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Area Monitoring Dosimeter Program for the Pacific Northwest National Laboratory: Results for CY 1997

S. R. Bivins
G. A. Stoetzel

July 1998

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Prepared for the U.S. Department of Energy
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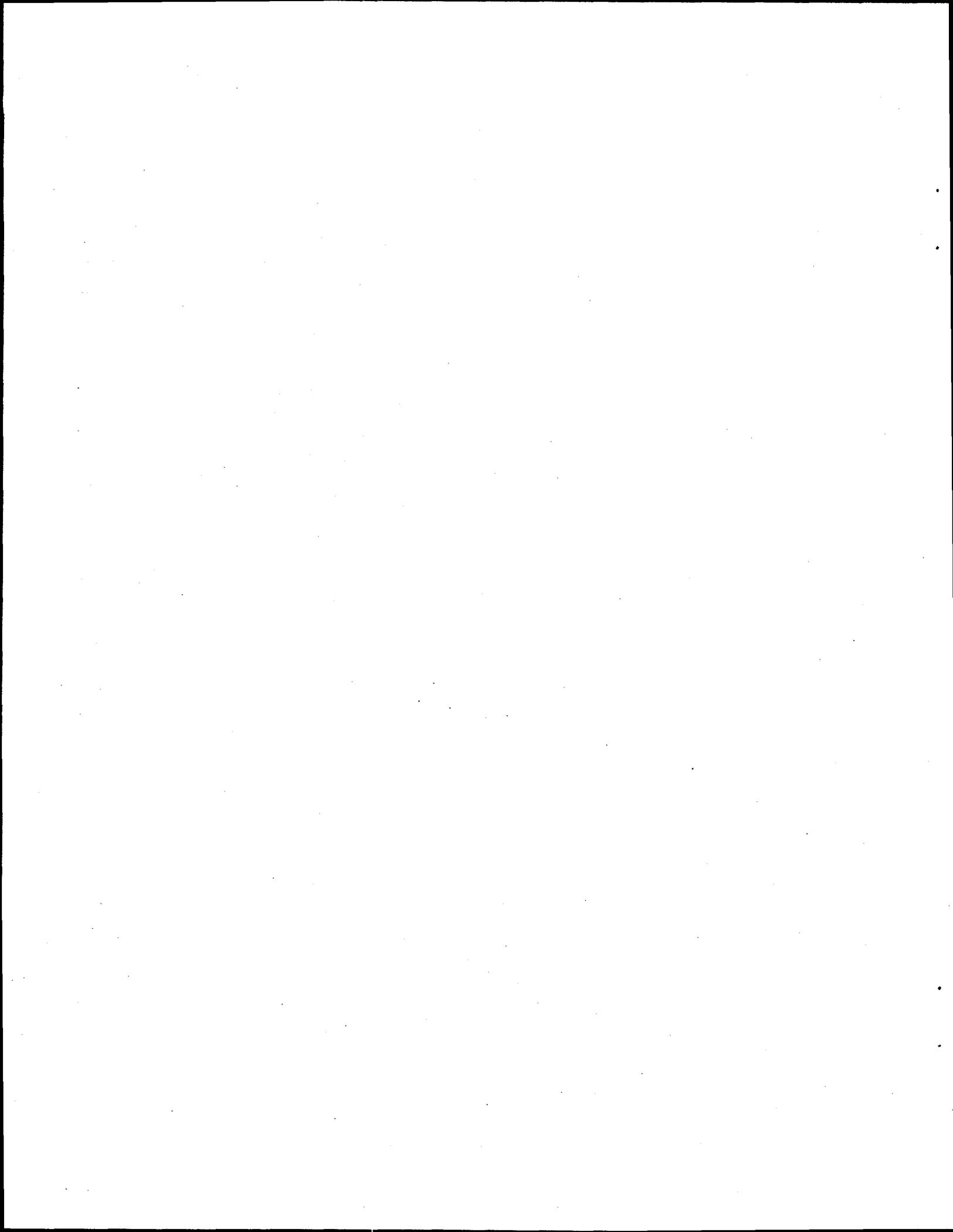
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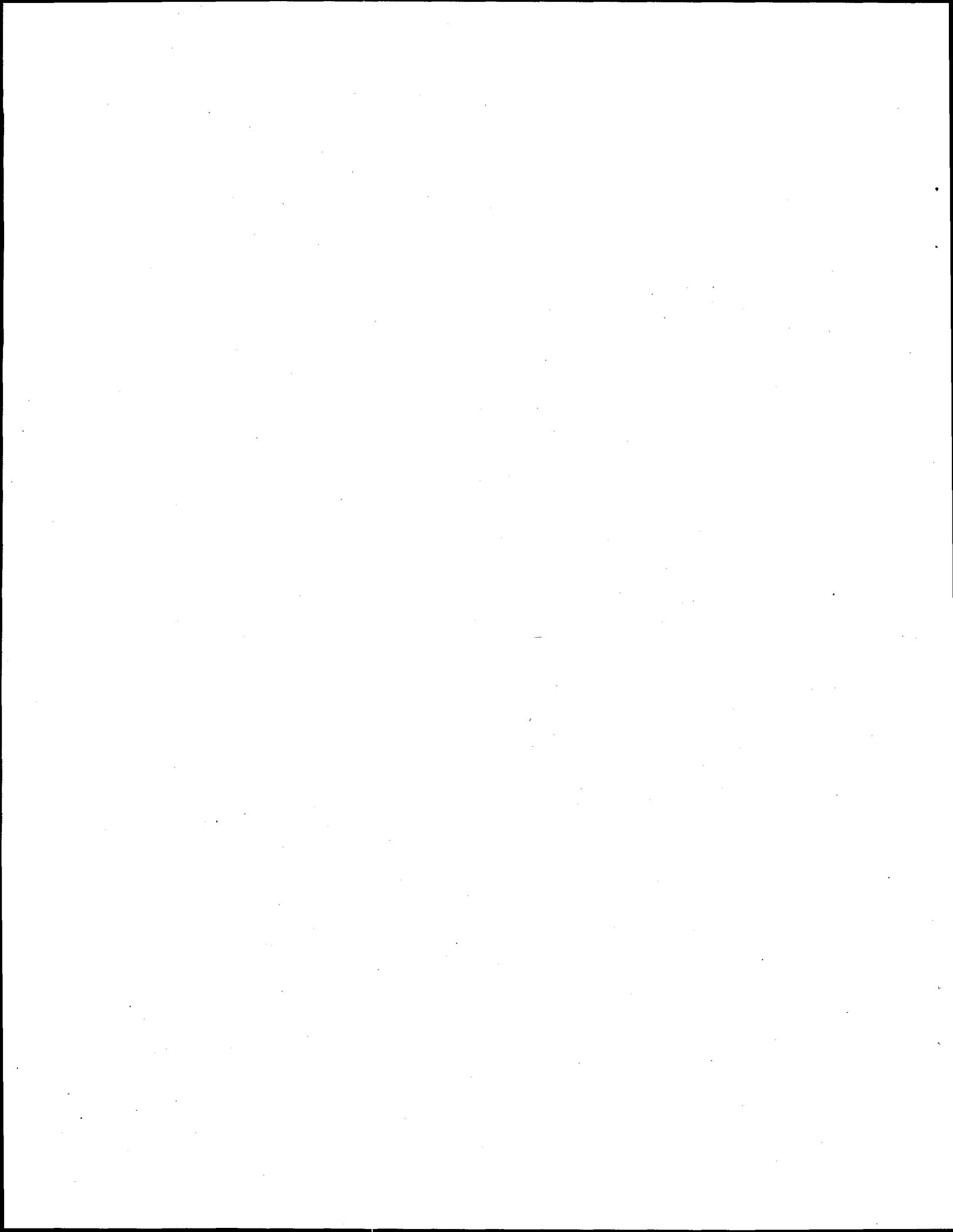
Pacific Northwest National Laboratory
Richland, Washington 99352



Summary

In January 1993, Pacific Northwest National Laboratory (PNNL) established an area monitoring dosimeter program in accordance with Article 514 of the U.S. Department of Energy (DOE) Radiological Control Manual (RCM). 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. In accordance with 10 CFR Part 835.402 (a) (1)-(3) and Article 511.1 of the RCM, personnel dosimetry shall be provided to 1) radiological workers who are likely to receive at least 100 mrem annually, and 2) declared pregnant workers, minors, and members of the public who are likely to receive at least 50 mrem annually. Program results for calendar years (CY) 1993-1996 confirmed that personnel dosimetry was not needed for individuals located in areas monitored by the program.

A total of 93 area thermoluminescent dosimeters (TLDs) were placed in PNNL facilities during CY 1997. The TLDs were exchanged and analyzed quarterly. 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, declared pregnant workers, minors, or members of the public in these monitored areas.



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1.0 Introduction

The U.S. 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. This program will also help demonstrate compliance with 10 CFR Part 835.401(a)(3), 401(b), 402(a)(3), and 1003(b). 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 (CY) 1993 and 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*. Program results for CY 1993/1994, CY 1995, and CY 1996 are found in Bivins and Stoetzel (1996a), Bivins and Stoetzel (1996b), and Bivins and Stoetzel (1997), respectively. 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 1997 are presented in this report.

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- (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 entitled "Area Monitoring Dosimeter." Pacific Northwest National Laboratory, Richland, Washington.

2.0 Materials and Methods

This section provides information on the type of TLDs used in the program, how they were located in the field, and frequency of exchange. Derivation of the investigation level, which triggers an evaluation into the potential cause of a reading, is also provided.

2.1 Description of Area TLDs

The Hanford Standard Dosimeter was used as the dosimeter for this program during CY 1997. This TLD has also been accredited by the DOE Laboratory Accreditation Program (DOELAP) and is known commercially as a Harshaw 8825 dosimeter. The TLD contains TLD-700 chips in positions one, two, and three and a TLD-600 chip in position four. The chips have thicknesses of 0.38 mm (100 mg/cm²) in positions one, two, and four, and 0.15 mm (40 mg/cm²) in position three. The TLD holder is constructed of black plastic with the following filtration:

- 1) position one - 1000 mg/cm² acrylonitrilebutadienestyrene (ABS) plastic and Teflon®.
- 2) position two - 242 mg/cm² ABS plastic and 91 mg/cm² copper
- 3) position 3 - 8 mg/cm² Teflon® and 9 mg/cm² mylar
- 4) position four - 240 mg/cm² ABS plastic and 463 mg/cm² tin.

The area TLDs were read for shallow dose, deep dose, neutron dose, and eye dose. Only deep dose readings are discussed in this report. A brief description of TLD processing, calibration, and the dose algorithm used in determining doses is included in Appendix A. A more detailed description of the TLD and processing system can be found in PNL-MA-568, *Hanford External Dosimetry Project Manual* (October 1996 issue).

2.2 Placement of Area TLDs

Area TLDs were placed in the following PNNL facilities (DOE-owned, DOE-leased, and Battelle private):

- all 300 Area PNNL facilities where staff worked at least eight hours per month
- all PNNL facilities where staff conducted radiological work (i.e., had 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 outdoors).

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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.

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).

2.3 Frequency of Area TLD Exchange

All area TLDs were scheduled to be exchanged and analyzed quarterly. The area monitoring TLD procedure allows for a facility manager to request a special exchange for any TLD in his/her facility. The Safety & Health 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.

2.4 Data Review

Any area TLD result greater than or equal to 40 mrem in a quarter was investigated. This action level was established to ensure that an individual would not likely receive greater than 50 mrem annually (the trigger level for requiring personnel dosimetry for declared pregnant workers,

minors, and members of the public). The investigation level of 40 mrem per quarter was derived by dividing the 50 mrem annual limit by four and adjusting for worker occupancy. The area TLDs were exposed for approximately 8760 h annually; individual occupancy was assumed to be 2000 h (8 h/d, 5 d/wk, and 50 wk/yr). Therefore, the occupancy-corrected quarterly limit is as follows:

$$\text{Quarterly limit} = (50 \text{ mrem}/4)(8760 \text{ h}/2000 \text{ h}) = 55 \text{ mrem}$$

The 55-mrem calculated quarterly limit was reduced to 40 mrem to allow for such factors as processing time, processing errors, the potential for individuals to be present more than 2000 h annually, and the potential for maximum exposure rates occurring during occupancy hours.

2.5 Quality Assurance and Quality Control

The Hanford External Dosimetry Project (HEDP) performed the measurements of the area TLDs. The HEDP laboratory is DOELAP accredited. Quality assurance and quality control programs are conducted in accordance with Section 5 of PNL-MA-568 and Section 3 of PNL-MA-842, *Hanford External Dosimetry Project Technical Basis Manual* (October 1996 issue).

3.0 Results and Discussion

Table 3.1 summarizes area monitoring TLD results for CY 1997. Quarterly area monitoring TLD results are grouped into dose ranges (i.e., ≤ 10 mrem; >10 mrem but <40 mrem; ≥ 40 mrem). In three locations, quarterly area monitoring TLD results for routine locations exceeded the quarterly investigation level of 40 mrem; however, none of these locations had potential personnel exposures of 50 mrem after considering worker occupancy. 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 1997

Routine Area TLDs	Quantity
• Number of Area TLD Locations	93
• Total Number of Area TLDs Analyzed ^(a)	350
• Area TLD Results by Dose Range	
≤ 10 mrem	328
>10 mrem but <40 mrem	16
≥ 40 mrem ^(b)	6
Special Area TLDs	
• Number of Area TLD Locations	10
• Total Number of Area TLDs Analyzed ^(c)	20
• Area TLD Results by Dose Range	
≤ 10 mrem	18
>10 mrem but < 40 mrem	1
≥ 40 mrem ^(b)	1
<p>(a) The total does not equal 372 (four times the number of TLD locations) because locations were started and terminated at various times throughout the year, and several samples were lost.</p> <p>(b) The quarterly investigation level was 40 mrem.</p> <p>(c) The total does not equal 40 (four times the number of TLD locations) because locations were started and terminated at various times throughout the year.</p>	

Individual area monitoring TLD results for each quarter as well as annual totals are presented in Appendix C. The results in Appendix C are not corrected for worker occupancy. Assuming workers to be present 2000 h/yr, 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, 747A Trl, ESB, LSL-II, PSL, RTL, 2400 Stevens, ROB, and EMSL) were ≤ 10 mrem. The three locations with quarterly results greater than or equal to the 40 mrem "investigation level" were located in the 300 Area. Reviews were conducted on these locations and results are summarized below.

- TLD ID# A3048 was located on the lunch room bulletin board in 3720 Building. The total measured deep dose for CY 1993 was 30 mrem, for CY 1994 was 120 mrem, for CY 1995 was 180, and for CY 1996 was 146 mrem. Total measured deep dose for CY 1997 was 486 mrem or about three times the dose for CY 1996. The higher dose was due to additional radioactive materials being added to the shielded glovebox in a laboratory across the hall from the lunchroom. The TLD was located on the wall closest the glovebox. An investigation conducted by the cognizant Radiological Control Technician (RCT) Supervisor showed readings of ~ 50 $\mu\text{R/h}$ on contact with the wall. Readings quickly returned to background levels several inches from the wall; therefore, there was no exposure concern to staff in the lunchroom. Currently, radioactive materials are being removed from this glovebox as the researchers are relocating the work. The projected dose to staff in the lunchroom is less than the 50 mrem annual dose requiring personnel dosimetry for a declared pregnant worker, a minor, or a member of the public.
- TLD ID# A3062 was located in Room 5 of the mezzanine of 325 Building near the pipe above the north door. The total measured deep dose for CY 1993-CY 1996 ranged from 20-58 mrem. Total measured deep dose for CY 1997 increased to 108 mrem. This represents an upward trend from the previous years but is still less than the 50 mrem annual dose requiring personnel dosimetry for a declared pregnant worker, a minor, or a member of the public when corrected for worker occupancy.
- TLD ID# A3157 was located in the basement on the bulletin board in Room 14A of 326 Building since the first quarter of CY 1996. Total measured deep dose for CY-1996 was 108 mrem and for CY 1997 was 60 mrem (with 50 mrem received during the first quarter). When corrected for worker occupancy, doses are projected at 14 mrem below the 50 mrem annual dose requiring personnel dosimetry for a declared pregnant worker, a minor, or a member of the public. The first quarter reading of 50 mrem appears to be an outlier as the remaining quarters were 0 or 10 mrem.

3.2 Special Area TLD Results

A total of 10 special area TLD locations were identified for CY 1997. These special locations were requested by line management or Radiological Control to better define radiological conditions in the workplace for ALARA considerations. Special area TLD results are provided in Appendix C.

4.0 Conclusions

The area monitoring TLD program for CY 1997 was a useful tool in determining exposure trends in work areas located outside radiological areas. 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 required for staff in these monitored areas.

5.0 References

Bivins, S. R. and G. A. Stoetzel. 1996a. *Area Monitoring Dosimeter Program for the Pacific Northwest National Laboratory: Results for CY 1993 and CY 1994*. PNNL-11088, March 1996, Pacific Northwest National Laboratory, Richland, Washington.

Bivins, S. R. and G. A. Stoetzel. 1996b. *Area Monitoring Dosimeter Program for the Pacific Northwest National Laboratory: Results for CY 1995*. PNNL-11185, May 1996, Pacific Northwest National Laboratory, Richland, Washington.

Bivins, S. R. and G. A. Stoetzel. 1997. *Area Monitoring Dosimeter Program for the Pacific Northwest National Laboratory: Results for CY 1996*. PNNL-11594, June 1997, Pacific Northwest National Laboratory, Richland, Washington.

PNL-MA-26, *PNNL Radiological Control Implementing Procedures*, March 1998.

PNL-MA-568, *Hanford External Dosimetry Project Manual*, October 1996.

PNL-MA-842, *Hanford External Dosimetry Project Technical Basis Manual*, October 1996.

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

Appendix A

Hanford Standard TLD - Processing, Calibration, and Dose Assessment

Appendix A

Hanford Standard TLD - Processing, Calibration, and Dose Assessment

Processing

Harshaw 8800 series automated reader systems were used to process the area TLDs. Automated processing steps included the following:

- Pre-issue reader annealings, in which each dosimeter card is processed through the automated reader systems to remove any remaining residual signal from past occupational exposure or environmental background radiation. Each dosimeter card is annealed at 80°C for 16 h before being issued.
- Reader processing, in which the reader heats all chips simultaneously at a rate of 25°C/s until a maximum temperature of 300°C is obtained.
- Glow-curve recording, in which the glow curve is recorded for all dosimeters and stored for a period of approximately 2 yr.

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:

$$E_i = G_i (FD - BD)$$

where: E_i = estimated environmental background for chip i (⁶⁰Co mR-equivalent)
 G_i = background growth rate (mR/d)
FD = field cycle days (days between previous and current processing date)
BD = blank days (mean days between previous and current processing for blank cards).

The adjusted chip readings are calculated using the following equation:

$$D_i = \frac{X_i - B_i - E_i}{(RRF_i * F_i)}$$

where: D_i = adjusted chip reading for chip i (^{137}C rem-equivalent)
 X_i = calibrated chip reading for chip i (^{60}Co mR-equivalent)
 B_i = mean calibrated chip I reading from blank cards (^{60}Co mR-equivalent)
 E_i = estimated environmental background for chip i (^{60}Co mR-equivalent)
 RRF_i = ^{137}Cs relative response factor (RRF) for chip i (mR/rem)
 F_i = fade factor for chip i.

Area TLD readings were provided for shallow dose, deep dose, neutron dose, and eye dose. Only deep dose results were included for discussion in this report.

Quality Control Program

Quality assurance and quality control programs are conducted in accordance with Section 5 of PNL-MA-568 and Section 3 of PNL-MA-842.

Appendix B

Locations of Area Monitoring TLDs

Appendix B

Locations of Area Monitoring TLDs

TLD ID #	BLDG	Location ID #	Description of Location
		Routine TLDs	
A3001	305-B	LOC. 1	Main entrance, hallway, bulletin board
A3004	350	LOC. 1	Bulletin board in Room 137
A3005	350	LOC. 2	Inside Room 156
A3006	3718-A	LOC. 1	Main office
A3007	3718-B	LOC. 1	Above phone on north wall
A3009	3760	LOC. 1	Lobby
A3010	3760	LOC. 2	Second floor Room 215 (SE cubicle)
A3011	3760	LOC. 3	Second floor - copy room
A3022	318	TRL. 4	Bulletin board on the north wall (main entrance)
A3032	3765	TRL. 1	Bulletin board in main entrance
A3033	3765	TRL. 2	Main entrance - bulletin board in corridor
A3034	306-W	LOC. 1	Main entrance on first bulletin board
A3035	306-W	LOC. 2	Second floor lunchroom
A3036	306-W	LOC. 3	First floor - Rm 131
A3039	318	LOC. 1	Front lobby
A3040	318	LOC. 2	Main corridor of second floor
A3041	318	LOC. 3	Main corridor outside instrument receiving
A3042	320	LOC. 1	Lobby
A3043	320	LOC. 2	Down west stairs through south door - Room B62
A3044	331	LOC. 1	First floor lobby on east wall
A3045	331	LOC. 2	Second floor hallway on bulletin board outside of Room 25
A3046	331	LOC. 3	Third floor - Room 45
A3047	3720	LOC. 1	North and south corridor across from Room 221
A3048	3720	LOC. 2	Bulletin board in lunchroom
A3049	3730	LOC. 1	Desk area near computers
A3050	3745	LOC. 1	Counting Laboratory bulletin board
A3061	325	LOC. 1	Main lobby near north door
A3062	325	LOC. 2	Mezzanine, Room 5, pipe above north door

TLD ID #	BLDG	Location ID #	Description of Location
A3063	325	LOC. 3	Second floor by elevator
A3064	326	LOC. 1	Lobby
A3065	326	LOC. 2	First floor - in front of exit door to basement
A3066	326	LOC. 3	First floor - in corridor across from Room 48-B
A3067	326	LOC. 4	Second floor - lunchroom bulletin board
A3068	326	LOC. 5	Second floor - corridor near Room 40-C
A3071	329	LOC. 1	Lobby
A3072	329	LOC. 2	Electrician's office
A3073	336-1	LOC. 1	New lobby near fire alarm
A3074	329	LOC. 4	North-south hallway (Room 2)
A3075	329	LOC. 5	North-south hallway (Room 6-C)
A3076	3760	TRL. 2	Bulletin board - corridor
A3077	329	TRL. 4	Bulletin board - corridor
A3078	329	TRL. 5	Bulletin board - corridor
A3079	329	TRL. 6	Bulletin board - corridor
A3080	337	LOC. 1	First floor (basement) - south
A3081	337	LOC. 2	First floor (basement) - north
A3082	337	LOC. 3	Second floor (south) above drinking fountain
A3083	337	LOC. 4	Rm 2213
A3084	337	LOC. 5	Third floor (south) on picture board
A3085	337	LOC. 6	Third floor (north) in Mt. Rainier Room
A3086	622-R	LOC. 1	Room 110 by red phone
A3087	622-R	LOC. 2	Exit sign in front of men's room
A3088	747-A	LOC. 1	Bulletin board on west wall by scale
A3089	747-A	TRL. 1, LOC. 1	Bulletin board by south door
A3091	ESB	LOC. 1	Inside of Room 14
A3092	ESB	LOC. 2	Entry way to Room 31
A3093	EMSL	LOC. 1	Accelerator Room (north wall)
A3094	EMSL	LOC. 2	Accelerator Room (east wall)
A3095	EMSL	LOC. 3	Accelerator Room (south wall enclosure)
A3096	EMSL	LOC. 4	Accelerator Room (south wall)
A3097	EMSL	LOC. 5	Accelerator Room (west wall)
A3098	EMSL	LOC. 6	Accelerator Room (control console)
A3099	PSL	LOC. 1	Lab 1611
A3100	PSL	LOC. 2	Bulletin board in Lab 1504
A3101	PSL	LOC. 3	East entrance on secretary's desk

TLD ID #	BLDG	Location ID #	Description of Location
A3102	PSL	LOC. 4	Bulletin board in Lab 1304
A3103	PSL	LOC. 5	Corridor outside of Lab 315
A3105	RTL	LOC. 1	Lab 428
A3106	RTL	LOC. 2	Lab 328
A3107	RTL	LOC. 3	Lab 218
A3108	RTL	LOC. 4	Outside Room 127 Secretary office
A3109	RTL	LOC. 5	Canteen above fire extinguisher
A3110	RTL	LOC. 6	Bulletin board in Room 21-A
A3113	2400	LOC. 1	Secretary's desk located in main entrance
A3114	2400	LOC. 2	Bulletin board in entry way to Room 1414
A3115	2400	LOC. 3	High-bay bulletin board in entry to Lab 1445
A3116	2400	LOC. 4	Second floor on bulletin board outside of Room 2428
A3119	3718-G	LOC. 1	North wall of warehouse office
A3155	337	LOC. 7	Duplicating room
A3156	ROB	LOC. 1	Room 257
A3157	326	LOC. 6	Basement - Room 14A bulletin board
A3167	LSL-II	LOC. 1	Lunchroom
A3168	LSL-II	LOC. 2	Corridor outside of Lab 1404
A3169	LSL-II	LOC. 3	Lab 1508
A3170	LSL-II	LOC. 4	Lab 1419
A3171	LSL-II	LOC. 5	Office 1224
A3172	LSL-II	LOC. 6	Lab 1336
A3173	329	LOC. 8	Room 129 (above sink)
A3174	325	LOC. 4	Lunchroom (second floor)
A3175	325	LOC. 5	East equipment room (second floor, east wall by door)
A3176	325	LOC. 6	Copy room (second floor)
A3177	338	LOC. 1	Conference room
A3178	326	LOC. 7	Room 37B (second floor, east wall)
		Special	
A3146	3708	LOC. 1	Special location requested by 3708 line management (Rm 111 SE wall)
A3147	3708	LOC. 2	Special location requested by 3708 line management (Rm 111 SW wall)
A3159	331	LOC. 4	Special location requested by cognizant radiological engineer
A3160	331	LOC. 5	Special location requested by cognizant radiological engineer
A3161	331	LOC. 6	Special location requested by cognizant radiological engineer

TLD ID #	BLDG	Location ID #	Description of Location
A3162	331	LOC. 7	Special location requested by cognizant radiological engineer
A3163	331	LOC. 8	Special location requested by cognizant radiological engineer
A3164	331	LOC. 9	Special location requested by cognizant radiological engineer
A3165	331	LOC. 10	Special location requested by cognizant radiological engineer
A3166	331	LOC. 11	Special location requested by cognizant radiological engineer

Appendix C

Area Monitoring TLD Results for CY 1997

Appendix C
Area Monitoring TLD Results for CY 1997^(a)

TLD ID#	TLD Location	RoutineArea TLDs				Annual Deep Dose (mrem)
		1st Quarter Deep Dose (mrem)	2nd Quarter Deep Dose (mrem)	3rd Quarter Deep Dose (mrem)	4th Quarter Deep Dose (mrem)	
A3001	305B LOC.1	0	0	0	5	5
A3004	350 LOC.1	0	0	0	0	0
A3005	350 LOC.2	0	0	(b)	0	0
A3006	3718A LOC.1	0	0	0	6	6
A3007	3718B LOC.1	0	0	0	6	6
A3009	3760 LOC.1	0	0	0	0	0
A3010	3760 LOC.2	0	0	0	0	0
A3011	3760 LOC.3	0	0	0	0	0
A3022	318 TRL.4	0	0	0	0	0
A3032	3765 TRL.1	0	0	0	(d)	0
A3033	3765 TRL.2	0	0	0	(d)	0
A3034	306W LOC.1	0	0	0	0	0
A3035	306W LOC.2	7	6	8	5	26
A3036	306W LOC.3	28	5	0	7	40
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	0	0	0	0	0
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	49	128	156	153	486
A3049	3730 LOC.1	0	0	0	0	0
A3050	3745 LOC.1	0	0	0	0	0
A3061	325 LOC.1	0	0	0	0	0
A3062	325 LOC.2	0	33	33	42	108
A3063	325 LOC.3	0	13	15	16	44
A3064	326 LOC.1	0	0	0	0	0
A3065	326 LOC.2	0	0	0	0	0
A3066	326 LOC.3	0	0	0	0	0
A3067	326 LOC.4	0	0	0	0	0
A3068	326 LOC.5	0	0	0	0	0

Appendix C
Area Monitoring TLD Results for CY 1997^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual	
		Deep Dose (mrem)									
A3071	329 LOC.1	0	0	0	0	0	0	0	0	0	0
A3072	329 LOC.2	0	0	0	0	0	0	0	0	0	0
A3073	336-1, LOC.1	0	0	0	0	0	0	6	6	6	6
A3074	329 LOC.4	0	0	0	0	0	0	0	0	0	0
A3075	329 LOC.5	(b)	0	0	0	0	0	0	0	0	0
A3076	3760 TRL.2	0	0	0	0	0	0	(d)	0	0	0
A3077	329 TRL.4	0	0	0	0	0	0	0	0	0	0
A3078	329 TRL.5	0	0	0	0	0	0	0	0	0	0
A3079	329 TRL.6	0	0	0	0	0	0	(d)	0	0	0
A3080	337 LOC.1	7	0	0	0	0	0	0	0	7	7
A3081	337 LOC.2	0	0	0	0	0	0	0	0	0	0
A3082	337 LOC.3	0	0	0	0	0	0	0	0	0	0
A3083	337 LOC.4	0	0	0	0	0	0	0	0	0	0
A3084	337 LOC.5	0	0	0	0	0	0	0	0	0	0
A3085	337 LOC.6	0	0	0	0	0	0	6	6	6	6
A3086	622R LOC.1	5	7	7	7	7	7	7	7	26	26
A3087	622R LOC.2	0	0	0	0	0	0	0	0	0	0
A3088	747A LOC.1	0	0	0	0	0	0	0	0	0	0
A3089	747A Tr LOC.1	0	0	0	0	0	0	0	0	0	0
A3091	ESB LOC.1	0	0	0	0	0	0	0	0	0	0
A3092	ESB LOC.2	0	0	0	0	0	0	0	0	0	0
A3093	EMSL LOC.1	(b)	5	5	5	0	0	6	6	11	11
A3094	EMSL LOC.2	(b)	7	7	7	7	7	9	9	23	23
A3095	EMSL LOC.3	(b)	6	6	6	8	8	8	8	22	22
A3096	EMSL LOC.4	(b)	6	6	6	5	5	6	6	17	17
A3097	EMSL LOC.5	(b)	6	6	6	5	5	7	7	18	18
A3098	EMSL LOC.6	(b)	0	0	0	0	0	0	0	0	0
A3099	PSL LOC.1	0	0	0	0	0	0	0	0	0	0
A3100	PSL LOC.2	0	0	0	0	0	0	0	0	0	0
A3101	PSL LOC.3	0	0	0	0	0	0	0	0	0	0
A3102	PSL LOC.4	0	0	0	0	0	0	0	0	0	0
A3103	PSL LOC.5	0	0	0	0	0	0	0	0	0	0
A3105	RTL LOC.1	0	0	0	0	6	6	7	7	13	13
A3106	RTL LOC.2	6	6	6	6	7	7	6	6	25	25
A3107	RTL LOC.3	0	0	5	5	6	6	6	6	17	17

Appendix C
Area Monitoring TLD Results for CY 1997^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual	
		Deep Dose (mrem)									
A3108	RTL LOC.4	0	0	0	6	6	6	6	6	12	12
A3109	RTL LOC.5	0	0	0	0	0	0	0	0	0	0
A3110	RTL LOC.6	0	0	0	0	0	0	0	0	0	0
A3113	2400 LOC.1	0	0	0	0	0	0	0	0	0	0
A3114	2400 LOC.2	0	0	0	0	0	0	0	0	0	0
A3115	2400 LOC.3	0	0	0	0	0	0	0	0	0	0
A3116	2400 LOC.4	0	0	0	0	0	0	0	0	0	0
A3119	3718-G	12	12	12	0	0	0	(d)	0	24	24
A3155	337, LOC. 7	0	0	0	6	6	6	6	6	12	12
A3156	ROB, LOC.1	0	0	0	0	0	0	0	0	0	0
A3157	326, LOC. 6	50	10	10	0	0	0	0	0	60	60
A3158	3745, LOC. 2	0	0	0	0	0	0	0	0	0	0
A3167	LSL-II LOC.1	0	0	0	0	0	0	0	0	0	0
A3168	LSL-II LOC.2	0	0	0	0	0	0	0	0	0	0
A3169	LSL-II LOC.3	6	0	0	0	0	0	6	6	12	12
A3170	LSL-II LOC.4	0	0	0	0	0	0	5	5	5	5
A3171	LSL-II LOC.5	6	0	0	0	0	0	7	7	13	13
A3172	LSL-II LOC.6	0	5	5	0	0	0	6	6	11	11
A3173	329, LOC. 8	9	15	15	22	22	22	25	25	71	71
A3174	325, LOC.4	(c)	0	0	0	0	0	0	0	0	0
A3175	325, LOC.5	(c)	19	19	38	38	38	23	23	80	80
A3176	325, LOC.6	(c)	9	9	7	7	7	13	13	29	29
A3177	338, LOC.1	(c)	(c)	(c)	0	0	0	(b)	(b)	0	0
A3178	326, LOC. 7	(c)	(c)	(c)	(c)	(c)	(c)	23	23	23	23
Special Area TLDs											
A3146	3708, LOC.1	36	(b)	(b)	0	0	0	(d)	(d)	36	36
A3147	3708, LOC.2	189	(b)	(b)	0	0	0	(d)	(d)	189	189
A3159	331, LOC.4	8	8	8	(d)	(d)	(d)	(d)	(d)	16	16
A3160	331, LOC.5	8	7	7	(d)	(d)	(d)	(d)	(d)	15	15
A3161	331, LOC.6	8	8	8	(d)	(d)	(d)	(d)	(d)	16	16
A3162	331, LOC.7	9	9	9	(d)	(d)	(d)	(d)	(d)	18	18
A3163	331, LOC.8	5	0	0	(d)	(d)	(d)	(d)	(d)	5	5
A3164	331, LOC.9	7	0	0	(d)	(d)	(d)	(d)	(d)	7	7
A3165	331, LOC.10	9	8	8	(d)	(d)	(d)	(d)	(d)	17	17

Appendix C
Area Monitoring TLD Results for CY 1997^(a)

TLD ID#	TLD Location	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual	
		Deep Dose (mrem)	7	Deep Dose (mrem)	9	Deep Dose (mrem)	(d)	Deep Dose (mrem)	(d)	Deep Dose (mrem)	16
A3166	331, LOC.11										
(a) - Multiply area TLD result by 0.23 to obtain dose estimates corrected for worker occupancy.											
(b) - Area TLD lost.											
(c) - Sample location not initiated yet.											
(d) - Sample location discontinued											

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