.1	0	0	0	0
A3005	350 LOC.2	0	0	0	0
A3006	3718A LOC.1	20	30	20	70
A3007	3718B LOC.1	40	50	30	120
A3008	3731A LOC.1	(b)	40	0	40
A3009	3760 LOC.1	0	0	0	0
A3010	3760 LOC.2	0	0	0	0
A3011	3760 LOC.3	0	0	0	0
A3012	3762 LOC.1	0	0	0	0
A3013	3762 LOC.2	0	0	0	0
A3014	3762 LOC.3	20	20	0	40
A3015	3764 LOC.1	0	0	0	0
A3016	3764 LOC.2	0	0	0	0
A3017	306W TRL.2	0	0	0	0
A3018	306W TRL.4	0	0	0	0
A3019	306W TRL.5	0	0	0	0
A3020	306W TRL.6	0	0	0	0
A3021	318 TRL.2	0	0	0	0
A3022	318 TRL.4	0	0	0	0
A3023	318 TRL.5	0	0	0	0
A3024	320 NE.TRL	0	0	0	0
A3025	320 SE.TRL	0	0	0	0
A3026	324 TRL.1	0	0	0	0
A3027	324 TRL.2	0	0	0	0
A3028	326 TRL.1	0	0	0	0
A3029	326 TRL.2	0	0	0	0
A3030	329 TRL.1	0	0	0	0
A3031	329 TRL.2	0	0	0	0
A3032	3765 TRL.1	0	0	0	0

Appendix D
Area Monitoring TLD Results for CY 1994^(a)

TLD ID#	TLD Location	1st Quarter	2nd/3rd Quarters		4th Quarters		Annual	
		Deep Dose (mrem)						
A3033	3765 TRL.2	0	0	0	0	0	0	
A3034	306W LOC.1	0	0	0	0	0	0	
A3035	306W LOC.2	0	0	0	0	0	0	
A3036	306W LOC.3	0	0	0	0	0	0	
A3037	314 LOC.1	0	0	0	0	0	0	
A3038	314 LOC.2	0	0	0	0	0	0	
A3039	318 LOC.1	0	0	0	0	0	0	
A3040	318 LOC.2	0	0	0	0	0	0	
A3041	318 LOC.3	0	0	0	0	0	0	
A3042	320 LOC.1	0	0	0	0	0	0	
A3043	320 LOC.2	0	0	0	0	0	0	
A3044	331 LOC.1	0	0	0	0	0	0	
A3045	331 LOC.2	0	0	0	0	0	0	
A3046	331 LOC.3	0	0	0	0	0	0	
A3047	3720 LOC.1	0	0	0	0	0	0	
A3048	3720 LOC.2	30	60	30	120	120	120	
A3049	3730 LOC.1	70	40	0	110	110	110	
A3050	3745 LOC.1	0	0	0	0	0	0	
A3051	3745A LOC.1	0	0	0	0	0	0	
A3052	3745B LOC.1	0	0	0	0	0	0	
A3053	3746 LOC.1	0	0	0	0	0	0	
A3054	3746A LOC.1	0	0	0	0	0	0	
A3055	3708 LOC.1	0	0	0	0	0	0	
A3056	324 LOC.1	0	0	0	0	0	0	
A3057	324 LOC.2	0	0	0	0	0	0	
A3058	324 LOC.3	0	0	0	0	0	0	
A3059	324 LOC.4	0	0	0	0	0	0	
A3060	324 LOC.5	0	0	0	0	0	0	
A3061	325 LOC.1	0	0	0	0	0	0	
A3062	325 LOC.2	0	20	0	20	20	20	
A3063	325 LOC.3	0	0	0	0	0	0	
A3064	326 LOC.1	0	0	0	0	0	0	
A3065	326 LOC.2	0	0	0	0	0	0	
A3066	326 LOC.3	0	0	0	0	0	0	
A3068	326 LOC.5	0	0	0	0	0	0	

Appendix D
Area Monitoring TLD Results for CY 1994^(a)

TLD ID#	TLD Location	1st Quarter		2nd/3rd Quarters		4th Quarters		Annual	
		Deep Dose (mrem)	0						
A3069	327 LOC.1	0		0		0		0	
A3070	327 LOC.2	50		50		30		130	
A3071	329 LOC.1	0		0		0		0	
A3072	329 LOC.2	0		0		0		0	
A3073 ^(c)	336-1 LOC.1	0		0		0		0	
A3074	329 LOC.4	20		50		50		120	
A3075	329 LOC.5	0		0		0		0	
A3076	3760 TRL.2	0		0		0		0	
A3077	329 TRL.4	0		0		0		0	
A3078	329 TRL.5	0		0		0		0	
A3079	329 TRL.6	0		0		0		0	
A3080	337 LOC.1	0		0		0		0	
A3081	337 LOC.2	0		0		0		0	
A3082	337 LOC.3	0		0		0		0	
A3083	337 LOC.4	0		0		0		0	
A3084	337 LOC.5	0		0		0		0	
A3085	337 LOC.6	0		0		0		0	
A3086	622R LOC.1	0		0		0		0	
A3087	622R LOC.2	0		0		0		0	
A3088	747A LOC.1	0		0		0		0	
A3089	747A Th LOC.1	0		0		0		0	
A3090	747A Th LOC.2	0		0		0		0	
A3091	ESB LOC.1	0		0		0		0	
A3092	ESB LOC.2	0		0		0		0	
A3093	LSL-II LOC.1	0		0		0		0	
A3094	LSL-II LOC.2	0		0		0		0	
A3095	LSL-II LOC.3	0		0		0		0	
A3096	LSL-II LOC.4	0		0		0		0	
A3097	LSL-II LOC.5	0		0		0		0	
A3098	LSL-II LOC.6	0		0		0		0	
A3099	PSL LOC.1	0		0		0		0	
A3100	PSL LOC.2	0		0		0		0	
A3101	PSL LOC.3	0		0		0		0	
A3102	PSL LOC.4	0		0		0		0	
A3103	PSL LOC.5	0		0		0		0	

Appendix D
Area Monitoring TLD Results for CY 1994^(a)

TLD ID#	TLD Location	1st Quarter		2nd/3rd Quarters		4th Quarters		Annual	
		Deep Dose (mrem)	0	Deep Dose (mrem)	0	Deep Dose (mrem)	0	Deep Dose (mrem)	0
A3105	RTL LOC.1	0	0	0	0	0	0	0	0
A3106	RTL LOC.2	0	0	0	0	0	0	0	0
A3107	RTL LOC.3	0	0	0	0	0	0	0	0
A3108	RTL LOC.4	0	0	0	0	0	0	0	0
A3109	RTL LOC.5	0	0	0	0	0	0	0	0
A3110	RTL LOC.6	0	0	0	0	0	0	0	0
A3111	Saint LOC.1	0	0	0	0	0	0	0	0
A3113	2400 LOC.1	0	0	c	0	0	0	0	0
A3114	2400 LOC.2	0	0	0	0	0	0	0	0
A3115	2400 LOC.3	0	0	0	0	0	0	0	0
A3116	2400 LOC.4	0	0	0	0	0	0	0	0
A3117	ALE LOC.1	0	0	0	0	0	0	0	0
A3118	ALE LOC.2	0	0	0	0	0	0	0	0
A3119	3718-G	(d)	(d)	(d)	(d)	40	40	40	40
SPECIAL AREA TLDs									
A3104 ^(e)	325 LOC.4	490	260	180	930				
<p>(a) Multiply area TLD results by 0.23 to obtain dose estimates corrected for worker occupancy.</p> <p>(b) Dosimeter was lost.</p> <p>(c) 329 LOC. 3 was identified as A3073 during CY 93, discontinued in CY 94, and designator was assigned to 336-1 LOC.1</p> <p>(d) Not initiated until 4th quarter of CY 94.</p> <p>(e) During CY 93, A3104 was referred to as A3112.</p>									

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