MASTER

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CIVIL EFFECTS STUDY

EXPERIMENTAL RADIATION MEASUREMENTS
IN CONVENTIONAL STRUCTURES

Part I

RADIATION MEASUREMENTS IN TWO
TWO-STORY AND THREE ONE-STORY
TYPICAL RESIDENTIAL STRUCTURES
BEFORE AND AFTER MODIFICATION

Z. G. Burson

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**CIVIL EFFECTS TEST OPERATIONS
U.S. ATOMIC ENERGY COMMISSION**

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RADIATION MEASUREMENTS IN TWO TWO-STORY AND THREE ONE-STORY TYPICAL RESIDENTIAL STRUCTURES BEFORE AND AFTER MODIFICATION

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ABSTRACT

An experimental study designed to provide a basis for estimating protection against fallout radiation was performed on two two-story structures with basements and on three one-story structures without basements. These structures, located at the Nevada Test Site, were studied before and after modifications. This study, sponsored by the Civil Effects Branch, Division of Biology and Medicine, U. S. Atomic Energy Commission, added data to the nuclear energy civil effects research on radiation shielding provided by structures.

An idealized fallout-radiation field was simulated with the use of the Mobile Radiological Measuring Unit. This unit used a sealed radioactive ^{60}Co source that was pumped at a uniform speed through a long length of flexible tubing evenly distributed over the area of interest. Radiation levels at selected points inside the structures were measured with sensitive ionization-chamber detectors.

These experiments were conducted simultaneously with an architectural-engineering study to develop and demonstrate practical means of improving fallout-radiation protection by economical modifications of existing typical houses. Experimental data were gathered at each house before and after shelters were constructed or modified. The effects of various practical modifications of the existent structures, such as adding transite panels to the walls, building planters, or adding baffle walls, were also considered.

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Chapter 1

INTRODUCTION

1.1 BACKGROUND

Certain portions of existing structures provide greater or lesser degrees of protection from fallout radiation than other portions. Before an existing structure is designated or used as a shelter, it is desirable to locate the area of greatest protection, to estimate the degree of this protection and, if necessary, to suggest means of improving the protection at an acceptable cost. Theoretical calculations provide estimates of the protection in existing structures. However, the calculations become difficult and intricate when consideration is given to different shielding materials, internal rooms and equipment, ground contours, and complicated shielding geometry. These effects may alter to a large extent the prediction of the degree of protection in a given structure.

Recognizing the need for specific information concerning the protection provided by a given structure, the Civil Effects Test Operations (CETO), Division of Biology and Medicine, U. S. Atomic Energy Commission, has developed experimental methods for measuring this protection. A series of field tests has been conducted to help evaluate the fallout-radiation protection offered by conventional structures ranging from underground shelters to residential homes and large office buildings.¹⁻⁷

The measurements and results contained in this report are a part of this series. The experiments were conducted simultaneously with an architectural-engineering study to determine modifications necessary to achieve an arbitrarily established degree of protection in two-story houses with basements and in one-story houses without basements.

Five houses located in Area 1 at the Nevada Test Site were selected for these tests. These houses, which were constructed in 1955 for use in Operation Teapot, included:

1. One-story reinforced-masonry-block (RMB) house without basement.
2. One-story precast concrete (PCC) house without basement.
3. One-story wood rambler (WR) house without basement.
4. Two-story brick (2SB) house with basement.
5. Two-story wood frame (2SWF) house with basement.

In general, experimental data were gathered at each house before and after shelters were constructed or modified. The effects of various practical

modifications of the existent structures, such as adding transite panels to the walls, building planters, or adding baffle walls, were also considered.

1.2 OBJECTIVE

The general objective of this project was to develop and demonstrate practical means of improving fallout-radiation protection by economical modification of existing-typical houses. More specifically, shelters were built (or modified) within each house. In the one-story structures, these shelters were designed to provide a protection factor of 100 at a point 3 ft above the floor (in the center) against fallout radiation. Measurements were made to confirm these designs.

Specific measurements obtained at each structure are discussed in the following section and in Chap. 4.

1.3 DESCRIPTION OF STRUCTURES

The following paragraphs describe briefly each of the structures studied in these investigations. Appendix C presents details of the modifications involved. Additional descriptions and photographs can be found in Ref. 1 and 8.

As shown in the photographs accompanying this section, a circular area approximately 260 ft in diameter was cleared and leveled around each of the houses before measurements were undertaken.

1.3.1 Reinforced-masonry-block House

The RMB house was constructed of expanded shale-aggregate masonry blocks, forming walls and partitions 8 in. thick. The partitions, as well as walls, were reinforced with vertical steel rods anchored to the floor and to the 6-in. precast lightweight-concrete roof slabs. The walls were also reinforced with horizontal steel rods at two levels. Outside dimensions of the house were 29 ft 4 in. by 27 ft 4 in., exclusive of the 2-ft overhang of the flat roof. Modification of this basic structure consisted in the construction of filled masonry-block walls inside the house. Transite (119 lb/cu ft) was placed on certain walls, and a 7-in.-thick concrete slab was laid over a portion of the roof to form an aboveground fallout shelter. The wall outside the bathroom was raised to the middle of the window (5 ft 8 in. above floor level) before measurements were made; this wall was subsequently raised to ceiling level, and a second set of measurements was taken. Floor plans of the structure are presented in Fig. 1.1. Figures 1.2 and 1.3 are photographs of the RMB house.

1.3.2 Precast Concrete House

The PCC house was constructed of precast, lightweight (98 lb/cu ft), expanded shale-aggregate concrete walls 6 in. thick. Partition panels erected on a concrete floor slab were also 6 in. thick. The roof was made of similar 6-in. panels. Exclusive of the 2-ft overhang of the roof, the outside dimensions were 40 by 27-1/2 ft. As a modification, 6-, 8-, and 12-in.-thick concrete-filled masonry-block walls were installed at various positions, and a 6-in.-thick concrete slab was laid over a portion of the roof. For the first series of measurements, the 8-in.-thick wall on the outside of the bathroom was

raised only to the midpoint of the bathroom window. For the second set of measurements, the wall was completed to the ceiling. Floor plans of this structure appear in Fig. 1.4. Figures 1.5 to 1.7 are photographs of the PCC house.

1.3.3 Wood Frame Rambler House

The outside dimensions of the WR house, a conventional one-story wood frame rambler, were 40 ft by 25 ft 4 in. This house had previously been modified to the extent that the bathroom walls, floor, and ceiling were of 8-in. -thick reinforced concrete (Fig. 1.8). The first additional modification consisted of the addition of 8-in. -thick concrete-filled masonry-block walls around the bathroom and an 8-in-thick concrete slab over its roof to increase the radiation protection afforded by the resulting aboveground shelter (Fig. 1.9). A second additional modification consisted in covering certain walls with 2-in. -thick transite having a density 119 lbs/cu ft (Fig. 1.10). The final modification consisted in the addition of a corner planter (Fig. 1.11). Measurements were taken before the masonry-block walls were added and after each modification. The WR house is shown in Figs. 1.12 and 1.13. Strings hanging from the ceiling in Fig. 1.13 indicate detector position locations.

1.3.4 Two-story Brick House

The walls of the 2SB house were constructed of 4-in. -thick brick. The basement foundation walls were masonry block, whereas the floors, partitions, and roof were wooden. The basic structure was, in general, conventional and similar to the two-story wood frame house except that the internal walls of the 2SB house were covered with heavy plasterboard. The roof had been so severely damaged during Operation Teapot that roof measurements were judged inexpedient. Two brick shelters and one wooden shelter had been constructed in the basement for previous experiments. The two brick shelters were standard Office of Civil and Defense (OCD) concrete-block fallout shelters. Measurements were made in the basement with these structures in place (Fig. 1.14) and again after their removal. The first additional modification consisted in building a new shelter of 8-in. -thick masonry blocks filled with concrete (Fig. 1.15). A plan and elevation view of an OCD basement shelter is shown in Fig. 1.16. After a series of measurements had been made, a short wall was built near the entrance to determine the screening effect it would provide against contamination on the steps and outside. The basement window wells were sand-bagged for all measurements. Photographs of the structure showing inside and outside views are presented in Figs. 1.17 to 1.19.

1.3.5 Two-story Wood Frame House

The 2SWF house was typical of two-story wood frame construction with a reinforced-concrete foundation. Exterior walls contained about 2 in. of wood siding, and interior walls were faced with 3/8-in. plywood. The exterior dimensions of the house were 24 ft 8 in. by 33 ft 4 in. The basement was constructed of 8-in. -thick reinforced-concrete exterior walls. Four shelters had been previously constructed in the basement of this house: (1) a wooden shelter in the northwest corner, (2) an 8-in. -thick

standard OCD concrete-block fallout shelter in the southeast corner, (3) an 8-in. -thick reinforced-concrete wall shelter in the center of the basement, adjacent to the staircase (Fig. 1.20), and (4) a lean-to type wood shelter in the southwest corner. One 8-in. -thick reinforced-concrete wall near the staircase had been erected for structural support during a previous test.

The first modification made during this study was the alteration of the passage leading to the center shelter: 8-in. -thick concrete walls were placed so as to reduce the radiation coming into the shelter through the entrance. The second modification consisted in the addition of an 8-in. -thick concrete wall in front of the door leading outside (Fig. 1.21). Measurements were made after each modification. Photographs of the structure are presented in Figs. 1.22 and 1.23. The lean-to type wood shelter previously built appears in Fig. 1.24. Basement window wells were sandbagged for the measurements at this structure.

Figure 1.25 shows the basement wall construction of the two basements tested (from Ref. 9).

All masonry blocks used in the modifications were hollow blocks made of lightweight concrete. Sample blocks were weighed, and the density of their solid material was estimated at 100 lb/cu ft.

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Fig. 1.1 — Floor plan of modified RMB house.

Fig. 1.2 — RMB house.

Fig. 1.3 — RMB house showing additional 7-in. -thick concrete slab on roof over shelter area.

Fig. 1.4 — Floor plan of modified PCC house.

Fig. 1.5 — Front view of PCC house.

Fig. 1.6 — PCC house showing additional 6-in. -thick concrete slab on roof over shelter area.

Fig. 1.7 — Concrete-filled masonry-block interior partition in PCC house.

Fig. 1.8 — Floor plan of WR house, premodification.

Fig. 1.9 — Floor plan of WR house, postmodification.

Fig. 1.10 — Transite attached to wall of WR house.

Fig. 1.11 — Planter constructed at WR house.

Fig. 1.12 — View of WR house (right), RMB house (center), and PCC house (left).

Fig. 1.13 — Interior view of WR house.

Fig. 1.14 — Basement plan view of 2SB house with old shelters in place.

Fig. 1.15 — Basement plan view of 2SB house, postmodification.

Fig. 1.16 — Plan and elevation of OCD basement shelter.

Fig. 1.17 — 2SB house.

Fig. 1.18 — Basement of 2SB house with original shelters in place.

Fig. 1.19 — Basement of 2SB house showing wooden shelter.

Fig. 1.20 — Basement floor plan of 2SWF house, premodification.

Fig. 1.21 — Basement floor plan of 2SWF house, postmodification.

Fig. 1.22 — 2SWF house.

Fig. 1.23 — Shelter in 2SWF house.

Fig. 1.24 — Lean-to shelter in 2SWF house.

Fig. 1.25 — Wall structure of two basement types tested.

Chapter 2

DESCRIPTION OF EXPERIMENTAL METHOD

2.1 GENERAL DESCRIPTION

The experimental method consisted in simulating a finite, idealized fallout field by pumping a ^{60}Co source through a length of tubing placed around, or on the roof of, the structure being tested and determining the exposure inside by means of appropriately placed ionization chambers.

The source-circulation system used for this project is explained in Appendix A. The same system was used for other experiments of this nature.¹⁻⁵ The system consisted of a remotely controlled hydraulic pumping unit which used water to pump a stainless-steel-encapsulated radioactive source from its shield through the associated tubing and back into the shield. Movable magnetic position indicators attached to the tubing and connected with lights on the control panel were used to locate the source capsule within the tubing.

Since the outside diameter of the source capsule was slightly less than the inside diameter of the tubing, a flow system rather than a pressure-differential system was used. Internal pressures in the neighborhood of 100 psi produced a source velocity of approximately 120 ft/min. From the console in the laboratory truck, situated about 500 ft from the pumping system, the movement of the slug was started, stopped, or reversed. Moreover, a hand pump located 100 ft from the pumping truck provided an emergency mechanism for returning the source capsule to its shield.

For simulation of an area source, the ^{60}Co source capsule was pumped at uniform speed through the tubing that had been distributed with constant spacing over either the roof or the ground adjacent to the building concerned. Measurements were also made with the tubing placed on the circumference of a circle with the center at the middle of the building and radius r (radii of 42.5, 63.7, and 127 ft being somewhat standard). In a few cases several small-radii measurements were made and an integration was performed to evaluate the exposure contribution due to an equivalent area source immediately around the building.

Ionization chambers with ranges of 0 to 10 and 0 to 200 mr were used, depending on the total exposure expected. This in turn was influenced by the length of time that the source was in the tubing and, obviously, by the source activity.

Experiments were also conducted with small point sources set on the basement steps outside the two-story buildings while measurements were made inside. In addition, results were obtained at some of the structures with a single point source of approximately 20 curies.

2.2 SOURCES AND INSTRUMENTATION

The investigations herein described were carried out with ^{60}Co sources. These sources consisted of one 300-curie source, one 200-curie source, one 20-curie source, and fourteen 2-3/4-mc sources. The three large sources were encapsulated in magnetic stainless-steel containers machined to pass through the tubing. Calibrations were performed by pumping a source into position at a height of 10 ft above ground and measuring the exposure rate 10 ft away by National Bureau of Standards calibrated Victoreen condenser r-chambers. Detailed calibration information is presented in Ref. 2. The strength of the source at the time of the measurements is indicated in Table 3.1, the values being obtained from standard decay curves. A photograph and drawing of the 300-curie ^{60}Co source are shown in Appendix A (Fig. A.2).

The instruments used in this experiment include integrating ionization chambers with associated charger-readers. The ionization chambers were of two types: 0- to 200-mr Victoreen model 362 pocket ionization chambers and 0- to 10-mr Victoreen model 239 stray-radiation chambers. Victoreen model 287 minometers were used for charging and reading the ionization chambers. Photographs, calibration, and energy-response curves appear in Appendix A. Tin sleeves were not used with the pocket ionization chambers during this experiment.

2.3 EXPERIMENTAL TECHNIQUE

The technique of this series of measurements consisted in placing the tubing according to a predetermined plan and measuring the total exposure received by the integrating detectors at selected locations within the building while the ^{60}Co source was pumped through the tubing at a constant rate. Since the detectors showed the total exposure, a uniformly contaminated field was simulated by pumping the source so that it spent the same time interval per unit area over the entire area where the tubing was laid. This technique assured that local features of the terrain and building influenced the measured exposure much as they would in an idealized fallout field.

At each location several dosimeters were placed in paper cups attached to string hung either from the ceiling (see Figs. 2.1 and 2.2) or from light aluminum stands. The average reading of all dosimeters placed at one point was taken as the exposure at that point. In general, dosimeters were placed at heights of 1, 3, and 6 ft above the floor. The time of measurement varied from a few minutes to 15 hr.

For estimations of the total contributions from simulated contamination outside a structure, experimental measurements were divided into essentially three parts to obtain estimates of (1) roof contribution, (2) close-in ground contribution, and (3) far-out ground contribution.

Roof contribution was measured by distributing tubing on the roofs of the structures and measuring the radiation levels within (Fig. 2.3). The roof of the 2SB house was damaged too severely for distribution of tubing. An estimation of the roof contribution at this structure was found by using data from the 2SWF house and from data obtained from point sources placed at the center of the roof of both structures. The two structures were geometrically similar and both internal walls and floors were of light, constructed materials.

At most of the structures, close-in ground contribution was measured by distributing the tubing in 4-ft intervals from the structure out to a distance of 50 or 60 ft (Figs. 2.4 and 2.5). At the 2SWF house (premodification), several measurements from ring sources were made and an integration was performed to evaluate the radiation contribution resulting from an equivalent area source immediately around the building.

In evaluation of the far-out contribution (contribution from simulated contamination beyond the close-in measurement area), a ring source at a radius of 127 ft was used. Data from this ring source and theoretical calculations were used to estimate the far-out contribution.

As mentioned in Sec. 1.3, various modifications at some of the structures were evaluated as to their shielding effect on the shelter area. These modifications were evaluated by comparing data from ring sources before and after the modification.

At each of the structures, the following general procedures were observed during a specific exposure:

1. Polyethylene tubing was distributed over the desired area according to a predetermined plan.
2. Dosimeters were charged and positioned while a dummy source capsule was pumped through the tubing to assure that it had not been damaged during placement.
3. After radiological-safety clearance was given, the system was energized and the experimental run was made. At the conclusion of the test, the source was secured in its shield, the dosimeters were read, and the readings were recorded.

In addition to the moving-source measurements, 14 small point sources of approximately 2-3/4 mc each were placed in the basement stairwells of the two-story houses to estimate the exposure which would occur if fallout were present on the stairs.

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Fig. 2.1 — Dosimeter positions near curtain wall of 2SWF house basement.

Fig. 2.2 — Dosimeters placed in paper cups in 2SB house basement.

Fig. 2.3 — View (toward southwest) of source-tube layout on roof of 2SWF house.

Fig. 2.4 — Tubing distribution for area source at 2SB house.

Fig. 2.5 — Tubing distribution for area source at WR house.

Chapter 3

PRESENTATION OF DATA

Because of the volume of data collected and the necessary corrections, normalizations, and calculations to be performed, the data were processed through an IBM digital computer for appropriate output. All normalized data appear in Appendix B, most of which is in machine-output format. A few sample data points are given in this chapter.

Table 3.1 contains a brief description of most of the experiments and exposure parameters at the houses. This information was used to normalize all data.

Tables 3.2 to 3.6 contain samples of some of the data taken at the five houses with various source configurations. Detector positions were plotted on floor plans, which appear in Appendix B.

TABLE 3.1 — INFORMATION USED IN CORRECTING
AND NORMALIZING DATA

Data in table No.	Type run*	Exposure time, hr.**	Average temp., °C	Average pressure, mm Hg	Area sq ft	Circum- ference, ft	Source activity, curies
REINFORCED-MASONRY-BLOCK HOUSE							
Postmodification, Basic							
B. 1	42.5 R	0.234z 0.0875x	7	669		267	289
B. 2	115 R	1.432z 0.714x	11	668		723	289
B. 3	Ground	0.533z 0.179z	3	667	8480		288
B. 4	Roof	0.209z 0.0814z	10	665	923		288
Window Blocked Up							
B. 5	42.5 R	0.233z 0.0875x	8	655		267	288
PRECAST CONCRETE HOUSE							
Post modification, Basic							
B. 6	42.5 R	0.240z 0.0888x, z	5	669		267	288
B. 7	127 R	1.667z 0.784x	7	668		798	288
B. 8	Ground	0.768z 0.197z	10	661	8930		288
B. 9	Roof	0.1835z 0.0903z	16	662	1239		288
Window Blocked Up							
B. 10	42.5 R	0.233z 0.0875x, z	11	655		267	287
WOOD RAMBLER HOUSE							
Premodification							
B. 11	25.5 R	0.0361z 0.265z 0.0361z 0.229z	11 10	666 666		160 160	184 184
B. 12	63.7 R	0.949z 0.239z 0.239z 0.956z	-0.6 10 4	667 667 667		400 400 400	184 184 184
B. 13	127 R	1.012z 4.033z 1.000z 2.467	8 2	667 667		798 798	184 184

TABLE 3.1—(Continued)

Data in table No.	Type run*	Exposure time, hr.**	Average temp., °C	Average pressure, mm hg	Area sq ft	Circum- ference, ft	Source activity, curies
Postmodification, Basic							
B. 14	63.7 R	0.213x, z	12	670		400	292
B. 15	127 R	1.021x, z	12	665		798	292
B. 16	Ground	0.928x, z	10	670	6260		18.2
B. 17	Roof	0.164x, z	8	660	1261		18.2
After Transite							
B. 18	63.7 R	0.272x, z	8	668		400	290
B. 19	Roof	0.250x, z	11	670	1261		18.2
After Planter							
B. 20	63.7 R	0.274x, z	5	668		400	290
B. 21	127 R	1.301x, z	9	658		798	290
TWO-STORY BRICK HOUSE							
Premodification, Old Shelters in Place							
B. 22	25.5 R	0.481x, z	22.5	662		160	208
		1.026z	24.8	661		160	208
		0.513x					
B. 23	42.5 R	2.057z	20.4	664		267	208
		1.031x					
		2.035z	23.8	662		267	208
		1.189x					
Shelters Removed							
B. 24	25.5 R	1.033z	17.6	649		160	207
		0.0985z					
B. 25	42.5 R	2.061z	18.6	645		267	207
		0.160z					
B. 26	63.7 R	0.304x, z	18.4	647		400	207
B. 27	127 R	0.723x, z	12.6	647		798	207
Postmodification, Before Curtain Wall							
B. 28	42.5 R	1.468x, z	9	666		267	294
After Curtain Wall							
B. 29	42.5 R	1.553x, z	9	667		267	293
B. 30	127 R	3.462x	9	672		798	293
		1.000x	9	672		798	293
B. 31	Ground	1.629z	10	672	9906		293
		0.681x	9	668	10,343		293

TABLE 3.1—(Continued)

Data in table No.	Type run*	Exposure time, hr. **	Average temp. °C	Average pressure, mm Hg	Area sq ft	Circum- ference, ft	Source activity, curies
TWO-STORY WOOD FRAME HOUSE							
Premodification							
B. 32	25.5 R	0.264z	15.6	652		160	183
		0.519z					
		0.351z	18.3	649		160	183
		1.493z					
B. 33	29 R	0.482x, z	22.6	660		182	208
		0.0311z					
B. 34	32.5 R	0.839z	21.4	661		203	208
		1.964z					
		0.0503z	25.2	660		203	208
		0.693x	26.5	659		203	208
		0.973z					
		0.503z	25.2	660		203	208
		0.822z	25.8	659		203	208
B. 35	36.6 R	1.064x, z	24.6	659		230	208
		0.0764z					
B. 36	42.5 R	1.229z	24.0	660		267	208
		1.072x					
		1.550z	20.0	646		267	208
		1.037x					
		0.0864z					
B. 37	63.7 R	2.000z	4.4	652		400	183
		4.050z	8.2	652		400	183
		7.156z	8.2	652		400	183
		7.002z	5.3	653		400	183
		15.50z	6.2	654		400	183
B. 38	127 R	1.458x	19.7	649		798	207
		0.993x	20.8	649		798	207
		4.975x	20.1	649		798	207
		1.458x	19.7	649		798	207
Postmodification, Before Curtain Wall							
B. 39	42.5 R	2.001z	8	668		267	192
After Curtain Wall							
B. 41	42.5 R	2.010x, z	11	672		267	192
B. 42	127 R	3.857x, z	10	676		798	191
		0.979x	7	670		798	191
B. 43	Ground	0.907x, z	12	669	11,500		191
B. 44	Roof	0.1306z	6	667	918		192
		0.556	5	670	918		192

TABLE 3.1—(Continued)

Data in table No.	Type run*	Exposure time, hr.**	Average temp., °C	Average pressure, mm Hg	Area sq ft	Circum- ference, ft	Source activity, curies
FREE-FIELD MEASUREMENTS							
B. 45	24 x 24 ft	0.0833z	13.9	658	576		20.0
		0.0833z	16.1	658	576		20.0
B. 46	24 x 36 ft	0.1172z	13.9	653	864		20.0
		0.1169z	15.6	653	864		20.0

*R is the radius (ring-source measurement) in feet. "Ground" indicates ground area measurement; "Roof" indicates roof area measurement.

**x indicates low-range chambers, and z indicates high-range chambers.

TABLE 3.2 — NORMALIZED* RATES FROM RING AND AREA SOURCES AT 3 FT IN RMB HOUSE, POSTMODIFICATION

Type run*	Position ^a				
	16	27	28	30	31
Basic					
42.5 R	0.48	0.037	0.041	0.050	0.080
115 R	0.16	0.011	0.013	0.016	0.024
Ground	22	1.2	1.4		2.9
Roof	5.4	6.0		0.92	0.90
Window Blocked Up					
42.5 R	0.50	0.034	0.036	0.048	0.077

*Ring-source (R) measurements normalized to mr/hr per mc/ft of circumference and area-source (ground or roof) measurements normalized to mr/hr per mc/sq ft.

^aSee Fig. B.1 for detector positions.

TABLE 3.3 — NORMALIZED* RATES FROM RING AND
AREA SOURCES AT 3 FT IN PCC HOUSE, POSTMODIFICATION

Type run*	Position ^a				
	25	28	30	33	51
Basic					
42.5 R	0.059	0.031	0.062	0.074	0.51
127 R	0.017		0.017	0.018	0.12
Ground	2.1	0.99	1.5	4.5	22
Roof	2.4	1.2	1.2	2.4	12
Window Blocked Up					
42.5 R	0.061	0.023	0.030	0.073	0.50

*Ring-source (r) measurements normalized to mr/hr per mc/ft of circumference and area-source (ground or roof) measurements normalized to mr/hr per mc/sq ft.

^aSee Fig. B.2 for detector positions.

TABLE 3.4 — NORMALIZED* RATES FROM RING AND AREA
SOURCES AT 3 FT IN WR HOUSE

Type run*	Position ^a				
	10	29	51	52	62
Premodification					
25.5R	3.0	1.2	0.24	0.30	0.65
63.7R	1.2	0.76	0.19	0.18	0.64
127 R	0.52	0.31	0.089	0.086	0.27
Type run	Position ^b				
	11	36	58	62	39
Postmodification, Basic					
63.7 R	1.2	0.58	0.030	0.045	0.30
127 R	0.45	0.24	0.012	0.018	0.12
Ground	50	28	1.0	1.6	9.4
Roof	53	30	0.72	1.2	16
After Transite					
63.7 R	1.1	0.37	0.021	0.031	0.18
Roof	49	24	0.73	0.97	11
After Planter					
63.7 R	1.1	0.33	0.015	0.024	0.12
127 R	0.41	0.15	0.0072	0.011	0.073

*Ring-source (R) measurements normalized to mr/hr per mc/ft of circumference and area-source (ground or roof) measurements normalized to mr/hr per mc/sq ft.

^aSee Fig. B.3 for detector positions.

^bSee Fig. B.4 for detector positions.

TABLE 3.5 — NORMALIZED* RATES FROM RING AND AREA
SOURCES AT 3 FT IN BASEMENT OF 2SB HOUSE

Type run	Position ^a				
	6	10	17	20	44
Premodification, Old Shelters in Place					
25.5 R	0.11	0.086	0.012	0.012	0.010
42.5 R	0.052	0.043	0.0069	0.0073	0.0057
Type run	Position ^b				
	1	8	15	33	37
Shelters Removed					
25.5 R	0.15	0.13	0.12	0.077	0.12
42.5 R	0.032	0.067	0.072	0.043	0.074
63.7 R	0.017	0.037	0.041	0.025	0.043
127 R	0.0099	0.017	0.020	0.013	0.019
Type run	Position ^c				
	1	12	20	40	43
Postmodification, Before Curtain Wall					
42.5 R	0.029	0.056	0.060	0.0055	0.0053
After Curtain Wall					
42.5 R	0.016	0.039	0.050	0.0053	0.0051
127 R	0.0063	0.015	0.019	0.0014	0.0013
Ground	2.7	2.6	3.1	0.46	0.47

*Ring-source (R) measurements normalized to mr/hr per mc/ft of circumference and area-source (ground or roof) measurements normalized to mr/hr per mc/sq ft.

^aSee Fig. B.5 for detector positions.

^bSee Fig. B.6 for detector positions.

^cSee Fig. B.7 for detector positions.

TABLE 3.6 — NORMALIZED* RATES FROM RING AND AREA
SOURCES AT 3 FT IN BASEMENT OF 2SWF HOUSE

Type run*	Position ^a				
	14	17	30	36	33
PREMODIFICATION					
25.5 R	0.021	0.021	0.019	0.10	0.13
29.0 R	0.013	0.013	0.0067	0.075	
32.5 R	0.011	0.011	0.0064	0.065	0.13
36.6 R	0.0077	0.0073	0.0046	0.058	0.075
42.5 R	0.0083	0.0079	0.0049	0.052	0.065
63.7 R	0.0060	0.0059		0.036	0.041
127 R	0.0020	0.0019	0.0013	0.013	0.016
Type run	Position ^b				
	5	15	23	31	40
POSTMODIFICATION BEFORE CURTAIN WALL					
42.5 R	0.0054		0.0021	0.044	0.053
After Curtain Wall					
42.5 R	0.0050	0.0068	0.0017	0.034	0.025
127 R	0.0027	0.0020	0.00058	0.011	0.0073
Ground	0.35	0.45	0.12	2.6	2.3
Roof	1.1	1.4	0.68	3.3	3.5

*Ring-source (R) measurements normalized to mr/hr per mc/ft of circumference and area-source (ground or roof) measurements normalized to mr/hr per mc/sq ft.

^aSee Fig. B.8 for detector positions.

^bSee Fig. B.9 for detector positions.

Chapter 4

RESULTS

4.1 INTRODUCTION

Several thousand data points were taken during the project. The data and a brief analysis are given, containing the overall protection factors and a few comparisons and comments to illustrate the type of information that can be obtained from the detailed data in Appendix B.

4.2 PROTECTION-FACTOR CALCULATIONS

To evaluate the protective qualities of a structure and to give this protection quantitative expression, the term "protection factor" (P. F.) is used. This factor is a number that indicates the protective value of a structure and provides a measure of how much less the radiation level would be at a given point inside the structure than outside in an unprotected area. In technical terms it is the ratio of the exposure rate 3 ft above a smooth infinite plane that is uniformly contaminated with radioactive material to the exposure rate at a specific point in question, assuming the same source distribution. Accordingly,

$$\text{Protection Factor} = \frac{D_{\infty}}{D} \quad (4.1)$$

where D_{∞} is the total infinite-plane exposure rate and D is the exposure rate at the point in question.

For the accurate measurement of a protection factor, it is necessary to simulate fallout radiation on the structure and on the ground surrounding the structure out to an infinite distance. Since this is impractical, simulation in these experiments was limited to the immediate vicinity of the structures where the results would be most helpful in the estimating of protection factors. The contribution from those areas not simulated was analytically estimated by theoretical calculations and by the use of experimental data as guidelines.

The use of ^{60}Co and the Mobile Radiological Measuring Unit (MRMU) in simulating fallout radiation for shielding studies is discussed in Chap. 5.

Generally, in the estimation of a protection factor at a point inside a structure, it was assumed that the radiation level at that point, from contamination outside, was composed of three contributions: (1) roof contribution, (2) close-in ground contribution, and (3) far-out ground contribution.

Accordingly,

$$D = D_r + D_{ci} + D_{fo} \quad (4.2)$$

where the subscripts r, ci, and fo represent roof, close-in, and far-out respectively.

Roof contribution was measured directly by distributing the tubing on the roof. Close-in ground contribution was also measured directly by distributing tubing evenly on the ground from the edge of the structure out to 50 or 60 ft. The far-out ground contribution (contribution from contamination beyond the close-in measurement area) was estimated through the use of experimental data from a ring source at a large radius and the estimated free-field (no structure) exposure. The following equation was used to estimate the far-out contribution:

$$D_{fo} = \frac{D_c \times I_m}{I_c} \quad (4.3)$$

where D_{fo} = the far-out contribution to a particular point in the structure

D_c = the free-field exposure rate at 3 ft above the ground from contamination beyond the close-in measurement area

I_m = the measured exposure rate at the point in question from a ring source at a large radius

I_c = the free-field exposure rate 3 ft above the center of a ring source at the same large radius

Equation 4.3 can apply if the energy and angular distributions of D_c are the same as those of I_c . With the source geometries used in these experiments, the use of the equation slightly overestimates the far-out contribution for aboveground positions and slightly underestimates it for belowground positions. However, errors incurred are not expected to be great.

The value of the infinite-plane exposure rate (D_∞) is taken from experimental measurements by Rexroad¹ and is estimated to be about 500 mr/hr when the radioactive material (⁶⁰Co) is distributed to a source density of 1 mc/sq ft at standard temperature and pressure. Values of D_c and I_c vary slightly with each experiment at each structure.

For proper evaluation of the results, it was convenient to normalize all experimental data from an exposure to a standard-source density.

In the case where an area source was simulated, the measurements were normalized to a standard area-source density. After dosimeter readings were corrected for background, air density, and calibration, they were normalized by multiplying the corrected readings (dc, in milliroentgens) by the total area (A, in square feet) over which the tubing was distributed and then dividing by the exposure time (T, in hours) and by the source activity (S, in millicuries). Thus

$$\text{Normalized exposure rate (mr/hr per mc/sq ft)} = \frac{dc \times A}{T \times S}$$

The resulting exposure rate at a particular point is the same as it would be if the same area were contaminated by ⁶⁰Co to a source density of 1 mc/sq ft.

Many times the tubing was distributed in a ring source at a particular radius from the center of the structure. These measurements were normalized to give results in milliroentgens per hour for a source distribution of 1 mc per foot of circumference. Accordingly, data were normalized as follows:

$$\text{Normalized exposure rate (mr/hr per mc/foot of circumference)} = \frac{dc \times 2\pi r}{T \times S}$$

where r is the radius in feet.

All normalized data appear in Appendix B, accompanied by detailed measurement procedures used at each of the structures. Chapter 3 and Appendix B should be consulted for experimental parameters, dosimeter positions on floor plans, and detailed data.

4.3 REINFORCED-MASONRY-BLOCK HOUSE

In addition to protection factors at selected points within the RMB house, Table 4.1 displays pertinent values used in the calculations of these protection factors. The results are for the basic modification, which included building the extra outside wall only up to the mid-height of the bathroom window (5 ft 8 in. above the floor).

The close-in measurement area extended out to an equivalent radius of 55 ft from the center of the house. The value of D_c was taken to be 208 mr/hr per mc/sq ft and that of I_c to be 0.76 mr/hr per mc/foot of circumference from a ring source at a radius of 115 ft. Both D_c and I_c were calculated from experimental measurements by Rexroad.¹

Figure 4.1 displays protection factors on a floor plan at the 3-ft level. At a few of the locations inside the sheltered area, two numbers are given. The first refers to the protection factor before the wall outside the bathroom was blocked completely to the roof, and the second, after the modification. As can be seen, the extra blocking had little effect on the values at 3 ft. It is expected, however, that the differences would be greater at heights nearer the ceiling. Protection factors, after the bathroom blocking was installed, were estimated by examining data from the 42.5-ft ring-source measurements taken before and after the blocking took place. This method probably underestimates the reduction of skyshine radiation. As a result the second numbers on Fig. 4.1 are probably somewhat conservative.

Protection factors in an unmodified house of this type would vary roughly from 5 to 10 away from windows or doors. As Fig 4.1 shows, after modification the protection factor is slightly less than 100 at the 3-ft level within the "inner sanctum" of the shelter area.

In general, protection factors are lower by about 15% at the 5-ft level (as compared to 3 ft) and are higher by about 30 to 40% at the 1-ft level.

TABLE 4.1—SAMPLE OF RESULTS AT 3 FT ABOVE FLOOR
IN RMB HOUSE, POSTMODIFICATION, BASIC

Position*	Radiation contributions, mr/hr per mc/sq ft				(P. F.)
	Roof (D _r)	Close-in (D _{ci})	Far-out (D _{fo})	Total (D)	
1	6.0	45	88	139	3.6
2	5.9	45	81	132	3.8
3	5.6	33	48	87	5.7
11	7.7	29	49	86	5.8
16	5.4	22	45	72	6.9
23	1.5	9.4	19	30	17
24	0.96	4.0	9.4	14	36
25	0.79	3.2	7.9	12	42
26	0.86	1.8	4.4	7.1	70
27	0.60	1.2	3.2	5.0	100
28	0.73	1.4	3.7	5.8	86
29	0.58	1.2	2.8	4.6	110
30	0.92	1.9	4.6	7.4	68
31	0.90	2.9	6.8	11	45
33	1.4	5.5	10	17	29
35	1.0	5.9	11	18	28

*See Fig. B. 1 for detector positions.

TABLE 4.2—SAMPLE OF RESULTS AT 3 FT ABOVE FLOOR
IN PCC HOUSE, POSTMODIFICATION, BASIC

Position*	Radiation contributions, mr/hr per mc/sq ft				P. F.
	Roof (D _r)	Close-in (D _{ci})	Far-out (D _{fo})	Total (D)	
1	9.2	50	56	115	4.3
2	9.1	11	23	43	12
3	12	11	29	52	9.6
10	12	14	35	61	8.2
15	11	14	38	63	7.9
24	7.0	8.5	29	45	11
25	2.4	2.1	5.0	10	50
26	1.1	1.0	2.5	4.6	110
27	0.82	0.94	2.2	4.0	120
28	1.2	1.0	2.1	4.3	120
30	1.2	1.5	5.0	7.7	65
31	1.7	2.1	3.8	7.6	66
33	2.4	4.5	5.3	12	42
34	1.6	3.4	4.8	9.8	51
44	3.9	8.7	18	31	16
45	1.5	2.5	6.6	11	45
46	1.1	1.5	3.4	6.0	83
47	0.94	1.0	2.5	4.4	110

*See Fig. B. 2 for detector positions.

4.4 PRECAST CONCRETE HOUSE

Table 4.2 contains a sample of results for the PCC house before the bathroom window was completely blocked up. The same procedure was used at this house as at the masonry-block house. The equivalent radius to the edge of the close-in measurement area was 57 ft. The value of D_c was taken as 204 mr/hr per mc/sq ft and that of I_c as 0.68 mr/hr per mc/foot of circumference for a ring source of 127-ft radius.

Figure 4.2 presents the protection factors on a floor plan both before and after final modifications were completed. Again, finishing the wall outside the bathroom had little effect on the protection factor at the 3-ft level.

Figure 4.3 and 4.4 show a comparison of data taken with the MRMU at this structure and data taken by Auxier² with distributed point sources of ^{60}Co . Positions in the garage were chosen for comparison, assuming these positions would be least affected by the modifications. Agreement is good both from ring-source measurements of 42.5-ft radius and from roof exposures.

Some measurements were made inside this structure from fallout deposition outside during the Plumbbob series. Miller⁵ reports that measurements made on $D + 1$ at several positions inside the building at the 3-ft level indicate a protection factor of from 10 to 20 near the center of the building at positions where maximum shielding is realized. The protection factor in outer rooms away from windows was measured to be from 5 to 8; near the windows it was measured to be from 2 to 5.

Eisenhauer³ reports that the protection factor in this structure (before modification) at 3 ft in height and away from windows and doors varied roughly from 6 to 10. This range of values for the unmodified structure could also be inferred from Fig. 4.2. After modification, the protection factors were estimated to be slightly more than 100 in the center of the sheltered area.

4.5 WOOD RAMBLER HOUSE

The WR house, before modification, was of conventional design except that it contained an aboveground shelter that had been built around the bathroom for studies during the Operation Teapot series in 1955.

The three ring-source measurements at this house before modifications were made primarily for comparisons with previous experiments.^{2,4} Figures 4.5 and 4.6 show some comparisons. Data inside the shelter agree closely with those taken by Auxier² at the 5-ft level, but agreement is poor at the 3-ft level. This is presumably caused by the difficulty of measuring low exposure rates encountered at low levels inside the shelter. Figure 4.6 presents exposure-rate distributions along a long center line 3 ft above the floor of the WR house. Data from USAEC Report CEX-58.1 are presented, as well as calculated free-field data. The lowest exposure rates from all radii were encountered, not in the center of the structure, but directly in front of the shelter. The MRMU and CEX-58.1 data for the 25.5 ft-radius measurements are in excellent agreement. It is interesting to note that the exposure rates near the center of the structure from a ring source at 63.7-ft radius are almost as high as those at 25.5 ft. The height of the first floor is about 1-1/2 ft above the average ground level. For positions near the outside, only the thin walls of the structure are between the source and the detector; whereas, for those 10 ft or more from the outside wall, the first-floor structure and the concrete foundation lie between the source (at 25.5-ft radius) and the detector.

Table 4.3 contains a sample of results for the WR house after the basic modification but before the addition of the transite or the construction of the planter. The equivalent radius to the edge of the close-in measurement area was 49 ft. The value of D_c was taken as 219 mr/hr per mc/sq ft and that of I_c as 0.68 mr/hr per mc/foot of circumference for a ring source at 127-ft radius.

For an estimate of protection factors after the transite was installed, the roof contribution was measured directly. The ground contribution was assumed to be reduced by the same proportion as data from the 63.7-ft-radius measurement after the transite, as compared to data before; i. e.,

$$\frac{\text{Ground contribution before transite}}{\text{Ground contribution after transite}} = \frac{\text{63.7-ft ring-source data before transite}}{\text{63.7-ft ring-source data after transite}}$$

The same general procedure was used to estimate the protection factors after the addition of the planter.

Figure 4.7 presents protection factors at the 3-ft level plotted on a floor plan. The three values presented at each position correspond to the three phases of modification. The height of the planter extended to window-sill level, which was slightly less than 3 ft above floor level. Therefore protection factors at 3 ft do not reflect the full usefulness of the planter as a shield. For this reason, protection factors were estimated 6 in. above the floor and are presented in Fig. 4.8 for a few sample points.

The normalized exposure rates from a ring source of 63.7-ft radius along the center hallway before modification and after the three phases of modification are compared in Fig. 4.9 for the 3-ft level.

Comparisons are also made for different heights in the center of the shelter. These are presented in Table 4.4. Relative to basic modification data, the addition of 2-in. -thick transite panels to the walls surrounding the shelter area reduced the exposure rates from the 63.7-ft ring source by about 30% at all heights. The planter, constructed of block and filled with earth, reduced the exposure rate by 50% at the 6-in. level, by 23% at the 3-ft level, and by 5% at the 5-ft level relative to the "after transite" values.

Eisenhauer³ estimates the protection factors inside the bathroom shelter (before modification) to be about 8 and in a WR house without a bathroom shelter to be about 2. After modifications, including the addition of transite and construction of the planter, the protection factor is estimated to be 100 at the 3-ft level.

4.6 TWO-STORY BRICK HOUSE

Measurements were made in the basement of the 2SB house before modification (old shelters in place) for comparison with previous data. These comparisons are made in Figs. 4.10 to 4.15. Data taken with the old shelters in place are compared to data taken by Clarke⁴ during an earlier experiment. Data taken in the basement after the shelters were removed are compared to data taken by Auxier.² Figure 4.10 shows excellent agreement with measurements taken by Technical Operations, Inc. (TOI), in the center of the basement. Agreement is also good with the data of Auxier (see Fig. 4.11). The reasons

TABLE 4. 3—SAMPLE OF RESULTS AT 3 FT ABOVE FLOOR
IN WR HOUSE, POSTMODIFICATION, BASIC

Position*	Radiation contributions, mr/hr per mc/sq ft				P. F.
	Roof (D _r)	Close-in (D _{ci})	Far-out (D _{fo})	Total (D)	
1	40	73	155	268	1.9
11	53	50	146	249	2.0
15	53	37	134	224	2.2
20	49	31	114	194	2.6
24	42	25	98	165	3.0
33	36	22	86	144	3.5
34	41	24	91	156	3.2
38	22	14	53	89	5.6
39	16	9.4	39	64	7.8
53	43	45	130	218	2.3
58	0.72	1.01	3.88	5.6	89
59	0.66	1.53	5.00	7.2	69
60	0.66	1.53	5.00	7.2	69
61	1.92	2.01	7.05	11.0	45
62	1.62	1.16	5.92	8.7	57

*See Fig. B. 4 for detector positions.

TABLE 4. 4—COMPARISON OF DATA IN CENTER OF SHELTER
BEFORE AND AFTER MODIFICATION OF THE WR HOUSE
FROM A RING SOURCE OF 63.7-FT RADIUS

Height above floor, ft		Premodi- fication	Basic modification	After transite	After planter
0.5	Exposure rate**	0.14*	0.029	0.020	0.010
	Attenuation***	0.10*	0.021	0.014	0.0071
3	Exposure rate**	0.18	0.045	0.031	0.024
	Attenuation***	0.13	0.032	0.022	0.017
5	Exposure rate**	0.30	0.048	0.035	0.033
	Attenuation***	0.21	0.034	0.025	0.024

*Height is 1 ft for premodification measurement.

**Milliroentgens/hour per millicurie/foot of circumference.

***Attenuation relative to free-field exposure rate at 3 ft (free-field exposure rate is assumed to be 1.4 mr/hr per mc/foot of circumference for a ring source of 63.7-ft radius).

for the low readings at the 5-ft level in USAEC Report CEX-58.1 are not known. Diagonal traverse data at the 3-ft height in the basement from a ring source of 42.5-ft radius are shown in Figs. 4.12 and 4.13 in comparison with previous experiments.

North-end traverse data from ring sources of 25.5- and 42.5-ft radius are shown in Fig. 4.14. As shown in Fig. 4.14, measurements by TOI appear to be consistently 10 to 15% lower than MRMU data. Since this difference was not noted in other locations, it is assumed that errors in the positioning of this line of detectors account for the difference.

Figure 4.15 presents exposure-rate distributions along the short center line at 3 ft above the basement floor in comparison with data by TOI. Agreement is good in the basement proper but poor inside the shelter, especially for the 42.5-ft measurements. Similar differences were also observed at all other positions in the shelters. The TOI measurements at the 3-ft level in the shelters from a 25.5-ft ring source were consistently from 30 to 50% higher, and those from a 42.5-ft ring source, a factor of 2 to 4 higher. Clarke⁴ states that errors were large for measurements in basement shelters. At the time TOI made their measurements, low-range ionization chambers were not available; thus it was impossible to obtain accurate data of low exposure rates.⁶

In a two-story structure of this type with a basement, the roof contribution very nearly equals the ground contribution to points in an unobstructed basement. The protection factor in the basement outside the shelter was estimated by TOI to be about 30.

In the estimating of protection factors inside the shelters (premodification), it will be assumed that the roof contribution also equals the ground contribution. This is a reasonable assumption since it was also found to apply in the shelters in the two-story wood frame house basement (discussed in the next section).

For estimating the ground contribution to points inside the old shelters in the 2SB house, it is assumed that the ratio of free-field exposure rate (3 ft above the ground, no structure) to measured exposure rate at the point in question from ring sources is independent of ring radius. The normalized free-field exposure rate 3 ft above the center of a ring source at a radius of 25.5 ft is found to be 3.80 mr/hr per mc/foot of circumference from experimental data by Rexroad.¹ The average exposure rate 3 ft above the basement floor in the shelters was about 0.010 mr/hr per mc/foot of circumference, reducing the free-field exposure rate by a factor of 0.0026. The free-field exposure rate from a 42.5-ft ring source was 2.22 and the average in the shelters was 0.0058 mr/hr per mc/foot of circumference, again reducing the free-field exposure rate by a factor of 0.0026. The free-field exposure rate 3 ft above the center of a cleared area equal to the area of the 2SB house (equivalent radius = 17 ft) is taken as 320 mr/hr per mc/sq ft. The ground contributions would then be 0.83 mr/hr per mc/sq ft (320×0.0026) at points 3 ft above the basement floor. If we assume that the roof contribution equals the ground contribution, then the protection factor in the old shelters in the basement of the brick house is estimated to be 300, obtained from $500 / (0.83 + 0.83)$.

After the shelters were removed, measurements were made in the "clean" basement from four ring sources. It is interesting to compare the exposure rate at several locations from the ring sources in terms of "reduction factors" relative to the free-field exposure rate. These reduction factors

were plotted for several positions at the 3-ft level and are shown in Fig. 4.16. The free-field exposure rates for ring sources of 25.5-, 42.5-, 63.7-, and 127-ft radii are taken as 3.80, 2.22, 1.40, and 0.68 mr/hr per mc/foot of circumference, respectively.

As shown for the detectors near the basement entrance, radiation coming through the entranceway strongly influences the data from the 25.5-ft ring source. For this particular radius the tubing was, of necessity, placed directly over the entranceway. However, all other positions and ring sources do not reflect this effect. The data in Fig. 4.16 indicate that the reduction factors are independent of the ring-source radius (exclusive of the entranceway effect). The reduction factors vary from 0.012 to 0.031 from corner to center. If the reduction factors were used to estimate the ground contribution in protection-factor estimates, the protection factors would vary from about 50 in the corners to about 20 in the center of the 3-ft level. This is assuming that the roof-contribution reduction factor is 0.015 (from Eisenhower³) in the center and about 0.008 in the corner.

Table 4.5 contains estimated roof and ground contributions and protection factors for positions in the basement after modifications. The equivalent radius to the outer edge of the close-in measurement area was 59 ft. The value of D_c was taken as 203 mr/hr per mc/sq ft and that of I_c as 0.68 mr/hr per mc/foot of circumference from a ring source of 127-ft radius.

Since the roof of the 2SB house was damaged too severely for direct measurements of the roof contribution to be made, the roof contribution was estimated from data taken at the 2SWF house. Both houses were similar in roof, internal-wall, and floor construction. For checking of the similarity of the two structures to roof sources, a single point source was placed on the roof of the brick house while measurements were made in the basement, and a similar experiment was made on the wood frame house. It was found that the exposure rate in the basement of the 2SB house was about 20% less than that in the 2SWF house in similar positions, presumably because of the heavy plasterboard on the internal walls of the 2SB house. The comparison took into account data at groups of similar positions as well as individual locations concerned. A "streaming" occurred directly below the source in the 2SB house, presumably caused by the damaged roof. It was assumed that this would not occur from an area source on an undamaged roof. The roof contribution in points in the 2SB house was estimated by examining the roof contribution in the 2SWF house at similar positions and multiplying by a factor of 0.8.

Table 4.5 shows that the total ground contribution very nearly equals the roof contribution for all points in the basement. This was also found to be true in previous experiments.²⁻⁴

Protection factors were plotted on a floor plan and are shown in Fig. 4.17. Technical Operations, Inc.,⁴ estimates the minimum protection factor in the basement of this structure to be 32, which is in excellent agreement with the value of 33 predicted by this experiment. Measurements were not made directly in the center of the shelter. The protection factor in the center of the shelter is estimated to be about 10 to 15% lower than the protection factors along the edges, or about 220.

TABLE 4.5—RESULTS AT A 3-FT HEIGHT IN THE 2SB
HOUSE BASEMENT AFTER MODIFICATION

Position*	Radiation contributions, mr/hr per mc/sq ft				P. F.
	Roof (D _r)**	Close-in (D _{ci})	Far-out (D _{fo})	Total (D)	
1	2.8	2.71	1.90	7.41	67
2	4.0	2.85	2.63	9.48	53
3	4.8	2.58	3.47	10.85	46
4	5.5	1.99	4.13	11.62	43
5	5.5	2.04	3.47	11.01	45
6	5.5	1.26	2.85	9.61	52
7	5.9	2.85	4.73	13.48	37
8	5.4	2.44	3.89	11.73	42
9	5.3	2.04	3.36	10.70	47
10	5.1	1.80	2.86	9.76	51
11	5.1	1.70	3.16	9.96	50
12	6.6	2.58	4.52	13.70	36
13	6.6	3.26	5.15	15.01	33
14	6.6	3.59	4.82	15.01	33
15	6.6	3.12	4.83	14.55	34
16	5.1	2.36	4.00	11.46	44
17	5.1	2.31	4.10	11.51	43
18	6.6	2.90	4.93	14.43	35
19	6.6	3.18	5.55**	15.33	33
20	6.6	3.12	5.55	15.27	33
21	6.6	2.93	5.25	14.78	34
22	5.1	2.12	4.31	11.53	43
23	5.1	1.99	4.00	11.09	45
24	4.7	2.85	4.62	12.17	41
25	4.4	1.73	3.68	9.81	51
26	6.0	3.10	4.93	14.03	36
27	4.0	1.70	2.86	8.56	58
28	6.0	2.71	4.72	13.43	37
29	5.1	1.99	3.78	10.87	46
30	5.1	1.52	3.05	9.67	52
31	6.0	2.17	3.89	12.06	41
32	5.5	1.39	2.74	9.63	52
33	5.1	1.13	2.53	8.76	57
34	5.5	2.12	3.68	11.30	44
35	5.1	1.65	3.36	10.11	49
36	5.5	1.00	2.32	8.82	57
37	5.1	1.26	2.40**	8.76	52
38	1.2	0.43	0.46	2.09	240
39	1.1	0.50	0.54	2.14	230
40	1.1	0.46	0.43	1.99	250
41	1.1	0.44	0.37	1.91	260
42	1.1	0.43	0.27	1.80	280
43	1.1	0.47	0.40	1.97	250
44	1.1	0.42	0.40	1.92	260

*See Fig. B. 7 for detector positions.

**Estimate.

Measurements were made from a ring source of 42.5-ft radius before and after the "curtain wall" was constructed near the basement entrance. Some of these normalized exposure rates are plotted on a floor plan and are shown in Fig. 4.18. The effect of the curtain wall was hardly noticeable inside the shelter or outside in the south half of the basement.

In summary, the protection factor near the center of the bare basement of this 2SB house is estimated to be about 20. After the fallout shelter was constructed in one end of the basement, the protection factor outside the shelter is estimated to be about 30 and that inside, about 220.

4.7 TWO-STORY WOOD FRAME HOUSE

Measurements were made in the basement of the 2SWF house before modification primarily for comparison with previous data.^{2,4} These comparisons are made in Figs. 4.19 to 4.24.

Figure 4.19 shows some horizontal traverse data across the south end of the basement from ring sources of various radii. Two curves from a previous experiment (TOI) are also shown for comparison. Agreement is good for points outside shelters but poor inside shelters, primarily because of the difficulty of measuring low exposure rates in previous experiments. As shown in Fig. 4.19, the exposure rates from the 25.5-ft ring sources appear to be unusually high inside the shelter. For the 25.5-ft ring source, it was necessary to place the tubing over the basement entrance (as in the case of the 2SB house). This was assumed to cause unusually high exposure rates, especially at points near the entrance. At all points inside the shelter, data from the 36.6-ft ring source appear to be unusually low. This was assumed to be caused by an exposure timing error. It is interesting to note that, as one approaches the east side inside the shelter, the exposure rates increase for all ring sources. This is probably caused by scattering through the shelter entranceway. A slight indication of this was noted in measurements by TOI.

Figures 4.20 to 4.22 present vertical traverses for three positions outside the fallout shelters and comparative data from TOI. Agreement is satisfactory.

Figure 4.23 presents normalized exposure rates at position 29 from various ring sources and data taken by Auxier.² In Fig. 4.24 vertical traverses for two positions from source distributions on the roof (after modification) are compared to data in CEX-58.1. Again agreement is satisfactory.

Protection factors that were estimated at the 3-ft level in the basement before modification are presented in Fig. 4.25 on a floor plan. Table 4.6 contains samples of results used to obtain these protection factors. Roof contribution was estimated from data at similar positions from the roof exposure after modification. Close-in ground contribution was estimated from the integration of ring-source data from the edge of the structure (effective radius, 16 ft) to a radius of 160 ft. Far-out contribution was estimated by assuming that D_c is equal to 112 mr/hr per mc/sq ft and I_c is equal to 0.68 mr/hr per mc/foot of circumference from a ring source of 127-ft radius and by using Eq. 4.3. Table 4.6 shows that the roof contribution very nearly equals the ground contribution for all points inside and out of shelters.

A protection factor of 180 is estimated in the center of the fallout shelter and one of 290 in the blast shelter. The minimum protection factor outside shelters and away from the entrance is 25, which is the same value predicted by Clarke⁴ from a previous experiment.

Table 4.7 contains some normalized exposure rates and reduction factors relative to the free-field exposure rates from various ring sources. The reduction factors are somewhat independent of ring-source radii, if one discounts the 25.5- and 36.6-ft (inside shelter) measurements. The unusually high readings from the 25.5-ft ring source and unusually low readings inside the shelter from the 36.6-ft ring source were mentioned previously and are again emphasized in Table 4.7. Ground contribution can be estimated by multiplying the average reduction factor by 326 mr/hr per mc/sq ft (free-field ground contribution, effective radius of 16 ft) and then computing the resulting protection factor. These protection factors compare favorably with those shown in Fig. 4.25.

Table 4.8 contains estimated roof and ground contributions and protection factors for positions in the basement after modifications. The equivalent radius to the outer edge of the close-in measurement area was 63 ft. The value of D_c was taken as 198 mr/hr per mc/sq ft and that of I_c as 0.68 mr/hr per mc/foot of circumference from a ring source of 127-ft radius.

Protection factors are plotted on a floor plan and appear in Fig. 4.26. These values compare favorably to those in Fig. 4.25 at points least affected by the modification. The protection factor in the fallout shelter is estimated to be about 190, which is essentially the same as that before modification. However, the protection factor in the blast shelter increased to more than 500.

TABLE 4.6—SAMPLE OF RESULTS AT 3 FT ABOVE FLOOR
IN BASEMENT OF 2SWF HOUSE, PREMODIFICATION

Position*	Radiation contributions, mr/hr per mc/sq ft				P. F.
	Roof (D_r)	Close-in (D_{ci})	Far-out (D_{fo})	Total (D)	
1	6.84	5.01	2.21	14.06	36
4	1.07	0.72	0.22	2.02	250
6	0.97	0.69	0.19	1.85	270
10	8.40	8.77	4.00	21.17	24
12	8.61	7.92	3.72	20.25	25
14	1.50**	0.93	0.33	2.76	180
17	1.41	0.91	0.31	2.63	190
19	1.90	1.39	0.48	3.77	130
30	0.68	0.86	0.21	1.75	290
33	6.84**	6.51	2.57	15.92	31
36	3.26	4.82	2.75	10.83	46

*See Fig. B.8 for detector positions.

**Estimate

TABLE 4.7—NORMALIZED EXPOSURE RATES, REDUCTION FACTORS, AND PROTECTION-FACTOR
ESTIMATES AT SAMPLE POSITIONS* AT THE 3-FT HEIGHT ABOVE THE BASEMENT FLOOR
FROM RING SOURCES AROUND 2SWF HOUSE, PREMODIFICATION

Ring radius, ft	Free-field exposure rate**	Position 29		Position 16		Position 14		Position 30	
		Exposure rate**	Reduction factor	Exposure rate**	Reduction factor	Exposure rate*	Reduction factor	Exposure rate**	Reduction factor
Normalized Exposure Rates and Reduction Factors									
25.5	3.80	0.146	0.038	0.0191	0.0050	0.0209	0.0055	0.0190	0.0050
29.0	3.30	0.111	0.034	0.0126	0.0038	0.0129	0.0039	0.0067	0.0020
32.3	2.97	0.098	0.033	0.0115	0.0039	0.0114	0.0039	0.0064	0.0022
36.6	2.64	0.084	0.032	0.0077	0.0029	0.0077	0.0029	0.0046	0.0017
42.5	2.22	0.078	0.035	0.0085	0.0038	0.0083	0.0037	0.0049	0.0022
63.7	1.40	0.051	0.036	0.0060	0.0043	0.0060	0.0043		
127	0.68	0.019	0.028	0.0021	0.0031	0.0020	0.0030	0.0013	0.0019
		Average	0.034		0.0038		0.0039		0.0025
Radiation contributions, mr/hr per mc/sq ft									
Position	Roof	Ground (average reduction factor x 326)		Total		P. F.			
29	6.70	11		17.7		28			
16	1.43	1.2		2.6		190			
14	1.50	1.3		2.8		180			
30	0.68	0.82		1.50		330			

*See Fig. B. 8 for detector positions.

**Milliroentgens per hour per millicurie per foot of circumference.

TABLE 4.8—RESULTS AT A HEIGHT OF 3 FT IN THE 2SWF
HOUSE BASEMENT AFTER MODIFICATION

Position*	Radiation contributions, mr/hr per mc/sq ft				P. F.
	Roof (D _r)	Close-in (D _{ci})	Far-out (D _{fo})	Total (D)	
1	6.84	2.84	4.28	13.96	36
2	7.90	3.67	6.76	18.33	27
3	7.2 **	2.60	4.56	14.36	35
4	1.07	0.33	0.81	2.21	230
5	1.11	0.35	0.78	2.24	220
6	0.97	0.30	0.81	2.08	240
7	6.35	2.60	4.18	13.13	38
8	8.4 **	4.75	7.40	20.55	24
9	8.40	5.00	7.80	21.20	24
10	8.10	4.33	7.30	19.73	25
11	8.61	4.08	7.40	20.09	25
12	7.70	3.66	6.10	17.46	29
13	1.39	0.45	0.62**	2.46	200
14	1.43	0.47	0.62**	2.52	200
15	1.41	0.45	0.57	2.43	210
16	1.36	0.56	0.70**	2.62	190
17	1.90	0.64	0.75**	3.29	150
18	5.38	2.43	3.60	11.41	44
19	6.25	3.09	4.79	14.13	35
20	4.95	2.27	2.91**	10.13	49
21	6.72	3.79	6.70**	17.21	29
22	0.79	0.21	0.29	1.29	390
23	0.68	0.12	0.17	0.97	510
24	0.62	0.15	0.17	0.94	530
25	0.93	0.42	0.61	1.96	250
26	2.57	2.03	2.92	7.52	66
27	5.86	4.50	6.38	16.74	30
28	7.79	5.34	8.12	21.25	23
29	7.04	4.75	7.24	19.03	26
30	2.39	1.79	2.20	6.38	78
31	3.26	2.60	3.12	8.98	55
32	4.95	3.09	4.95	12.99	38
33	7.44	4.50	7.62	19.56	25
34	6.70	4.08	5.80**	15.58	32
35	6.65	3.42	4.68	14.75	34
36	6.35	2.84	4.10	13.29	37
37	1.38	1.45	2.30**	5.13	97
38	6.84	3.72	5.46	16.02	31
39	5.62	3.25	4.10	12.97	38
40	3.63	2.27	2.12	8.02	62

*See Fig. B.9 for detector positions.

**Estimate.

Measurements were made from a ring source of 42.5-ft radius before and after the "curtain wall" was constructed near the basement entrance. As in the 2SB house, the effect of the curtain wall was hardly noticeable beyond a few feet from the entranceway.

Measurements were also made from several point sources placed on the steps of the basement entrance before and after the curtain wall was constructed. These data appear in Appendix B.

In summary, the minimum protection factor in a basement of this type and outside of shelters is about 25. A factor of almost 200 was estimated in a corner fallout shelter. The protection factor in the heavily constructed center shelter before modification was about 300 (shelter door open). Construction of two short, masonry-block walls, which formed a maze pattern at the entrance, and the placement of a concrete roof over the entrance raised the protection factor to 500, a gain of 67%. This evidence points to the importance of a carefully designed entrance if maximum radiation sheltering is to be obtained from a structure.

4.8 FREE-FIELD MEASUREMENTS

Two different area sources were created on the ground with the MRMU system, and the radiation level was measured at several points over these areas. All the data appear in Appendix B. The two areas measured 24 by 24 ft and 24 by 36 ft. The conversion of the rectangular area to a circular area, gives an effective radius of 13.4 and 16.6 ft respectively.

Normalized exposure rates at 6 ft above the ground and as a function of radius of contamination are plotted in Fig. 4.27 from experimental data taken by Rexroad.¹ Data from this experiment are also plotted and are noted to be from 12 to 14% lower than those by Rexroad. This difference can probably be explained by the fact that neither the detectors nor the source was completely isotropic. Because of this factor, lower exposure rates of this magnitude are expected.

REFERENCES

1. R. E. Rexroad and M. A. Schmoke, Scattered Radiation and Free Field Dose Rates from Distributed Co^{60} and Cs^{137} Sources, Report NDL-TR-2, Nuclear Defense Laboratory, September 1960.
2. J. A. Auxier, J. O. Buchanan, C. Eisenhauer, and H. E. Menker, Protection Afforded by Residential Structures Against Distributed Sources USAEC Report CEX-58.1, Jan. 19, 1959.
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4. E. T. Clarke, J. F. Batter, Jr., and A. L. Kaplan, Measurements of Attenuation in Existing Structures of Radiation from Simulated Fallout, Report NP-9123 (TO-B 59-4), Technical Operations, Inc., Apr. 27, 1959.
5. C. F. Miller, The Radiological Assessment and Recovery of Contaminated Areas, USAEC Report CEX-57.1, September 1960.
6. John Batter, Technical Operations, Inc., personal communication.

Fig. 4.1 — Protection factors on floor plan of RMB house, postmodification.

Fig. 4.2 — Protection factors at 3 ft on floor plan of PCC house, postmodification.

Fig. 4.3—Exposure-rate distribution at 3-ft level in garage of PCC house.

Fig. 4.4—Exposure-rate distribution at 3-ft level in garage of PCC house from roof source.

Fig. 4.5—Exposure-rate distribution along center line of shelter in unmodified WR house, source distribution at 25.5-ft radius.

Fig. 4.6—Exposure-rate distribution along center line 3 ft above floor of WR house.

Fig. 4.7 — Protection factors at 3 ft above floor of WR house, postmodification (three readings).

Fig. 4.8 — Protection factors at 6 in. above floor of WR house, postmodification (three readings).

Fig. 4.9—Exposure-rate distribution at the 3-ft level along center hallway of WR house from a ring source of 63.7-ft radius.

Fig. 4.10—Vertical traverse in center of 2SB house basement from ring sources, premodification.

Fig. 4.11—Vertical traverse in center of 2SB house basement from ring sources, shelters removed.

Fig. 4.12—Diagonal traverse across 2SB house basement at 3-ft height from a 42.5-ft ring source, premodification.

Fig. 4.13—Diagonal traverse across 2SB house basement at 3-ft height from a 42.5-ft ring source, shelters removed.

Fig. 4.14—North-end traverse of 2SB house, premodification.

Fig. 4.15—Exposure-rate distribution along short center line at 3 ft above basement of 2SB house, premodification.

Fig. 4.16—Reduction factors relative to the free-field exposure rate as a function of ring-source radii for various positions in the basement of the 2SB house, 3-ft level, shelter removed.

Fig. 4.19—Horizontal traverse at 3-ft level across south end of 2SWF house basement, premodification.

Fig. 4.20—Vertical traverse at position 13 in 2SWF house basement, premodification.

Fig. 4.21—Vertical traverse at position 32 in 2SWF house basement, premodification.

Fig. 4.22—Vertical traverse at position 31 in 2SWF house basement, premodification.

Fig. 4.23—Exposure rate at 3-ft level at position 29 in 2SWF house, premodification.

Fig. 4.24—Vertical traverse at two positions in basement of 2SWF house from roof exposure, postmodification.

Fig. 4.25—Protection factors at 3 ft above the basement floor of the 2SWF house, premodification.

Fig. 4.26—Protection factors at 3 ft above the basement floor of the 2SWF house, postmodification.

Fig. 4.27—Normalized exposure rate 6 ft above the center of a contaminated circular area.

Chapter 5

SUMMARY AND DISCUSSION

Cobalt-60 has been widely used in radiation shielding studies. The extent to which results obtained by using ^{60}Co can be applied to idealized fallout radiation has been discussed by Eisenhauer¹ and implied by extensive calculations by Spencer.² For two source configurations cited,¹ it requires about 10% more mass thickness to produce a given attenuation for 1-hr fission-product radiation than it does for ^{60}Co radiation.

Source configurations used in these studies were simulated line sources or area sources created by propelling a ^{60}Co source through a length of tubing appropriately placed over the area of interest. Source configurations were such that data could be added or integrated and used to calculate a total result that would encompass an infinite ^{60}Co field from the structure out to an infinite distance. The protection factors calculated are for ^{60}Co and are assumed to apply to an idealized fallout situation to the extent mentioned above. An idealized fallout situation is defined as fallout having a 1-hr fission spectrum and existing uniformly on a smooth infinite plane.

The extent to which an idealized fallout situation applies to a real fallout situation is not known. The main differences lie in the change of spectrum with time and location, ground roughness, and nonuniform distributions of the fallout particles. The change of spectrum with time of fission products is well known. Less is known about neutron-induced activity and fractionation. Some limited ground-roughness studies have been made.³⁻⁴

Errors in source and detector calibrations, source and detector positioning, and air-density correction result in an estimated accuracy of about $\pm 10\%$ for the data in this experiment. Errors in estimating far-out contributions, summing, and differentiating data points result in ^{60}Co radiation protection factors estimated to be accurate to ± 15 to 20% .

Experiments contained in this report were conducted simultaneously with an architectural-engineering study to develop and demonstrate practical means of improving fallout-radiation protection by economical modifications of existing typical houses.

In general, experimental data were gathered at each house before and after shelters were constructed or modified. The effects of various practical modifications of the existent structures, such as adding transite panels to the walls, building planters or adding baffle walls, were also considered.

In this report the data and a brief analysis are presented for informational purposes. The results given are short. They contain the overall estimated protection factors and a few comparisons and comments to illustrate the type of information which can be obtained from the detailed data in Appendix B.

In both the RMB and the PCC one-story houses, the estimated protection factors before modification were from 5 to 10 away from windows or doors. After modification the protection factor was estimated to be about 100 at the 3-ft level within the "inner sanctum" of the shelter areas.

The protection factor inside the bathroom shelter (before modification) of the one-story WR house was estimated to be about 8, and in a WR house without a bathroom shelter, about 2. After modification, including the addition of transite and construction of the planter, the protection factor was estimated to be 100 at the 3-ft level.

Near the center of the bare basement of the 2SB house, the protection factor was estimated to be about 20. After a fallout shelter was constructed in one end of the basement, the protection factor outside the shelter was estimated to be about 30 and that inside, about 220.

The minimum protection factor in the basement of the 2SWF house and outside of the shelter was found to be about 25. A factor of almost 200 was estimated in a corner fallout shelter. The protection factor in a center blast shelter of heavier construction was about 300 before modification. Construction of two short, masonry block walls which formed a maze pattern at the entrance, and the placement of a concrete roof over the entrance raised the protection factor to 500.

Roof contribution very nearly equaled ground contribution to most points in the basements of both two-story structures studied.

Data points at specific locations and from specific source geometries compared favorably with data from previous experiments.

The experience, general information, and specific data gained from this series of experiments apply to a variety of shielding problems as well as to architectural-engineering design and evaluation of fallout shelters. The objectives were met and the experiment was conducted safely within the criteria established for the project.

REFERENCES

1. C. E. Eisenhauer, Analysis of Experiments on Light Residential Structures with Distributed Co⁶⁰ Sources, Report NBS-6539, National Bureau of Standards, Oct. 15, 1959.
2. L. V. Spencer, Structure Shielding Against Fallout Radiation from Nuclear Weapons, National Bureau of Standards (U.S.), Monograph 42: June 1, 1962.
3. R. L. Mather, R. F. Johnson, F. M. Tomnovec, and C. S. Cook, Gamma Radiation Field above Fallout Contaminated Ground, USAEC Report WT-1225, October 28, 1959.
4. C. M. Huddleston, Z. G. Burson, R. M. Kinkaid, and Q. G. Klingler, Ground Roughness Effects on the Energy and Angular Distribution of Fallout Radiation, USAEC Report CEX-62.81, July, 1964.

Appendix A

MOBILE RADIOLOGICAL MEASURING UNIT

A.1 GENERAL

The MRMU was a mobile system used to simulate area sources or ring sources outside a structure while radiation levels were measured inside the structure.

This unit used a moving radioactive ^{60}Co source, hydraulically pumped through polyethylene tubing. The tubing was laid over the area of interest in such a manner that the amount of tubing per unit area was constant. Since the source traveled at a uniform speed, an area of uniformly distributed radioactivity was simulated. Thus fallout radiation was simulated since, under ideal conditions, fallout is uniformly deposited over large areas.

A ^{60}Co source was used for shielding studies because the energy of the gamma radiation emitted (1.17 and 1.33 Mev) approximated the effective energy of gamma radiation from fallout at early times after a detonation.

As the source was pumped through the tubing, radiation exposures were accumulated on sensitive ionization chambers (dosimeters) at desired positions inside the structure. The use of these integrating detectors made the total radiation exposure appear to be arising from an area source. This technique had the advantage of averaging local features of the terrain and of the building under test in much the same way as would a true fallout field.

The MRMU was also used to simulate a ring source at a particular radius around a structure by pumping the source through the tubing placed at that radius.

A.2 MECHANICAL EQUIPMENT

The equipment that made up the MRMU system, which was mounted on a truck for mobility, consisted of a hydraulic pumping unit, a mile of tubing, source-position indicators, a remote-control console, ^{60}Co sources, source containers, interconnecting cables, ionization chambers, charger-readers, and a 256-channel analyzer with associated equipment.

The MRMU equipment was installed in three vehicles. The hydraulic system and source shields were mounted on one truck. Tubing reels and cable reels were mounted on a caisson trailer. A laboratory truck (Fig. A.1) contained the control console, the data-readout equipment, tools, supplies, and general equipment for the system. The entire system was practically self-sufficient. The hydraulic pumping system consisted of a 120-gal reservoir,

a 1-hp 220-volt electric motor, a piston type positive-displacement pump, filters, several hand-operated and electrically operated solenoid valves, and connecting lines. The outside diameter of the source capsule was slightly less than the inside diameter of the tubing, and thus a flow system rather than a pressure-differential system was used. In normal operation the internal pressure was approximately 100 psi when 3000 ft of tubing was used. At this pressure the source traveled at 120 ft/min.

Cobalt-60 source activities from 100 mc to 300 curies were used as required, according to the type of structure being measured and the precautions necessary to minimize personnel exposure.

All ^{60}Co sources were encapsulated in magnetic stainless-steel containers accurately machined to pass through the plastic tubing. The large (300-curie) source was doubly encapsulated (a capsule within a capsule). It was approximately 2 in. long (Fig. A. 2). The capsules were Heliarc-welded and passed all AEC leak tests.

Shielded storage was provided for the sources when they were not being used. Figure A. 3 is a photograph of one of the source shields. Within this shield were two S-shaped stainless-steel tubes in which the source traveled. Stops were provided in the center of each tube to halt the motion of the source when it returned to the shield. A method was provided to secure and lock the source in place when it was not being used. Two source shields, an air compressor (used to empty the water from the tubing), and the hydraulic system were mounted on the same truck (Fig. A. 4).

The source was conveyed by water (antifreeze added to the water in cold weather) through 1/2-in. Marlex (high-density polyethylene) tubing that was rated at 200-psi hoop stress at 130°F for a one-year period. Burst pressure was rated in excess of 1000 psi. The tubing bend radius was usually limited to a minimum of 2 ft to assure safe passage of the ^{60}Co source.

An emergency hand pump (Fig. A. 5) could have retrieved the source from either direction if the main pumping unit had failed during actual operation.

The hydraulic pumping system was remotely controlled from the console (Fig. A. 6) in the laboratory truck a safe distance from the pumping system. On the panel of the console was a series of lights which were connected individually to magnetic position indicators (Fig. A. 7) on the tubing. These lights indicated the exact location of the source at any time. The control system could start, stop, or reverse the movement of the source with maximum speed obtainable in either direction.

Dosimeters in the building accumulated the radiation exposures as the source traveled through the tubing. Figure A. 8 is an operational diagram of the MRMU system.

A. 3 INSTRUMENTATION

Instruments used for radiation measurements in a structure included integrating ionization chambers with associated charger-readers (Fig. A. 9).

Approximately 250 Victoreen model 362 chambers (0- to 200-mr pocket ionization chambers) and 140 Victoreen model 239 chambers (0- to 10-mr stray-radiation chambers) were used in this experiment. Victoreen model 287 minometers were used for charging and reading these chambers.

The chambers were calibrated with a ^{60}Co standard. Several chambers were selected at random and exposed several times to obtain an average exposure and standard deviation at several points over the range of the instruments. Calibration curves for the two types of chambers, at standard temperature and pressure (20°C, 760 mm) are shown in Figs. A.10 and A.11.

The energy and angular response of the low-range (10 mr) chambers was measured at the EG&G Santa Barbara Laboratories. The response curves are presented in Figs. A.12 and A.13. The energy and angular response of the high-range (200-mr) chambers has been discussed by F. W. Sanders et al.¹

Health physics monitoring equipment consisted of radiation meters, alarms, film badges, and pocket ionization chambers (Fig. A.14).

REFERENCE

1. F. W. Sanders, J. A. Auxier, and J. S. Cheka, "A Simple Method of Minimizing the Energy Dependence of Pocket Ionization Chambers," Health Phys., 2: 308-309 (1960).

Fig. A.1 — Laboratory vehicle.

Fig. A.2 — The 300-curie ^{60}Co source, photo and detail drawing.

Fig. A.3 — Large ^{60}Co source shield.

Fig. A. 4 — Source truck showing shields and pumping system.

Fig. A. 5 — Emergency hand pump.

Fig. A.6 — Remote-control console.

Fig. A.7 — Source-position indicator.

Fig. A.8 — Operational diagram of the MRMU system.

Fig. A.9 — Ionization chambers and charger-reader.

Fig. A.10 — Calibration curve for Victoreen model 362 ionization chamber.

Fig. A.11 — Calibration curve for Victoreen model 239 ionization chamber.

Fig. A.12 — Energy response of Victoreen model 239 ionization chamber.

Fig. A.13 — Relative angular response with ^{137}Cs , Victoreen model 239 chamber.

Fig. A.14 — Health-physics instruments.

Appendix B

PRESENTATION OF NORMALIZED DATA

B.1 GENERAL

Because of the volume of data collected, the necessary corrections, normalizations, and calculations to be performed, data were processed through a digital computer for appropriate output. Most of the data in this appendix appear in machine format. All zeros in the tables indicate that no data were taken at that point.

The notation E-01 in the tables means 10^{-1} , E-02 means 10^{-2} etc. Thus a data point 9.070E-02 becomes 9.070×10^{-2} , or 0.091 rounded to two significant figures.

In several tables the position numbers do not necessarily follow in order. Different exposure times were used for different detector positions; therefore data appear in this particular order because of the computer input code.

At the beginning of the project, only a few positions were used for the measurements. However, it was soon decided that, since charging and placing the dosimeters was a minor consumer of time, several positions would be used in each house to obtain wider coverage. At most positions a datum point appears at a height of 3 ft. To increase coverage, data at other heights were taken at selected points.

Reference should be made to Table 3.1, which contains a brief description of most of the experiments and exposure parameters.

Data are presented in tables at each position and height. Detector positions are plotted on floor plans, appearing at the first of each group of data.

Exposure rates reported are normalized as follows: for area sources, milliroentgens/hour per millicurie/square foot; for ring sources milliroentgen/hour per millicurie/foot of circumference; and for point sources, milliroentgen/hour per curie. These data are not expected to be good to more than two significant figures, even though the machine output is in four numbers.

In several instances more than one exposure was made for a specific measurement. In these cases data in the tables reflect the average of the readings.

B. 2 REINFORCED-MASONRY-BLOCK HOUSE

Basic modifications to the RMB house consisted of those shown in Fig. B. 1 except that the outside concrete-block wall was built up only to mid-window height. Data were then taken with the tubing in a 42.5-ft-radius ring source, a 115-ft-radius ring source, an area source distributed on the ground from the building out to about 50 ft, and an area source distributed on the roof. These data appear in Tables B. 1 to B. 4, corresponding to the preceding source geometries.

Construction of the outside concrete-block wall was then completed to the roof level, and the 42.5-ft-radius ring-source measurement was repeated. These results appear in Table B. 5.

B. 3 PRECAST CONCRETE HOUSE

Almost identical source configurations and procedures for measurements were used at the PCC house as at the RMB house. Dosimeter positions appear in Fig. B. 2 and data appear in Tables B. 6 to B. 10.

B. 4 WOOD RAMBLER HOUSE

Before modification of the WR house, three ring-source measurements were made to compare with previous data (USAEC Report CEX-58.1) and to estimate the protection factors before modification. The radii of the ring sources were 25.5, 63.7, and 127 ft, and data appear in Tables B. 11 to B. 13. Dosimeter positions before modification appear in Fig. B. 3.

The basic modifications consisted of those shown on the floor plan in Fig. B. 4 with the exception of the transite and planter. Data were taken with the tubing distributed at radii of 63.7 and 127 ft; on the ground, from the building out to about 50 ft, and on the roof (see Tables B. 14 to B. 17).

The 63.7-ft ring-source and roof exposures were repeated after the addition of the transite (Tables B. 18 and B. 19). The ring-source measurements of 63.7- and 127-ft radius were repeated after the planter was added (Tables B. 20 and B. 21).

B. 5 TWO-STORY BRICK HOUSE

Two measurements were made from ring sources at radii of 25.5 and 42.5 ft with the old shelters in place at the 2SB house to compare with previous experiments (CEX-58.1). Dosimeter positions appear in Fig. B. 5 and data appear in Tables B. 22 and B. 23.

Shelters were removed and measurements were taken from ring sources at radii of 25.5, 42.5, 63.7, and 127 ft. Dosimeter positions are shown in Fig. B. 6 and data are given in Tables B. 24 to B. 27.

A shelter was constructed in one end of the basement as shown in the floor plan (Fig. B. 7). The shelter roof consisted of 2-in. precast lightweight-concrete planks and a 4-in. poured concrete slab at a height of 6 ft 8 in. above the basement floor. Table B. 28 presents data from a ring source at a radius of 42.5 ft before the curtain wall was constructed near the basement entrance.

The curtain wall was constructed, and measurements were made from ring sources at 42.5 and 127 ft and from an area source on the ground (see Tables B. 29 to B. 31).

For the roof-contribution estimate, a point source was placed on top of the roof in the center, and the exposure rate was measured at several positions within. Identical measurements were made at the 2SWF house in similar positions. These data and data from an area source on the roof of the 2SWF house were used to estimate roof contribution at points in the basement of the 2SB house. These data appear in Sec. B. 6.

B. 6 TWO-STORY WOOD FRAME HOUSE

Before the 2SWF house was modified several measurements were made in the basement from six ring sources at radii of 25.5, 29.0, 32.5, 36.6, 42.5, 63.7, and 127 ft. Data are given in Tables B. 32 to B. 38, according to the dosimeter positions on the floor plan in Fig. B. 8.

The modification consisted in constructing 8-in. concrete walls and a 6-in. concrete roof near the center shelter (Fig. B. 9). A 42.5-ft-radius measurement was made after this construction (see Table B. 39).

A curtain wall was then constructed near the basement entrance, and measurements were made from ring sources at 42.5- and 127-ft radii and from area sources on the ground and on the roof (see Tables B. 40 to B. 43).

For estimating the effect of fallout located on the stairway entrance to the basement, 12 ⁶⁰Co sources of 2.2 mc each were evenly placed on the stairs, and the exposure rate was measured at several locations in the basement before and after the curtain wall was constructed. These data appear on a partial floor plan in Fig. B. 10 in mr/hr per mc/sq ft.

As mentioned in Sec. B. 5, measurements were made in the basement of both two-story buildings from a point source on each roof for estimating the roof contribution of the 2SB house (see Table B. 44).

B. 7 FREE-FIELD MEASUREMENTS

Two different area sources were effected on the ground with the MRMU system, and the radiation level was measured at several points over these areas. Tubing layouts are shown in Figs. B. 11 and B. 12, and dosimeter positions are shown in Figs. B. 13 and B. 14. Data appear in Tables B. 45 and B. 46.

TABLE B.1 — EXPOSURE RATES FROM 42.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT,
RMB HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.140E-00	0.	0.	0.
2	0.	1.112E-00	0.	0.
3	0.	6.081E-01	0.	0.
4	5.146E-01	5.768E-01	7.354E-01	0.
5	4.992E-01	5.924E-01	6.873E-01	0.
6	0.	6.449E-01	0.	0.
7	0.	1.055E-00	0.	0.
8	7.784E-01	7.317E-01	9.930E-01	7.651E-01
9	0.	6.502E-01	0.	0.
10	5.768E-01	6.714E-01	8.765E-01	0.
11	0.	6.186E-01	0.	0.
12	4.889E-01	5.924E-01	1.033E-00	0.
13	0.	4.889E-01	0.	0.
14	0.	4.889E-01	0.	0.
15	1.283E-01	4.379E-01	3.975E-01	0.
16	1.713E-01	4.787E-01	5.716E-01	0.
17	4.177E-01	5.872E-01	9.706E-01	0.
18	0.	0.	0.	0.
19	6.449E-01	0.	0.	0.
20	0.	4.532E-01	0.	0.
21	2.634E-01	3.674E-01	6.344E-01	0.
22	0.	7.173E-01	0.	0.
23	7.161E-02	2.147E-01	2.002E-01	0.
33	0.	1.073E-01	1.569E-01	0.
34	0.	1.665E-01	0.	0.
35	0.	1.378E-01	0.	0.
37	0.	1.331E-01	0.	0.
38	2.585E-01	2.341E-01	4.025E-01	0.
39	0.	2.099E-01	0.	0.
40	0.	5.664E-01	0.	0.
41	4.025E-01	3.674E-01	6.029E-01	0.
42	0.	3.474E-01	0.	0.
43	0.	4.379E-01	0.	0.
44	4.126E-01	4.481E-01	4.922E-01	0.
45	0.	4.634E-01	0.	0.
46	5.220E-01	5.664E-01	7.567E-01	7.407E-01
48	1.378E-01	1.521E-01	1.426E-01	0.
49	0.	2.176E-01	0.	0.
50	2.732E-01	2.693E-01	5.075E-01	0.
51	1.046E-01	1.331E-01	1.905E-01	0.
53	2.978E-01	3.325E-01	5.664E-01	0.
54	0.	3.824E-01	0.	0.
55	0.	5.976E-01	0.	0.
56	0.	6.714E-01	0.	0.
57	6.608E-01	5.198E-01	0.	0.
58	9.986E-01	7.151E-01	1.083E-00	1.027E-00
59	0.	6.873E-01	0.	0.
60	0.	5.146E-01	0.	0.
61	4.838E-01	5.872E-01	7.461E-01	0.
62	0.	4.177E-01	0.	0.
24	4.343E-02	1.056E-01	1.231E-01	0.
25	0.	9.070E-02	0.	0.
26	0.	5.018E-02	0.	0.
27	2.182E-02	3.668E-02	4.298E-02	0.
28	2.722E-02	4.073E-02	4.208E-02	0.
29	0.	3.128E-02	0.	0.
30	3.803E-02	5.018E-02	5.424E-02	0.
31	0.	7.970E-02	0.	0.
32	0.	7.585E-02	0.	0.
36	5.694E-02	8.125E-02	7.450E-02	0.
47	0.	8.125E-02	0.	0.
52	0.	7.476E-02	0.	0.
33	8.935E-02	0.	0.	0.

TABLE B.2 — EXPOSURE RATES FROM 115-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT
RMB HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	2.656E-01	3.154E-01	3.346E-01	3.322E-01
2	0.	2.868E-01	0.	0.
3	0.	1.714E-01	0.	0.
4	1.512E-01	1.940E-01	2.238E-01	0.
5	1.535E-01	1.746E-01	2.376E-01	0.
6	0.	1.714E-01	0.	0.
7	0.	2.656E-01	0.	0.
8	1.986E-01	2.353E-01	2.703E-01	2.609E-01
9	0.	1.827E-01	0.	0.
10	1.917E-01	1.875E-01	2.726E-01	0.
11	0.	1.736E-01	0.	0.
12	1.669E-01	1.736E-01	3.106E-01	0.
13	0.	1.357E-01	0.	0.
14	0.	1.268E-01	0.	0.
15	1.115E-01	1.158E-01	1.537E-01	0.
16	1.268E-01	1.602E-01	2.008E-01	0.
17	1.602E-01	2.656E-01	2.844E-01	0.
18	0.	3.784E-01	0.	0.
19	1.736E-01	3.661E-01	3.784E-01	0.
20	0.	2.100E-01	0.	0.
21	2.402E-02	1.535E-01	1.917E-01	0.
22	0.	2.008E-01	0.	0.
23	5.747E-02	6.815E-02	6.815E-02	0.
33	0.	3.628E-02	0.	0.
34	0.	4.261E-02	0.	0.
35	0.	4.050E-02	0.	0.
37	0.	3.417E-02	0.	0.
38	6.397E-02	8.320E-02	1.270E-01	0.
39	0.	6.387E-02	0.	0.
40	0.	1.270E-01	0.	0.
41	1.047E-01	1.027E-01	1.917E-01	0.
42	0.	8.105E-02	0.	0.
43	0.	1.071E-01	0.	0.
44	1.027E-01	1.071E-01	1.557E-01	0.
45	0.	1.224E-01	0.	0.
46	1.468E-01	1.490E-01	2.146E-01	2.123E-01
48	4.261E-02	4.261E-02	8.536E-02	0.
49	0.	4.684E-02	0.	0.
50	7.029E-02	7.244E-02	1.512E-01	0.
51	2.787E-02	3.628E-02	4.876E-02	0.
53	8.536E-02	1.071E-01	1.731E-01	0.
54	0.	1.335E-01	0.	0.
55	0.	1.470E-01	0.	0.
56	0.	2.054E-01	0.	0.
57	1.490E-01	1.379E-01	3.178E-01	0.
58	1.763E-01	2.353E-01	2.703E-01	2.633E-01
59	0.	1.940E-01	0.	0.
60	0.	1.423E-01	0.	0.
61	1.136E-01	1.357E-01	2.376E-01	0.
62	0.	1.027E-01	0.	0.
24	2.422E-02	3.379E-02	3.060E-02	0.
25	0.	2.832E-02	0.	0.
26	0.	1.556E-02	0.	0.
27	8.727E-03	1.146E-02	1.419E-02	0.
28	9.638E-03	1.328E-02	1.511E-02	0.
29	0.	1.007E-02	0.	0.
30	1.283E-02	1.647E-02	2.057E-02	0.
31	0.	2.422E-02	0.	0.
32	0.	2.240E-02	0.	0.
36	2.148E-02	2.057E-02	3.698E-02	0.
47	0.	2.148E-02	0.	0.
52	0.	2.969E-02	0.	0.
33	2.786E-02	0.	0.	0.

TABLE B.3 - EXPOSURE RATES FROM GROUND EXPOSURE,
NORMALIZED TO MR/HR PER MC/SQ FT, RMB HOUSE,
POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	3.258E 01	0.	0.
4	2.645E 01	3.347E 01	3.081E 01	0.
5	2.601E 01	3.347E 01	2.810E 01	0.
6	0.	3.481E 01	0.	0.
7	0.	0.	0.	0.
8	3.819E 01	0.	3.979E 01	3.774E 01
9	0.	3.593E 01	0.	0.
10	1.755E 01	3.302E 01	3.459E 01	0.
11	0.	2.062E 01	0.	0.
12	2.710E 01	2.645E 01	4.440E 01	0.
13	0.	2.301E 01	0.	0.
14	0.	2.068E 01	0.	0.
15	5.460E 00	1.776E 01	1.726E 01	0.
16	7.818E 00	2.174E 01	2.465E 01	0.
17	1.384E 01	2.818E 01	3.979E 01	0.
18	0.	0.	0.	0.
19	3.526E 01	0.	0.	0.
20	0.	2.645E 01	0.	0.
21	9.805E 00	2.810E 01	2.580E 01	0.
22	0.	3.414E 01	0.	0.
23	2.939E 00	9.406E 00	9.805E 00	0.
33	1.242E 01	5.460E 00	0.	0.
34	0.	7.226E 00	0.	0.
35	0.	5.851E 00	0.	0.
37	0.	4.875E 00	0.	0.
38	1.041E 01	1.222E 01	0.	0.
39	0.	1.041E 01	0.	0.
40	0.	2.753E 01	0.	0.
41	1.589E 01	2.174E 01	2.387E 01	0.
42	0.	1.589E 01	0.	0.
43	0.	2.523E 01	0.	0.
44	2.216E 01	2.387E 01	2.110E 01	0.
45	0.	2.751E 01	0.	0.
46	3.706E 01	3.236E 01	3.414E 01	3.481E 01
48	3.705E 00	6.459E 00	6.832E 00	0.
49	0.	0.	0.	0.
50	8.412E 00	1.242E 01	1.486E 01	0.
51	2.939E 00	5.460E 00	5.851E 00	0.
53	9.406E 00	1.589E 01	2.110E 01	0.
54	0.	2.089E 01	0.	0.
55	0.	3.347E 01	0.	0.
56	0.	3.571E 01	0.	0.
57	2.601E 01	3.302E 01	4.139E 01	0.
58	0.	0.	4.208E 01	0.
59	0.	3.777E 01	0.	0.
60	0.	3.037E 01	0.	0.
61	2.776E 01	3.081E 01	3.125E 01	0.
62	0.	2.429E 01	0.	0.
24	2.294E 00	3.967E 00	4.854E 00	0.
25	0.	3.159E 00	0.	0.
26	0.	0.	0.	0.
27	6.645E-01	1.181E 00	1.572E 00	0.
28	6.645E-01	1.376E 00	1.657E 00	0.
29	0.	1.181E 00	0.	0.
30	0.	0.	0.	0.
31	0.	2.892E 00	0.	0.
32	0.	3.629E 00	0.	0.
36	1.181E 00	3.092E 00	3.293E 00	0.
47	0.	0.	0.	0.
52	0.	4.239E 00	0.	0.
33	0.	0.	0.	0.
38	0.	0.	1.413E 01	0.

TABLE B.4 - EXPOSURE RATES FROM ROOF EXPOSURE,
NORMALIZED TO MR/HR PER MC/SQ FT,
RMB HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	4.374E 00	5.988E 00	8.035E 00	9.786E 00
2	0.	5.882E 00	0.	0.
3	0.	5.619E 00	0.	0.
4	4.786E 00	6.147E 00	8.677E 00	0.
5	4.837E 00	5.988E 00	7.598E 00	0.
6	0.	6.466E 00	0.	0.
7	0.	6.359E 00	0.	0.
8	3.712E 00	5.357E 00	8.586E 00	0.
9	0.	6.466E 00	0.	0.
10	5.514E 00	7.056E 00	9.647E 00	0.
11	0.	7.707E 00	0.	0.
12	2.810E 00	4.067E 00	3.510E 00	0.
13	0.	4.477E 00	0.	0.
14	0.	4.374E 00	0.	0.
15	3.510E 00	3.813E 00	3.510E 00	0.
16	4.889E 00	5.357E 00	5.882E 00	0.
17	7.543E 00	9.198E 00	0.	0.
18	0.	7.647E 00	0.	0.
19	7.164E 00	9.254E 00	1.010E 01	0.
20	0.	7.707E 00	0.	0.
21	4.323E 00	5.567E 00	6.948E 00	0.
22	0.	6.359E 00	0.	0.
23	0.	0.	0.	0.
33	0.	0.	0.	0.
34	0.	0.	0.	0.
35	0.	0.	0.	0.
37	0.	0.	0.	0.
38	5.045E 00	6.519E 00	8.752E 00	0.
39	0.	6.041E 00	0.	0.
40	0.	7.704E 00	0.	0.
41	6.573E 00	9.031E 00	0.	0.
42	0.	0.	0.	0.
43	0.	4.941E 00	0.	0.
44	4.941E 00	6.733E 00	1.021E 01	0.
45	0.	9.145E 00	0.	0.
46	5.619E 00	7.002E 00	1.033E 01	0.
48	0.	0.	1.296E 00	0.
49	0.	1.925E 00	0.	0.
50	3.079E 00	3.307E 00	3.864E 00	0.
51	0.	0.	1.546E 00	0.
53	3.813E 00	4.837E 00	5.988E 00	0.
54	0.	6.306E 00	0.	0.
55	0.	6.573E 00	0.	0.
56	0.	9.254E 00	0.	0.
57	6.041E 00	8.310E 00	0.	0.
58	4.837E 00	6.306E 00	8.677E 00	1.027E 01
59	0.	8.808E 00	0.	0.
60	0.	0.	0.	0.
61	3.661E 00	4.941E 00	8.808E 00	0.
62	0.	4.271E 00	0.	0.
24	9.020E-01	9.595E-01	1.036E 00	0.
25	0.	7.875E-01	0.	0.
26	0.	8.637E-01	0.	0.
27	5.046E-01	5.984E-01	9.787E-01	0.
28	6.361E-01	0.	0.	0.
29	0.	5.796E-01	0.	0.
30	7.875E-01	9.211E-01	1.056E 00	0.
31	0.	9.020E-01	0.	0.
32	0.	8.066E-01	0.	0.
36	1.505E 00	1.328E 00	1.152E 00	0.
47	0.	7.875E-01	0.	0.
52	0.	8.829E-01	0.	0.
33	1.485E 00	1.387E 00	1.604E 00	0.
38	0.	0.	0.	0.
34	0.	3.236E 00	0.	0.
35	0.	1.036E 00	0.	0.
37	0.	2.394E 00	0.	0.
48	1.152E 00	1.485E 00	0.	0.
51	1.114E 00	1.387E 00	0.	0.

TABLE B.5 — EXPOSURE RATES FROM 42.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT,
RMB HOUSE, POSTMODIFICATION, WINDOW BLOCKED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	0.	0.	0.	0.
2	0.	0.	0.	0.
3	0.	6.380E-01	0.	0.
4	5.519E-01	6.109E-01	7.753E-01	0.
5	5.572E-01	6.163E-01	7.199E-01	0.
6	0.	6.652E-01	0.	0.
7	0.	0.	0.	0.
8	8.311E-01	9.444E-01	1.013E 00	9.501E-01
9	0.	6.706E-01	0.	0.
10	5.626E-01	7.090E-01	8.875E-01	0.
11	0.	6.271E-01	0.	0.
12	4.882E-01	6.055E-01	0.	0.
13	0.	5.093E-01	0.	0.
14	0.	5.041E-01	0.	0.
15	1.468E-01	4.514E-01	3.993E-01	0.
16	1.814E-01	5.041E-01	5.519E-01	0.
17	3.941E-01	6.109E-01	9.387E-01	0.
18	0.	0.	0.	0.
19	5.840E-01	0.	0.	0.
20	0.	4.514E-01	0.	0.
21	2.462E-01	3.529E-01	6.434E-01	0.
22	0.	6.706E-01	0.	0.
23	0.	0.	0.	0.
33	9.795E-02	1.077E-01	1.419E-01	0.
34	0.	1.616E-01	0.	0.
35	0.	1.077E-01	0.	0.
37	0.	1.272E-01	0.	0.
38	2.765E-01	2.362E-01	3.993E-01	0.
39	0.	2.062E-01	0.	0.
40	0.	6.597E-01	0.	0.
41	4.462E-01	3.683E-01	6.380E-01	0.
42	0.	3.632E-01	0.	0.
43	0.	4.410E-01	0.	0.
44	4.149E-01	4.619E-01	5.359E-01	0.
45	0.	4.935E-01	0.	0.
46	5.733E-01	5.679E-01	8.255E-01	7.808E-01
48	1.126E-01	1.518E-01	1.567E-01	0.
49	0.	1.963E-01	0.	0.
50	2.563E-01	2.462E-01	4.619E-01	0.
51	9.795E-02	1.370E-01	1.567E-01	0.
53	3.120E-01	3.273E-01	5.786E-01	0.
54	0.	4.077E-01	0.	0.
55	0.	6.001E-01	0.	0.
56	0.	6.597E-01	0.	0.
57	6.217E-01	5.199E-01	0.	0.
58	8.311E-01	8.988E-01	1.002E 00	9.903E-01
59	0.	7.144E-01	0.	0.
60	0.	5.041E-01	0.	0.
61	4.514E-01	5.733E-01	7.697E-01	0.
62	0.	4.149E-01	0.	0.
24	3.637E-02	1.087E-01	1.226E-01	0.
25	0.	8.783E-02	0.	0.
26	0.	4.750E-02	0.	0.
27	4.611E-02	3.359E-02	3.915E-02	0.
28	2.524E-02	3.637E-02	4.054E-02	0.
29	0.	4.054E-02	0.	0.
30	3.081E-02	4.750E-02	4.750E-02	0.
31	0.	7.670E-02	0.	0.
32	0.	7.531E-02	0.	0.
36	3.498E-02	8.365E-02	7.114E-02	0.
47	0.	8.087E-02	0.	0.
52	0.	9.478E-02	0.	0.

TABLE B.6 — EXPOSURE RATES FROM 127-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT,
PCC HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.626E-01	1.881E-01	2.182E-01	2.096E-01
2	4.192E-02	7.594E-02	1.003E-01	0.
3	4.987E-02	9.625E-02	1.209E-01	0.
4	4.192E-02	9.625E-02	1.230E-01	0.
5	0.	8.810E-02	0.	0.
6	0.	1.209E-01	0.	0.
7	1.044E-01	1.250E-01	1.500E-01	1.542E-01
8	0.	1.106E-01	0.	0.
9	7.594E-02	9.829E-02	1.626E-01	0.
10	5.986E-02	1.168E-01	1.188E-01	0.
11	0.	0.	0.	0.
12	0.	2.885E-01	0.	0.
13	0.	2.752E-01	0.	0.
14	0.	1.796E-01	0.	0.
15	6.186E-02	0.	1.458E-01	0.
16	0.	6.788E-02	1.065E-01	0.
17	4.192E-02	6.587E-02	0.	0.
18	0.	7.999E-02	0.	0.
19	7.594E-02	9.625E-02	2.267E-01	0.
20	1.024E-01	1.542E-01	1.626E-01	0.
21	1.003E-01	1.147E-01	1.354E-01	0.
22	0.	1.126E-01	0.	0.
23	0.	1.396E-01	0.	0.
24	4.391E-02	7.625E-02	1.106E-01	0.
35	2.023E-02	2.416E-02	3.598E-02	0.
36	2.612E-02	3.006E-02	7.796E-02	0.
37	0.	7.796E-02	0.	0.
38	8.404E-02	1.003E-01	1.500E-01	1.584E-01
39	0.	5.986E-02	0.	0.
40	3.994E-02	5.386E-02	0.	0.
41	2.416E-02	3.598E-02	7.796E-02	0.
42	0.	4.192E-02	0.	0.
43	4.391E-02	5.586E-02	1.003E-01	0.
44	4.391E-02	5.986E-02	1.168E-01	0.
45	0.	2.219E-02	0.	0.
*46	6.208E-03	1.259E-02	2.023E-02	0.
*47	0.	1.047E-02	0.	0.
48	1.209E-01	1.271E-01	0.	0.
49	0.	8.607E-02	0.	0.
50	6.788E-02	8.404E-02	1.605E-01	0.
51	9.625E-02	1.188E-01	2.443E-01	0.
52	0.	9.421E-02	0.	0.
53	1.147E-01	1.209E-01	1.988E-01	0.
54	0.	1.312E-01	0.	0.
55	0.	1.417E-01	0.	0.
56	1.458E-01	2.031E-01	2.074E-01	2.096E-01
57	0.	0.	0.	0.
58	0.	0.	0.	0.
59	0.	0.	0.	0.
60	0.	0.	0.	0.
61	0.	0.	0.	0.
26	0.	0.	0.	0.
28	0.	0.	0.	0.
11	0.	1.704E-01	0.	0.
15	0.	1.275E-01	0.	0.
24	0.	0.	0.	0.
25	1.141E-02	1.685E-02	2.093E-02	0.
26	5.513E-03	8.235E-03	1.005E-02	0.
27	0.	7.328E-03	0.	0.
28	4.153E-03	9.142E-03	0.	0.
29	3.246E-03	5.967E-03	8.235E-03	0.
30	6.420E-03	1.685E-02	1.549E-02	0.
31	0.	1.277E-02	0.	0.
32	9.595E-03	1.322E-02	3.318E-02	0.
33	1.232E-02	1.776E-02	4.270E-02	0.
34	0.	1.575E-02	0.	0.
35	0.	0.	0.	0.
36	0.	0.	0.	0.
40	0.	0.	1.275E-01	0.
44	0.	0.	0.	0.
45	0.	0.	0.	0.
46	0.	0.	0.	0.
47	0.	0.	0.	0.
48	0.	0.	3.375E-01	0.
49	0.	0.	0.	0.
50	0.	0.	0.	0.
57	0.	2.050E-01	0.	0.
58	0.	1.790E-01	0.	0.
59	1.704E-01	1.920E-01	2.575E-01	0.
60	0.	2.268E-01	0.	0.
61	0.	2.707E-01	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
41	0.	0.	0.	0.

*Readings extremely low, invalid data.

TABLE B.7 — EXPOSURE RATES FROM 42.5-FT RADIUS EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, PCC HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	7.738E-01	8.690E-01	8.477E-01	8.743E-01
2	1.472E-01	2.882E-01	2.929E-01	0.
3	1.012E-01	3.121E-01	3.748E-01	0.
4	9.208E-02	2.786E-01	3.651E-01	0.
5	0.	2.786E-01	0.	0.
6	0.	4.581E-01	0.	0.
7	4.138E-01	5.078E-01	5.730E-01	5.730E-01
8	0.	4.089E-01	0.	0.
9	1.380E-01	3.121E-01	5.629E-01	0.
10	1.288E-01	4.978E-01	4.779E-01	0.
11	0.	7.320E-01	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	7.425E-01	0.	0.
15	1.242E-01	5.228E-01	5.278E-01	0.
16	8.296E-02	2.171E-01	2.691E-01	0.
17	0.	2.218E-01	0.	0.
18	0.	2.644E-01	0.	0.
19	2.882E-01	3.265E-01	8.583E-01	0.
20	4.335E-01	6.751E-01	6.648E-01	0.
21	4.089E-01	5.228E-01	5.278E-01	0.
22	0.	4.631E-01	0.	0.
23	0.	5.529E-01	0.	0.
24	1.104E-01	2.407E-01	5.128E-01	0.
35	0.	0.	0.	0.
36	0.	0.	0.	0.
37	0.	3.506E-01	0.	0.
38	4.236E-01	4.631E-01	6.187E-01	6.136E-01
39	0.	2.576E-01	0.	0.
40	1.426E-01	1.937E-01	4.680E-01	0.
41	0.	0.	1.380E-01	0.
42	0.	1.751E-01	0.	0.
43	1.150E-01	1.984E-01	3.169E-01	0.
44	1.519E-01	2.313E-01	2.644E-01	0.
45	0.	0.	0.	0.
46	0.	0.	0.	0.
47	0.	0.	0.	0.
48	5.278E-01	5.730E-01	0.	0.
49	0.	3.313E-01	0.	0.
50	1.472E-01	3.025E-01	3.700E-01	0.
51	4.236E-01	5.128E-01	0.	0.
52	0.	3.651E-01	0.	0.
53	4.779E-01	5.629E-01	7.372E-01	0.
54	0.	6.187E-01	0.	0.
55	0.	6.597E-01	0.	0.
56	7.791E-01	9.766E-01	9.766E-01	9.279E-01
57	0.	0.	0.	0.
58	0.	0.	0.	0.
59	0.	0.	0.	0.
60	0.	0.	0.	0.
61	0.	0.	0.	0.
26	0.	0.	0.	0.
28	0.	0.	0.	0.
11	0.	0.	0.	0.
15	0.	0.	0.	0.
24	0.	0.	0.	0.
25	2.803E-02	5.851E-02	7.176E-02	0.
26	1.611E-02	2.803E-02	3.731E-02	0.
27	0.	2.141E-02	0.	0.
28	1.346E-02	3.068E-02	2.936E-02	0.
29	9.484E-03	2.008E-02	2.273E-02	0.
30	2.008E-02	6.249E-02	4.261E-02	0.
31	0.	4.924E-02	0.	0.
32	3.598E-02	5.056E-02	6.381E-02	0.
33	5.454E-02	7.441E-02	9.694E-02	0.
34	0.	7.309E-02	0.	0.
35	6.911E-02	7.839E-02	1.036E-01	0.
36	1.102E-01	1.195E-01	0.	0.
40	0.	0.	0.	0.
44	0.	0.	0.	0.
45	0.	7.309E-02	0.	0.
46	2.008E-02	3.598E-02	4.261E-02	0.
47	0.	3.068E-02	0.	0.
48	0.	0.	0.	0.
49	0.	0.	0.	0.
50	0.	0.	0.	0.
57	0.	8.684E-01	0.	0.
58	0.	9.204E-01	0.	0.
59	5.862E-01	8.684E-01	1.130E 00	0.
60	0.	1.038E 00	0.	0.
61	0.	1.398E 00	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
41	5.984E-02	1.168E-01	0.	0.

TABLE B.8 — EXPOSURE RATES FROM GROUND EXPOSURE, NORMALIZED TO MR/HR PER MC/SQ FT, PCC HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	0.	0.	3.905E 01	3.860E 01
2	5.792E 00	1.090E 01	1.170E 01	0.
3	4.055E 00	1.130E 01	1.453E 01	0.
4	4.055E 00	1.050E 01	1.351E 01	0.
5	0.	1.031E 01	0.	0.
6	0.	1.739E 01	0.	0.
7	2.473E 01	2.367E 01	2.197E 01	2.197E 01
8	0.	1.842E 01	0.	0.
9	5.598E 00	1.170E 01	1.760E 01	0.
10	4.825E 00	1.371E 01	1.718E 01	0.
11	0.	2.240E 01	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	2.688E 01	0.	0.
15	4.247E 00	1.412E 01	1.967E 01	0.
16	3.289E 00	7.545E 00	9.711E 00	0.
17	0.	8.920E 00	0.	0.
18	0.	1.090E 01	0.	0.
19	1.822E 01	1.718E 01	3.905E 01	0.
20	2.623E 01	3.255E 01	3.101E 01	0.
21	2.261E 01	2.494E 01	2.197E 01	0.
22	0.	1.780E 01	0.	0.
23	0.	2.176E 01	0.	0.
24	3.672E 00	8.526E 00	1.371E 01	0.
35	0.	0.	0.	0.
36	0.	0.	0.	0.
37	0.	1.616E 01	0.	0.
38	2.176E 01	1.967E 01	2.796E 01	2.559E 01
39	0.	1.050E 01	0.	0.
40	4.055E 00	8.133E 00	1.371E 01	0.
41	2.336E 00	4.247E 00	5.792E 00	0.
42	0.	6.374E 00	0.	0.
43	5.598E 00	7.937E 00	7.513E 00	0.
44	6.374E 00	8.723E 00	9.315E 00	0.
45	0.	2.526E 00	0.	0.
46	0.	0.	0.	0.
47	0.	0.	0.	0.
48	2.602E 01	2.580E 01	0.	0.
49	0.	1.371E 01	0.	0.
50	5.404E 00	1.170E 01	1.554E 01	0.
51	1.210E 01	2.155E 01	2.948E 01	0.
52	0.	1.575E 01	0.	0.
53	2.796E 01	2.602E 01	3.057E 01	0.
54	0.	2.861E 01	0.	0.
55	0.	2.882E 01	0.	0.
56	4.294E 01	4.110E 01	3.544E 01	3.477E 01
57	0.	0.	0.	0.
58	0.	0.	0.	0.
59	0.	0.	0.	0.
60	0.	0.	0.	0.
61	0.	0.	0.	0.
*26	0.	8.271E-01	0.	0.
28	0.	0.	0.	0.
11	0.	0.	0.	0.
15	0.	0.	0.	0.
24	0.	0.	0.	0.
25	1.090E 00	2.137E 00	2.542E 00	0.
26	5.972E-01	0.	1.386E 00	0.
27	0.	9.419E-01	0.	0.
28	4.235E-01	9.910E-01	1.238E 00	0.
29	4.235E-01	6.480E-01	8.927E-01	0.
30	7.457E-01	1.486E 00	1.585E 00	0.
31	0.	2.137E 00	0.	0.
32	1.386E 00	1.986E 00	2.491E 00	0.
33	2.187E 00	4.514E 00	0.	0.
34	0.	3.362E 00	0.	0.
35	4.197E 00	3.414E 00	3.987E 00	0.
36	5.637E 00	5.152E 00	0.	0.
40	0.	0.	0.	0.
44	0.	0.	0.	0.
45	0.	0.	0.	0.
46	8.437E-01	1.486E 00	1.535E 00	0.
47	0.	1.040E 00	0.	0.
48	0.	0.	0.	0.
49	0.	0.	0.	0.
50	0.	0.	0.	0.
*57	0.	9.437E 00	0.	0.
*58	0.	8.748E 00	0.	0.
*59	0.	7.321E 00	0.	0.
60	0.	0.	0.	0.
61	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
41	0.	0.	0.	0.

*Reading extremely low, invalid data.

TABLE B.9 — EXPOSURE RATES FROM ROOF EXPOSURE,
NORMALIZED TO MR/HR PER MC/SQ FT,
PCC HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	7.450E 00	9.186E 00	1.187E 01	0.
2	7.913E 00	9.118E 00	1.308E 01	0.
3	1.083E 01	1.215E 01	1.401E 01	0.
4	1.055E 01	1.230E 01	1.279E 01	0.
5	0.	1.117E 01	0.	0.
6	0.	1.401E 01	0.	0.
7	7.450E 00	9.051E 00	1.223E 01	0.
8	0.	1.187E 01	0.	0.
9	1.111E 01	1.329E 01	0.	0.
10	1.215E 01	0.	0.	0.
11	0.	0.	0.	0.
12	0.	1.201E 01	0.	0.
13	0.	1.351E 01	0.	0.
14	0.	0.	0.	0.
15	1.104E 01	0.	0.	0.
16	7.715E 00	8.446E 00	9.321E 00	0.
17	0.	1.014E 01	0.	0.
18	0.	9.661E 00	0.	0.
19	7.450E 00	9.321E 00	1.035E 01	0.
20	9.118E 00	1.117E 01	0.	0.
21	7.122E 00	8.647E 00	1.138E 01	0.
22	0.	9.457E 00	0.	0.
23	0.	1.173E 01	0.	0.
24	0.	0.	0.	0.
25	0.	0.	0.	0.
26	6.275E 00	7.450E 00	0.	0.
27	0.	1.076E 01	0.	0.
28	5.632E 00	8.113E 00	1.069E 01	0.
29	0.	1.097E 01	0.	0.
30	7.582E 00	1.041E 01	0.	0.
31	5.058E 00	6.795E 00	8.113E 00	0.
32	0.	8.379E 00	0.	0.
33	6.017E 00	6.795E 00	9.389E 00	0.
34	0.	0.	0.	0.
35	0.	0.	0.	0.
36	0.	0.	0.	0.
37	0.	0.	0.	0.
38	0.	0.	0.	0.
39	0.	0.	0.	0.
40	0.	0.	0.	0.
41	0.	0.	0.	0.
42	0.	0.	0.	0.
43	0.	0.	0.	0.
44	0.	0.	0.	0.
45	0.	0.	0.	0.
46	0.	0.	0.	0.
47	0.	0.	0.	0.
48	0.	0.	0.	0.
49	0.	0.	0.	0.
50	0.	0.	0.	0.
51	8.513E 00	1.152E 01	0.	0.
52	0.	8.916E 00	0.	0.
53	6.925E 00	8.446E 00	1.117E 01	0.
54	0.	1.265E 01	0.	0.
55	0.	9.661E 00	0.	0.
56	0.	0.	0.	0.
57	0.	1.401E 01	0.	0.
58	0.	0.	0.	0.
59	1.152E 01	0.	0.	0.
60	0.	1.343E 01	0.	0.
61	0.	1.152E 01	0.	0.
62	0.	1.134E 01	0.	0.
63	0.	0.	1.789E 00	0.
64	0.	0.	0.	0.
65	0.	0.	0.	0.
66	0.	0.	0.	0.
67	6.689E 00	0.	0.	0.
68	2.181E 00	2.398E 00	2.119E 00	0.
69	8.224E 01	0.	1.418E 00	0.
70	0.	8.224E 01	0.	0.
71	8.813E 01	1.178E 00	0.	0.
72	6.462E 01	9.404E 01	1.268E 00	0.
73	9.977E 01	1.238E 00	1.599E 00	0.
74	0.	1.690E 00	0.	0.
75	1.238E 00	1.418E 00	1.690E 00	0.
76	2.150E 00	2.367E 00	2.743E 00	0.
77	0.	1.599E 00	0.	0.
78	3.444E 00	3.638E 00	3.768E 00	0.
79	0.	0.	0.	0.
80	0.	0.	0.	0.
81	3.931E 00	3.931E 00	2.901E 00	0.
82	0.	1.148E 00	0.	0.
83	7.048E 01	1.059E 00	1.539E 00	0.
84	0.	9.404E 01	0.	0.
85	6.795E 00	0.	0.	0.
86	0.	6.795E 00	0.	0.
87	5.746E 00	0.	0.	0.
88	0.	0.	0.	0.
89	0.	0.	0.	0.
90	0.	0.	0.	0.
91	0.	0.	0.	0.
92	0.	0.	0.	0.
93	0.	0.	0.	0.
94	0.	0.	0.	0.
95	0.	0.	0.	0.
96	0.	0.	0.	0.
97	0.	0.	0.	0.
98	0.	0.	0.	0.
99	0.	0.	0.	0.
100	0.	0.	0.	0.

TABLE B.10 — EXPOSURE RATES FROM 42.5-FT RADIUS*
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT,
PCC HOUSE, POSTMODIFICATION, WINDOW BLOCKED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	7.747E-01	8.313E-01	8.313E-01	8.826E-01
2	1.538E-01	2.955E-01	3.058E-01	0.
3	0.	3.472E-01	3.785E-01	0.
4	0.	2.699E-01	3.837E-01	0.
5	0.	3.007E-01	0.	0.
6	0.	0.	0.	0.
7	4.205E-01	5.486E-01	6.029E-01	0.
8	0.	4.363E-01	0.	0.
9	1.339E-01	2.648E-01	5.594E-01	0.
10	1.140E-01	4.575E-01	4.522E-01	0.
11	0.	6.193E-01	0.	0.
12	0.	0.	0.	0.
13	0.	0.	0.	0.
14	0.	7.020E-01	0.	0.
15	1.042E-01	4.735E-01	4.948E-01	0.
16	0.	2.191E-01	2.495E-01	0.
17	0.	2.373E-01	0.	0.
18	0.	2.904E-01	0.	0.
19	3.007E-01	3.942E-01	9.402E-01	0.
20	3.890E-01	6.633E-01	6.303E-01	0.
21	3.628E-01	5.002E-01	5.109E-01	0.
22	0.	4.160E-01	0.	0.
23	0.	5.324E-01	0.	0.
24	0.	0.	3.472E-01	0.
25	0.	0.	0.	0.
26	0.	0.	0.	0.
27	0.	3.576E-01	0.	0.
28	4.047E-01	4.469E-01	6.248E-01	6.193E-01
29	0.	2.393E-01	0.	0.
30	1.388E-01	1.938E-01	3.995E-01	0.
31	0.	0.	1.091E-01	0.
32	0.	1.488E-01	0.	0.
33	0.	2.089E-01	2.904E-01	0.
34	1.488E-01	2.089E-01	2.593E-01	0.
35	0.	0.	0.	0.
36	0.	0.	0.	0.
37	0.	0.	0.	0.
38	5.486E-01	5.866E-01	0.	0.
39	0.	3.524E-01	0.	0.
40	1.488E-01	3.007E-01	3.420E-01	0.
41	4.152E-01	5.002E-01	1.028E 00	0.
42	0.	3.680E-01	0.	0.
43	4.682E-01	5.270E-01	7.579E-01	0.
44	0.	6.138E-01	0.	0.
45	0.	6.743E-01	0.	0.
46	0.	0.	0.	0.
47	0.	0.	0.	0.
48	0.	0.	0.	0.
49	0.	0.	0.	0.
50	0.	0.	0.	0.
51	0.	0.	0.	0.
52	0.	0.	0.	0.
53	0.	0.	0.	0.
54	0.	0.	0.	0.
55	0.	0.	0.	0.
56	0.	0.	0.	0.
57	0.	0.	0.	0.
58	0.	0.	0.	0.
59	0.	0.	0.	0.
60	0.	0.	0.	0.
61	0.	0.	0.	0.
62	0.	0.	0.	0.
63	0.	0.	0.	0.
64	0.	0.	0.	0.
65	0.	0.	0.	0.
66	0.	0.	0.	0.
67	0.	0.	0.	0.
68	0.	0.	0.	0.
69	0.	0.	0.	0.
70	0.	0.	0.	0.
71	0.	0.	0.	0.
72	0.	0.	0.	0.
73	0.	0.	0.	0.
74	0.	0.	0.	0.
75	0.	0.	0.	0.
76	0.	0.	0.	0.
77	0.	0.	0.	0.
78	0.	0.	0.	0.
79	0.	0.	0.	0.
80	0.	0.	0.	0.
81	0.	0.	0.	0.
82	0.	0.	0.	0.
83	0.	0.	0.	0.
84	0.	0.	0.	0.
85	0.	0.	0.	0.
86	0.	0.	0.	0.
87	0.	0.	0.	0.
88	0.	0.	0.	0.
89	0.	0.	0.	0.
90	0.	0.	0.	0.
91	0.	0.	0.	0.
92	0.	0.	0.	0.
93	0.	0.	0.	0.
94	0.	0.	0.	0.
95	0.	0.	0.	0.
96	0.	0.	0.	0.
97	0.	0.	0.	0.
98	0.	0.	0.	0.
99	0.	0.	0.	0.
100	0.	0.	0.	0.

TABLE B.11 — EXPOSURE RATES FROM 127-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT WR
HOUSE, PREMODIFICATION, AVERAGE OF 2 EXPOSURES

Position	Height above floor, ft			
	1.0	3.0	5.0	7.0
1	4.633E-01	5.434E-01	5.490E-01	4.688E-01
2	4.660E-01	5.184E-01	5.323E-01	0.
3	4.550E-01	5.267E-01	5.544E-01	0.
4	4.633E-01	5.184E-01	5.378E-01	0.
5	0.	4.936E-01	0.	0.
6	0.	5.184E-01	0.	0.
7	4.715E-01	5.267E-01	5.377E-01	5.267E-01
8	4.359E-01	5.156E-01	5.323E-01	0.
9	4.305E-01	5.212E-01	5.295E-01	0.
10	4.332E-01	5.184E-01	5.322E-01	0.
11	4.250E-01	5.378E-01	5.824E-01	0.
12	4.250E-01	5.239E-01	5.295E-01	0.
13	4.387E-01	4.825E-01	5.212E-01	0.
14	4.169E-01	4.742E-01	5.239E-01	0.
15	4.087E-01	4.633E-01	5.130E-01	4.878E-01
16	3.819E-01	4.142E-01	4.224E-01	0.
17	3.925E-01	4.468E-01	4.743E-01	0.
18	4.006E-01	4.687E-01	4.908E-01	0.
19	4.114E-01	4.852E-01	5.156E-01	0.
20	3.762E-01	5.239E-01	4.633E-01	4.715E-01
21	0.	4.798E-01	0.	0.
22	0.	3.980E-01	0.	0.
23	0.	4.114E-01	0.	0.
24	0.	3.898E-01	0.	0.
25	0.	3.682E-01	0.	0.
26	0.	3.467E-01	0.	0.
27	3.308E-01	3.520E-01	3.655E-01	3.628E-01
28	0.	3.682E-01	0.	0.
29	2.694E-01	3.119E-01	3.226E-01	3.092E-01
30	0.	3.146E-01	0.	0.
31	0.	4.636E-01	0.	0.
32	0.	3.440E-01	0.	0.
33	0.	3.494E-01	0.	0.
34	0.	3.547E-01	0.	0.
35	0.	3.226E-01	0.	0.
36	0.	3.279E-01	0.	0.
37	0.	4.660E-01	0.	0.
38	0.	4.962E-01	0.	0.
39	0.	4.440E-01	0.	0.
40	4.386E-01	5.128E-01	5.295E-01	0.
41	0.	4.633E-01	0.	0.
42	0.	4.176E-01	0.	0.
43	0.	4.495E-01	0.	0.
44	0.	4.468E-01	0.	0.
45	0.	4.033E-01	0.	0.
46	0.	3.899E-01	0.	0.
47	0.	3.386E-01	0.	0.
48	0.	4.196E-01	0.	0.
49	0.	4.770E-01	0.	0.
50	0.	5.101E-01	0.	0.
51	0.	2.960E-01	0.	0.
52	2.431E-01	2.695E-01	3.039E-01	2.695E-01
53	0.	3.655E-01	0.	0.
54	0.	4.660E-01	0.	0.
55	0.	3.682E-01	0.	0.
56	0.	4.495E-01	0.	0.
57	0.	4.332E-01	0.	0.
58	3.682E-01	4.196E-01	4.660E-01	4.468E-01
59	0.	7.416E-02	0.	0.
60	6.284E-02	8.945E-02	1.255E-01	6.725E-02
61	0.	8.636E-02	0.	0.
62	0.	1.413E-01	0.	0.
63	0.	8.403E-02	0.	0.
64	0.	5.707E-02	0.	0.
65	0.	6.142E-02	0.	0.
66	0.	1.072E-01	0.	0.
67	0.	9.753E-02	0.	0.
68	0.	1.030E-01	0.	0.

TABLE B.12 — EXPOSURE RATES FROM 63.7-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR
HOUSE, PREMODIFICATION, AVERAGE OF 3 EXPOSURES

Position	Height above floor, ft			
	1.0	3.0	5.0	7.0
1	1.232E 00	1.376E 00	1.388E 00	1.340E 00
2	1.208E 00	1.316E 00	1.358E 00	0.
3	1.144E 00	1.309E 00	1.328E 00	0.
4	1.164E 00	1.298E 00	1.298E 00	0.
5	0.	1.262E 00	0.	0.
6	0.	1.280E 00	0.	0.
7	1.320E 00	1.358E 00	1.382E 00	1.309E 00
8	1.113E 00	1.213E 00	1.256E 00	0.
9	1.061E 00	1.211E 00	1.268E 00	0.
10	1.103E 00	1.238E 00	1.328E 00	0.
11	1.126E 00	1.334E 00	1.376E 00	0.
12	1.083E 00	1.250E 00	1.280E 00	0.
13	1.133E 00	1.140E 00	1.238E 00	0.
14	1.009E 00	1.136E 00	1.213E 00	0.
15	9.877E-01	1.097E 00	1.138E 00	0.
16	8.308E-01	9.817E-01	9.874E-01	0.
17	9.090E-01	1.035E 00	1.079E 00	0.
18	9.893E-01	1.105E 00	1.132E 00	0.
19	1.022E 00	1.184E 00	1.205E 00	0.
20	9.068E-01	1.094E 00	1.105E 00	1.117E 00
21	0.	1.144E 00	0.	0.
22	0.	9.972E-01	0.	0.
23	0.	9.665E-01	0.	0.
24	0.	9.245E-01	0.	0.
25	0.	9.031E-01	0.	0.
26	0.	7.876E-01	0.	0.
27	7.214E-01	8.229E-01	8.539E-01	8.694E-01
28	0.	8.676E-01	0.	0.
29	6.761E-01	7.647E-01	7.839E-01	7.820E-01
30	0.	7.450E-01	0.	0.
31	0.	9.147E-01	0.	0.
32	0.	7.898E-01	0.	0.
33	0.	7.918E-01	0.	0.
34	0.	7.957E-01	0.	0.
35	0.	7.880E-01	0.	0.
36	0.	7.995E-01	0.	0.
37	0.	1.134E 00	0.	0.
38	0.	1.408E 00	0.	0.
39	0.	1.232E 00	0.	0.
40	1.256E 00	1.352E 00	1.382E 00	1.388E 00
41	0.	1.183E 00	0.	0.
42	0.	1.081E 00	0.	0.
43	0.	1.124E 00	0.	0.
44	0.	1.041E 00	0.	0.
45	0.	1.033E 00	0.	0.
46	0.	9.794E-01	0.	0.
47	0.	8.815E-01	0.	0.
48	0.	1.008E 00	0.	0.
49	0.	1.268E 00	0.	0.
50	0.	1.226E 00	0.	0.
51	0.	7.068E-01	0.	0.
52	5.676E-01	6.380E-01	6.590E-01	6.704E-01
53	0.	8.972E-01	0.	0.
54	0.	1.180E 00	0.	0.
55	0.	9.442E-01	0.	0.
56	0.	1.134E 00	0.	0.
57	0.	1.006E 00	0.	0.
58	9.147E-01	1.007E 00	1.095E 00	1.097E 00
59	0.	3.555E-01	0.	0.
60	1.409E-01	1.883E-01	2.957E-01	1.883E-01
61	0.	1.771E-01	0.	0.
62	0.	3.546E-01	0.	0.
63	0.	1.827E-01	0.	0.
64	0.	1.312E-01	0.	0.
65	0.	1.381E-01	0.	0.
66	0.	2.451E-01	0.	0.
67	0.	2.080E-01	0.	0.
68	0.	2.379E-01	0.	0.

TABLE B.13 — EXPOSURE RATES FROM 25.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR
HOUSE, PREMODIFICATION, AVERAGE OF 2 EXPOSURES

Position	Height above floor, ft			
	1.0	3.0	5.0	7.0
1	0.	0.	4.461E 00	3.274E 00
2	5.004E 00	4.781E 00	3.927E 00	0.
3	3.752E 00	3.891E 00	3.521E 00	0.
4	3.571E 00	3.664E 00	3.403E 00	0.
5	0.	3.874E 00	0.	0.
6	0.	4.156E 00	0.	0.
7	0.	0.	4.050E 00	2.996E 00
8	6.107E-01	2.652E 00	2.723E 00	0.
9	6.863E-01	2.841E 00	2.905E 00	0.
10	1.239E 00	3.035E 00	3.351E 00	0.
11	2.716E 00	4.071E 00	4.021E 00	0.
12	2.311E 00	2.922E 00	3.056E 00	0.
13	1.558E 00	2.113E 00	2.542E 00	0.
14	6.463E-01	1.907E 00	2.270E 00	0.
15	4.850E-01	1.688E 00	2.113E 00	0.
16	4.391E-01	1.170E 00	1.545E 00	0.
17	4.933E-01	1.351E 00	1.708E 00	0.
18	1.202E 00	1.697E 00	1.996E 00	0.
19	2.376E 00	2.485E 00	2.643E 00	0.
20	4.475E-01	1.500E 00	1.876E 00	1.907E 00
21	0.	1.681E 00	0.	0.
22	0.	1.923E 00	0.	0.
23	0.	1.591E 00	0.	0.
24	0.	1.375E 00	0.	0.
25	0.	1.170E 00	0.	0.
26	0.	9.576E-01	0.	0.
27	5.434E-01	1.026E 00	1.161E 00	1.304E 00
28	0.	1.070E 00	0.	0.
29	1.073E 00	1.232E 00	1.351E 00	1.367E 00
30	0.	1.193E 00	0.	0.
31	0.	1.867E 00	0.	0.
32	0.	9.725E-01	0.	0.
33	0.	1.067E 00	0.	0.
34	0.	9.960E-01	0.	0.
35	0.	8.321E-01	0.	0.
36	0.	9.256E-01	0.	0.
37	0.	2.385E 00	0.	0.
38	0.	2.725E 00	0.	0.
39	0.	3.557E 00	0.	0.
40	0.	0.	3.900E 00	2.959E 00
41	0.	4.038E 00	0.	0.
42	0.	3.420E 00	0.	0.
43	0.	3.220E 00	0.	0.
44	0.	2.880E 00	0.	0.
45	0.	2.547E 00	0.	0.
46	0.	1.9714E 00	0.	0.
47	0.	1.114E 00	0.	0.
48	0.	2.554E 00	0.	0.
49	0.	4.984E 00	0.	0.
50	0.	2.864E 00	0.	0.
61	0.	8.703E-01	0.	0.
62	2.794E-01	6.463E-01	9.789E-01	1.152E 00
63	0.	1.414E 00	0.	0.
64	0.	3.168E 00	0.	0.
65	0.	2.128E 00	0.	0.
66	0.	2.367E 00	0.	0.
67	0.	1.640E 00	0.	0.
68	1.155E 00	1.688E 00	1.892E 00	2.119E 00
50	0.	2.151E-01	0.	0.
51	1.664E-01	2.411E-01	5.770E-01	5.934E-01
52	0.	3.039E-01	0.	0.
53	0.	3.716E-01	0.	0.
54	0.	3.181E-01	0.	0.
55	0.	1.903E-01	0.	0.
57	0.	2.124E-01	0.	0.
58	0.	3.350E-01	0.	0.
59	0.	3.817E-01	0.	0.
60	0.	3.835E-01	0.	0.

TABLE B.14 — EXPOSURE RATES FROM 127-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR
HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	1.0	3.0	5.0	7.0
1	3.850E-01	4.798E-01	4.835E-01	5.132E-01
2	0.	4.467E-01	0.	0.
3	0.	4.577E-01	0.	0.
4	3.742E-01	4.467E-01	4.724E-01	0.
5	0.	4.467E-01	0.	0.
6	0.	4.577E-01	0.	0.
7	4.067E-01	4.504E-01	4.835E-01	4.946E-01
8	3.670E-01	4.139E-01	4.394E-01	0.
9	0.	4.175E-01	0.	0.
10	0.	4.430E-01	0.	0.
11	3.706E-01	4.504E-01	4.540E-01	0.
12	0.	4.687E-01	0.	0.
13	3.706E-01	4.467E-01	4.761E-01	0.
14	0.	4.357E-01	0.	0.
15	3.279E-01	4.139E-01	4.467E-01	0.
16	0.	4.103E-01	0.	0.
17	0.	3.527E-01	0.	0.
18	3.032E-01	3.670E-01	3.922E-01	0.
19	0.	3.706E-01	0.	0.
20	3.067E-01	3.527E-01	3.850E-01	0.
21	0.	4.030E-01	0.	0.
22	3.492E-01	4.175E-01	4.394E-01	0.
23	0.	4.175E-01	0.	0.
24	2.647E-01	3.032E-01	3.385E-01	0.
25	0.	4.103E-01	0.	0.
26	0.	3.599E-01	0.	0.
27	2.926E-01	3.456E-01	3.706E-01	0.
28	3.067E-01	3.778E-01	4.067E-01	0.
29	3.350E-01	4.067E-01	4.175E-01	0.
30	0.	3.492E-01	0.	0.
31	0.	2.335E-01	0.	0.
32	0.	3.350E-01	0.	0.
33	2.335E-01	2.647E-01	3.067E-01	0.
34	0.	2.821E-01	0.	0.
35	1.959E-01	2.370E-01	2.612E-01	0.
36	0.	2.439E-01	0.	0.
37	0.	2.926E-01	0.	0.
38	1.418E-01	1.654E-01	1.891E-01	0.
39	0.	1.218E-01	0.	0.
40	0.	2.717E-01	0.	0.
41	2.404E-01	2.926E-01	3.137E-01	0.
42	3.102E-01	3.527E-01	3.922E-01	0.
43	0.	3.706E-01	0.	0.
44	4.030E-01	4.321E-01	0.	4.577E-01
45	0.	4.103E-01	0.	0.
46	3.563E-01	4.067E-01	4.394E-01	0.
47	0.	4.139E-01	0.	0.
48	0.	3.385E-01	0.	0.
49	0.	4.394E-01	0.	0.
50	0.	4.467E-01	0.	0.
51	4.103E-01	4.504E-01	4.650E-01	4.798E-01
52	0.	4.103E-01	0.	0.
53	3.635E-01	4.030E-01	4.394E-01	0.
54	0.	4.030E-01	0.	0.
55	3.456E-01	4.030E-01	4.467E-01	0.
56	0.	3.706E-01	0.	0.
57	1.925E-01	2.370E-01	2.647E-01	0.
58	2.173E-03	1.198E-02	1.268E-02	0.
59	1.093E-02	1.549E-02	1.689E-02	0.
60	1.093E-02	1.549E-02	1.759E-02	0.
61	1.584E-02	2.180E-02	2.391E-02	0.
62	1.233E-02	1.829E-02	2.005E-02	0.

TABLE B.15 — EXPOSURE RATES FROM 63.7-FT RADIUS EXPOSURE, NORMALIZED TO MR/HR PER MC/FT,
WR HOUSE, POSTMODIFICATION, BASIC

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.144E 00	1.294E 00	1.330E 00	1.402E 00
2	0.	1.241E 00	0.	0.
3	0.	1.232E 00	0.	0.
4	9.607E-01	1.197E 00	1.241E 00	0.
5	0.	1.232E 00	0.	0.
6	0.	1.241E 00	0.	0.
7	1.135E 00	1.268E 00	1.312E 00	1.330E 00
8	9.693E-01	1.135E 00	1.170E 00	0.
9	0.	1.100E 00	0.	0.
10	0.	1.144E 00	0.	0.
11	9.177E-01	1.179E 00	1.214E 00	0.
12	0.	1.268E 00	0.	0.
13	9.435E-01	1.152E 00	1.223E 00	0.
14	0.	1.108E 00	0.	0.
15	5.733E-01	1.047E 00	1.100E 00	0.
16	0.	1.039E 00	0.	0.
17	0.	9.521E-01	0.	0.
18	5.733E-01	8.835E-01	0.	0.
19	0.	9.607E-01	0.	0.
20	7.144E-01	8.920E-01	9.780E-01	0.
21	0.	9.693E-01	0.	0.
22	6.976E-01	1.056E 00	1.073E 00	0.
23	0.	1.108E 00	0.	0.
24	5.404E-01	7.479E-01	8.070E-01	0.
25	0.	1.047E 00	0.	0.
26	0.	8.835E-01	0.	0.
27	5.897E-01	8.239E-01	8.920E-01	0.
28	6.726E-01	8.750E-01	1.004E 00	0.
29	7.985E-01	1.039E 00	1.056E 00	0.
30	0.	8.750E-01	0.	0.
31	0.	5.733E-01	0.	0.
32	0.	7.816E-01	0.	0.
33	4.265E-01	6.145E-01	7.144E-01	7.060E-01
34	0.	6.643E-01	0.	0.
35	4.833E-01	5.650E-01	6.145E-01	0.
36	0.	5.815E-01	0.	0.
37	0.	7.227E-01	0.	0.
38	2.352E-01	3.863E-01	4.346E-01	0.
39	0.	2.984E-01	0.	0.
40	0.	7.311E-01	0.	0.
41	6.726E-01	7.227E-01	8.070E-01	0.
42	8.154E-01	8.750E-01	9.607E-01	0.
43	0.	9.349E-01	0.	0.
44	1.135E 00	1.188E 00	0.	1.241E 00
45	0.	1.030E 00	0.	0.
46	9.780E-01	1.004E 00	1.071E 00	0.
47	0.	1.013E 00	0.	0.
48	0.	8.579E-01	0.	0.
49	0.	1.135E 00	0.	0.
50	0.	1.126E 00	0.	0.
51	1.091E 00	1.241E 00	1.223E 00	1.259E 00
52	0.	1.073E 00	0.	0.
53	8.835E-01	1.004E 00	1.091E 00	0.
54	0.	1.047E 00	0.	0.
55	8.324E-01	9.953E-01	1.135E 00	0.
56	0.	8.920E-01	0.	0.
57	4.023E-01	5.568E-01	6.145E-01	0.
58	1.435E-02	3.024E-02	3.192E-02	0.
59	2.355E-02	3.693E-02	4.195E-02	0.
60	2.941E-02	4.028E-02	4.446E-02	0.
61	4.112E-02	5.534E-02	5.868E-02	0.
62	2.857E-02	4.530E-02	4.781E-02	0.

TABLE B.16 — NORMALIZED EXPOSURE RATES FROM GROUND CONTAMINATION
AT WR HOUSE, POSTMODIFICATION, BASIC

Position	Exposure rate, mr/hr per mc/sq ft			
	At 0.5 ft	At 3 ft	At 5 ft	At 6.5 ft
1	82	73	66	64
2		65		
3		59		
4	41	60	59	
5		65		
6		66		
7	84	76	66	65
8	26	50	56	
9		45		
10		46		
11	25	50	55	
12		62		
13	33	48	56	
14		44		
15	13	37	46	
16		38		
17		52		
18	13	38	42	
19		35		
20	13	31	36	
21		34		
22	22	41	45	
23		51		
24	10	25	28	
25		48		
26		36		
27	13	30	35	
28	17	35	43	
29	44	57	52	
30		35		
31		22		
32		27		
33	9.4	22	27	
34		24		
35	13	26	27	
36		28		
37		45		
38	50	14	17	
39		9.4		
40		26		
41	13	28	32	
42	21	41	47	
43		53		
44	70	75	65	60
45		55		
46	43	56	52	
47		55		
48		36		
49		59		
50		65		
51	70	75	65	62
52		61		
53	27	45	51	
54		60		
55	42	56	56	
56		36		
57	9.0	21	27	
58	0.44	1.0	1.1	
59	1.3	1.5	1.6	
60	1.3	1.5	1.6	
61	0.96	2.0	2.1	
62	0.96	1.6	1.7	

TABLE B.17 — NORMALIZED EXPOSURE RATES FROM ROOF CONTAMINATION
OF WR HOUSE, POSTMODIFICATION, BASIC

Position	Exposure rate, mr/hr per mc/sq ft			
	At 0.5 ft	At 3 ft	At 5 ft	At 6.5 ft
1	31	40	54	64
2		43		
3		45		
4	36	43	53	
5		47		
6		41		
7	27	34	46	63
8	36	46	60	
9		50		
10		53		
11	42	53		
12		51		
13	41	53	74	
14		58		
15	43	53	67	
16		52		
17		45		
18	34	46	56	
19		45		
20	41	49	54	
21		55		
22	47	59	74	
23		52		
24	36	42	53	
25		27		
26		54		
27	41	52	65	
28	42	54	70	
29	33	46	26	
30		47		
31		33		
32		46		
33	33	36	47	53
34		41		
35	25	31	42	
36		30		
37		31		
38	19	22	25	
39		16		
40		31		
41	21	26	32	
42	21	27	41	
43		20		
44	18	23	35	43
45		30		
46	26	31	42	
47		36		
48				
49		35		
50		35		
51	26	31	41	53
52		38		
53	35	43	58	
54		42		
55	33	42	57	
56		47		
57	25	32	41	
58	0.39	0.72	0.94	
59	0.56	0.66	0.77	
60	0.66	0.66	0.66	
61	1.5	1.9	2.6	
62	0.83	1.2	1.1	

TABLE B. 18 — NORMALIZED EXPOSURE RATES FROM ROOF CONTAMINATION
OR WR HOUSE, POSTMODIFICATION, AFTER TRANSITE

Position	Exposure rate, mr/hr per mc/sq ft			
	At 0.5 ft	At 3 ft	At 5 ft	At 6.5 ft
1	32	38	50	61
2		41		
3		42		
4	34	40	49	
5		41		
6		37		
7	26	32	42	57
8	32	39	55	
9		45		
10		50		
11	42	49	63	
12		47		
13	38	48	68	
14		53		
15	41	49	61	
16		45		
17		38		
18	30	39	58	
19		41		
20	35	43	55	
21		48		
22	40	50	66	
23		45		
24	31	36	45	
25		38		
26		44		
27	32	41		
28	34	47	62	
29	30	41	53	
30		42		
31		29		
32		34		
33	24	28	40	48
34		29		
35	17	23	33	
36		24		
37		24	53	
38	13	18	20	
39		11		
40		22		
41	16	21	29	
42	18	25	41	
43		20		
44	15	20	33	39
45		27		
46	24	28	39	
47		38		
48		16		
49		31		
50		34		
51	24	31	39	49
52		37		
53	32	41	58	
54		40		
55	30	38	53	
56		42		
57	21	28	37	
58	0.65	0.73	0.93	
59	0.43	0.51	0.61	
60	0.51	0.61	0.61	
61	1.3	1.7	2.4	
62	0.7	1.0	0.97	

TABLE B.19 — EXPOSURE RATES FROM 63.7-FT RADIUS EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR HOUSE, POSTMODIFICATION, AFTER TRANSITE

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.099E-00	1.299E-00	1.321E-00	0.
2	0.	1.184E-00	0.	0.
3	0.	1.184E-00	0.	0.
4	1.057E-00	1.163E-00	1.242E-00	0.
5	0.	1.192E-00	0.	0.
6	0.	1.234E-00	0.	0.
7	1.163E-00	1.285E-00	1.321E-00	0.
8	9.668E-01	1.092E-00	1.177E-00	0.
9	0.	1.071E-00	0.	0.
10	0.	1.106E-00	0.	0.
11	9.460E-01	1.149E-00	1.234E-00	0.
12	0.	1.249E-00	0.	0.
13	8.979E-01	1.128E-00	1.177E-00	0.
14	0.	1.043E-00	0.	0.
15	6.818E-01	9.737E-01	1.050E-00	0.
16	0.	9.391E-01	0.	0.
17	0.	8.364E-01	0.	0.
18	5.633E-01	7.554E-01	8.025E-01	0.
19	0.	8.229E-01	0.	0.
20	6.421E-01	7.621E-01	8.296E-01	0.
21	0.	8.276E-01	0.	0.
22	7.486E-01	9.391E-01	9.668E-01	0.
23	0.	1.036E-00	0.	0.
24	3.767E-01	5.113E-01	6.091E-01	0.
25	0.	6.952E-01	0.	0.
26	0.	6.157E-01	0.	0.
27	3.262E-01	5.633E-01	6.289E-01	0.
28	4.276E-01	7.018E-01	7.486E-01	0.
29	4.597E-01	7.085E-01	7.621E-01	0.
30	0.	5.633E-01	0.	0.
31	0.	3.388E-01	0.	0.
32	0.	4.468E-01	0.	0.
33	2.949E-01	3.767E-01	4.532E-01	4.661E-01
34	0.	3.577E-01	0.	0.
35	2.451E-01	3.641E-01	4.021E-01	0.
36	0.	3.704E-01	0.	0.
37	0.	5.568E-01	0.	0.
38	1.284E-01	2.949E-01	3.011E-01	0.
39	0.	1.834E-01	0.	0.
40	0.	3.262E-01	0.	0.
41	3.388E-01	4.276E-01	5.633E-01	0.
42	4.919E-01	6.157E-01	7.554E-01	0.
43	0.	7.621E-01	0.	0.
44	7.486E-01	8.296E-01	8.229E-01	8.296E-01
45	0.	6.752E-01	0.	0.
46	6.421E-01	6.952E-01	9.047E-01	0.
47	0.	7.958E-01	0.	0.
48	0.	5.048E-01	0.	0.
49	0.	8.842E-01	0.	0.
50	0.	7.958E-01	0.	0.
51	7.419E-01	8.296E-01	8.229E-01	8.500E-01
52	0.	6.885E-01	0.	0.
53	5.698E-01	6.818E-01	8.773E-01	0.
54	0.	6.619E-01	0.	0.
55	5.502E-01	6.447E-01	7.554E-01	0.
56	0.	6.026E-01	0.	0.
57	2.513E-01	3.199E-01	3.831E-01	0.
58	1.249E-01	2.097E-02	2.619E-02	0.
59	1.836E-02	2.945E-02	3.271E-02	0.
60	2.358E-02	3.076E-02	3.663E-02	0.
61	2.293E-02	3.590E-02	3.858E-02	0.
62	2.032E-02	3.141E-02	3.532E-02	0.

TABLE B.20 — EXPOSURE RATES FROM 63.7-FT RADIUS EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR HOUSE, POSTMODIFICATION, AFTER PLANTER

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	9.895E-01	1.190E-00	1.232E-00	1.225E-00
2	0.	1.093E-00	0.	0.
3	0.	1.127E-00	0.	0.
4	9.352E-01	1.093E-00	1.148E-00	0.
5	0.	1.183E-00	0.	0.
6	0.	1.162E-00	0.	0.
7	1.282E-00	1.232E-00	1.246E-00	0.
8	9.352E-01	1.037E-00	1.141E-00	0.
9	0.	7.555E-01	0.	0.
10	0.	1.037E-00	0.	0.
11	8.744E-01	1.079E-00	1.155E-00	0.
12	0.	1.155E-00	0.	0.
13	8.677E-01	1.072E-00	1.106E-00	0.
14	0.	9.895E-01	0.	0.
15	6.693E-01	9.284E-01	9.964E-01	0.
16	0.	8.744E-01	0.	0.
17	0.	7.945E-01	0.	0.
18	5.465E-01	7.019E-01	7.480E-01	0.
19	0.	7.546E-01	0.	0.
20	6.044E-01	7.019E-01	8.009E-01	0.
21	0.	8.009E-01	0.	0.
22	6.889E-01	8.812E-01	7.081E-01	0.
23	0.	9.895E-01	0.	0.
24	3.574E-01	4.892E-01	5.465E-01	0.
25	0.	6.562E-01	0.	0.
26	0.	5.722E-01	0.	0.
27	3.327E-01	5.338E-01	6.044E-01	0.
28	4.261E-01	5.979E-01	7.151E-01	0.
29	4.765E-01	6.823E-01	7.348E-01	0.
30	0.	5.465E-01	0.	0.
31	0.	3.141E-01	0.	0.
32	0.	4.261E-01	0.	0.
33	2.712E-01	3.388E-01	4.261E-01	4.324E-01
34	0.	3.637E-01	0.	0.
35	1.861E-01	3.265E-01	3.699E-01	0.
36	0.	3.327E-01	0.	0.
37	0.	4.956E-01	0.	0.
38	1.321E-01	2.224E-01	2.834E-01	0.
39	0.	1.202E-01	0.	0.
40	0.	2.346E-01	0.	0.
41	1.321E-01	2.163E-01	5.210E-01	0.
42	1.261E-01	4.073E-01	6.889E-01	0.
43	0.	5.083E-01	0.	0.
44	9.638E-02	7.414E-01	8.007E-01	8.677E-01
45	0.	6.108E-01	0.	0.
46	4.450E-01	5.979E-01	8.009E-01	0.
47	0.	5.979E-01	0.	0.
48	0.	4.261E-01	0.	0.
49	0.	8.076E-01	0.	0.
50	0.	7.414E-01	0.	0.
51	7.414E-01	8.076E-01	8.142E-01	8.343E-01
52	0.	6.368E-01	0.	0.
53	5.401E-01	6.173E-01	8.610E-01	0.
54	0.	6.173E-01	0.	0.
55	5.465E-01	6.173E-01	7.282E-01	0.
56	0.	5.529E-01	0.	0.
57	2.467E-01	3.018E-01	4.136E-01	0.
58	5.866E-03	1.547E-02	2.252E-02	0.
59	5.866E-03	2.444E-02	3.149E-02	0.
60	6.507E-03	2.508E-02	3.341E-02	0.
61	1.868E-02	3.085E-02	3.982E-02	0.
62	1.035E-02	2.444E-02	3.341E-02	0.

TABLE B.21 — EXPOSURE RATES FROM 127-FT RADIUS EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, WR HOUSE, POSTMODIFICATION, AFTER PLANTER

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	3.472E-01	4.410E-01	4.291E-01	4.709E-01
2	0.	4.114E-01	0.	0.
3	0.	4.114E-01	0.	0.
4	3.242E-01	4.084E-01	4.380E-01	0.
5	0.	4.055E-01	0.	0.
6	0.	4.114E-01	0.	0.
7	3.820E-01	4.410E-01	4.649E-01	4.739E-01
8	3.242E-01	3.820E-01	4.262E-01	0.
9	0.	3.820E-01	0.	0.
10	0.	4.084E-01	0.	0.
11	3.242E-01	4.084E-01	4.410E-01	0.
12	0.	4.321E-01	0.	0.
13	2.985E-01	4.055E-01	4.380E-01	0.
14	0.	3.791E-01	0.	0.
15	2.731E-01	3.588E-01	3.850E-01	0.
16	0.	3.501E-01	0.	0.
17	0.	3.042E-01	0.	0.
18	2.202E-01	2.787E-01	3.042E-01	0.
19	0.	3.042E-01	0.	0.
20	2.202E-01	2.900E-01	3.213E-01	0.
21	0.	3.156E-01	0.	0.
22	2.591E-01	3.501E-01	3.675E-01	0.
23	0.	3.675E-01	0.	0.
24	1.521E-01	2.092E-01	2.368E-01	0.
25	0.	2.368E-01	0.	0.
26	0.	2.312E-01	0.	0.
27	1.440E-01	2.174E-01	2.451E-01	0.
28	1.575E-01	2.396E-01	2.900E-01	0.
29	1.575E-01	2.647E-01	2.900E-01	0.
30	0.	2.147E-01	0.	0.
31	0.	1.307E-01	0.	0.
32	0.	1.818E-01	0.	0.
33	1.227E-01	1.521E-01	1.873E-01	1.900E-01
34	0.	1.548E-01	0.	0.
35	1.121E-01	1.387E-01	1.521E-01	0.
36	0.	1.521E-01	0.	0.
37	0.	1.982E-01	0.	0.
38	7.272E-02	9.101E-02	1.174E-01	0.
39	0.	7.272E-02	0.	0.
40	0.	1.042E-01	0.	0.
41	5.457E-02	1.575E-01	2.037E-01	0.
42	5.198E-02	2.368E-01	2.675E-01	0.
43	0.	2.731E-01	0.	0.
44	2.888E-02	2.675E-01	2.872E-01	2.929E-01
45	0.	2.759E-01	0.	0.
46	1.575E-01	2.507E-01	3.042E-01	0.
47	0.	2.731E-01	0.	0.
48	0.	1.845E-01	0.	0.
49	0.	3.242E-01	0.	0.
50	0.	2.872E-01	0.	0.
51	2.174E-01	2.703E-01	2.957E-01	3.128E-01
52	0.	0.	0.	0.
53	1.791E-01	2.535E-01	3.185E-01	0.
54	0.	2.340E-01	0.	0.
55	1.737E-01	2.368E-01	2.900E-01	0.
56	0.	2.202E-01	0.	0.
57	8.315E-02	1.280E-01	1.602E-01	0.
58	2.814E-03	7.249E-03	9.466E-03	0.
59	2.260E-03	9.743E-03	1.335E-02	0.
60	2.260E-03	1.002E-02	1.335E-02	0.
61	5.863E-03	1.251E-02	1.473E-02	0.
62	3.923E-03	1.057E-02	1.362E-02	0.

TABLE B.22 — EXPOSURE RATES FROM 25.5-FT RADIUS EXPOSURE, NORMALIZED TO
MR/HR PER MC/FT, 2SB HOUSE, PREMODIFICATION, OLD SHELTERS

Position	Height above floor, ft								
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	2.941E-02	3.839E-02	4.141E-02	0.	4.946E-02	6.621E-02	0.	1.221E-01	1.201E-01
2	4.893E-02	6.060E-02	6.671E-02	0.	7.804E-02	9.311E-02	0.	1.115E-01	2.018E-01
3	0.	0.	0.	5.553E-02	0.	0.	9.416E-02	0.	0.
4	0.	0.	0.	9.364E-02	0.	0.	1.373E-01	0.	0.
5	0.	0.	0.	1.174E-01	0.	0.	1.568E-01	0.	0.
6	0.	0.	0.	1.116E-01	0.	0.	1.541E-01	0.	0.
7	0.	0.	0.	1.195E-01	0.	0.	1.525E-01	0.	0.
8	0.	0.	0.	1.165E-01	0.	0.	1.492E-01	0.	0.
9	0.	0.	0.	7.085E-02	0.	0.	8.633E-02	0.	0.
10	0.	0.	0.	8.633E-02	0.	0.	1.394E-01	0.	0.
11	0.	0.	0.	1.020E-01	0.	0.	1.292E-01	0.	0.
12	0.	0.	0.	1.116E-01	0.	0.	1.372E-01	0.	0.
15	0.	0.	0.	1.057E-01	0.	0.	1.302E-01	0.	0.
16	0.	0.	0.	8.477E-02	0.	0.	1.121E-01	0.	0.
18	0.	0.	0.	8.894E-02	0.	0.	1.169E-01	0.	0.
23	0.	0.	0.	6.775E-02	0.	0.	8.841E-02	0.	0.
24	7.032E-02	6.775E-02	8.219E-02	0.	8.746E-02	9.888E-02	0.	1.148E-01	1.351E-01
25	6.878E-02	0.	0.	8.737E-02	0.	0.	1.158E-01	0.	0.
26	6.163E-02	0.	0.	7.649E-02	0.	0.	1.057E-01	0.	0.
27	5.095E-02	0.	0.	6.060E-02	0.	0.	8.115E-02	0.	0.
28	0.	0.	0.	8.218E-02	0.	0.	9.626E-02	0.	0.
29	3.395E-02	0.	0.	3.735E-02	0.	0.	6.781E-02	0.	0.
30	0.	0.	0.	8.477E-02	0.	0.	1.068E-01	0.	0.
31	0.	0.	0.	8.530E-02	0.	0.	1.100E-01	0.	0.
32	0.	0.	0.	8.374E-02	0.	0.	1.041E-01	0.	0.
33	3.042E-02	0.	0.	4.844E-02	0.	0.	7.083E-02	0.	0.
35	0.	0.	0.	7.959E-02	0.	0.	1.201E-01	0.	0.
36	0.	0.	0.	5.566E-02	0.	0.	9.050E-02	0.	0.
37	0.	0.	0.	7.131E-02	0.	0.	1.206E-01	0.	0.
38	0.	0.	0.	7.029E-02	0.	0.	1.116E-01	0.	0.
39	0.	0.	0.	5.804E-02	0.	0.	6.876E-02	0.	0.
45	0.	0.	0.	5.806E-02	0.	0.	1.201E-01	0.	0.
46	0.	0.	0.	3.440E-02	0.	0.	5.957E-02	0.	0.
47	0.	0.	0.	3.987E-02	0.	0.	0.	0.	0.
13	9.222E-03	0.	0.	1.411E-02	0.	0.	1.875E-02	0.	0.
14	5.511E-03	0.	0.	7.970E-03	0.	0.	1.027E-02	0.	0.
17	8.420E-03	0.	0.	1.169E-02	0.	0.	1.192E-02	0.	0.
19	7.854E-03	9.341E-03	1.050E-02	0.	1.168E-02	1.204E-02	0.	9.605E-03	9.540E-03
20	0.	0.	0.	1.181E-02	0.	0.	1.168E-02	0.	0.
21	0.	0.	0.	1.133E-02	0.	0.	1.216E-02	0.	0.
22	0.	0.	0.	1.062E-02	0.	0.	1.361E-02	0.	0.
34	6.390E-03	0.	0.	9.805E-03	0.	0.	1.181E-02	0.	0.
40	0.	0.	0.	9.805E-03	0.	0.	1.145E-02	0.	0.
41	0.	0.	0.	9.805E-03	0.	0.	9.454E-03	0.	0.
43	0.	0.	0.	9.805E-03	0.	0.	1.277E-02	0.	0.
44	7.737E-03	0.	0.	1.015E-02	0.	0.	9.919E-03	0.	0.
48	4.849E-03	0.	0.	7.170E-03	0.	0.	1.145E-02	0.	0.
49	4.960E-03	0.	0.	7.286E-03	0.	0.	1.398E-02	0.	0.

TABLE B.23 — EXPOSURE RATES FROM 42.5-FT RADIUS EXPOSURE, NORMALIZED TO
MR/HR PER MC/FT, 2SB HOUSE, PREMODIFICATION, OLD SHELTERS

Position	Height above floor, ft								
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	1.841E-02	2.281E-02	2.523E-02	0.	2.726E-02	3.252E-02	0.	5.024E-02	0.
2	2.967E-02	3.415E-02	3.865E-02	0.	4.111E-02	5.023E-02	0.	6.327E-02	1.023E-01
3	0.	0.	0.	2.564E-02	0.	0.	4.732E-02	0.	0.
4	0.	0.	0.	3.988E-02	0.	0.	6.538E-02	0.	0.
5	0.	0.	0.	5.275E-02	0.	0.	8.093E-02	0.	0.
6	0.	0.	0.	5.239E-02	0.	0.	8.257E-02	0.	0.
7	0.	0.	0.	5.870E-02	0.	0.	7.609E-02	0.	0.
8	0.	0.	0.	5.318E-02	0.	0.	7.393E-02	0.	0.
9	0.	0.	0.	5.620E-02	0.	0.	4.236E-02	0.	0.
10	0.	0.	0.	4.276E-02	0.	0.	6.922E-02	0.	0.
11	0.	0.	0.	5.483E-02	0.	0.	7.179E-02	0.	0.
12	0.	0.	0.	5.650E-02	0.	0.	8.083E-02	0.	0.
15	0.	0.	0.	5.820E-02	0.	0.	8.083E-02	0.	0.
16	0.	0.	0.	5.482E-02	0.	0.	7.393E-02	0.	0.
18	0.	0.	0.	5.650E-02	0.	0.	7.521E-02	0.	0.
23	0.	0.	0.	4.402E-02	0.	0.	5.693E-02	0.	0.
24	4.236E-02	4.276E-02	5.149E-02	0.	5.819E-02	6.453E-02	0.	7.479E-02	8.430E-02
25	4.029E-02	0.	0.	5.525E-02	0.	0.	7.307E-02	0.	0.
26	3.741E-02	0.	0.	4.731E-02	0.	0.	6.793E-02	0.	0.
27	3.170E-02	0.	0.	3.824E-02	0.	0.	4.982E-02	0.	0.
28	0.	0.	0.	5.064E-02	0.	0.	5.903E-02	0.	0.
29	2.040E-02	0.	0.	2.594E-02	0.	0.	4.194E-02	0.	0.
30	0.	0.	0.	5.272E-02	0.	0.	6.920E-02	0.	0.
31	0.	0.	0.	5.064E-02	0.	0.	7.071E-02	0.	0.
32	0.	0.	0.	4.981E-02	0.	0.	6.538E-02	0.	0.
33	2.042E-02	0.	0.	3.170E-02	0.	0.	4.236E-02	0.	0.
35	0.	0.	0.	4.690E-02	0.	0.	6.920E-02	0.	0.
36	0.	0.	0.	3.170E-02	0.	0.	4.815E-02	0.	0.
37	0.	0.	0.	4.236E-02	0.	0.	6.837E-02	0.	0.
38	0.	0.	0.	4.194E-02	0.	0.	6.793E-02	0.	0.
39	0.	0.	0.	3.455E-02	0.	0.	4.153E-02	0.	0.
45	0.	0.	0.	3.292E-02	0.	0.	6.326E-02	0.	0.
46	0.	0.	0.	2.242E-02	0.	0.	3.252E-02	0.	0.
47	0.	0.	0.	2.362E-02	0.	0.	3.170E-02	0.	0.
13	4.311E-03	0.	0.	6.902E-03	0.	0.	9.888E-03	0.	0.
14	3.335E-03	0.	0.	4.553E-03	0.	0.	5.552E-03	0.	0.
17	4.971E-03	0.	0.	6.902E-03	0.	0.	6.812E-03	0.	0.
19	5.050E-03	7.250E-03	6.559E-03	0.	7.247E-03	7.429E-03	0.	5.888E-03	0.
20	0.	0.	0.	7.321E-03	0.	0.	6.992E-03	0.	0.
21	0.	0.	0.	6.911E-03	0.	0.	7.255E-03	0.	0.
22	0.	0.	0.	6.138E-03	0.	0.	8.034E-03	0.	0.
34	3.916E-03	0.	0.	5.897E-03	0.	0.	7.346E-03	0.	0.
40	0.	0.	0.	5.808E-03	0.	0.	6.911E-03	0.	0.
41	0.	0.	0.	5.393E-03	0.	0.	5.729E-03	0.	0.
43	0.	0.	0.	5.729E-03	0.	0.	6.658E-03	0.	0.
44	4.320E-03	0.	0.	5.729E-03	0.	0.	5.640E-03	0.	0.
48	2.948E-03	0.	0.	3.916E-03	0.	0.	5.147E-03	0.	0.
49	3.023E-03	0.	0.	3.677E-03	0.	0.	5.226E-03	0.	0.

TABLE B.24 — EXPOSURE RATES FROM 25.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, PREMODIFICATION, SHELTERS REMOVED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	6.830E-02	1.547E-01	-0.	-0.
2	-0.	1.916E-01	-0.	-0.
3	-0.	8.870E-02	1.191E-01	-0.
4	-0.	8.561E-02	1.053E-01	-0.
5	-0.	7.234E-02	1.191E-01	-0.
6	4.145E-02	5.130E-02	8.767E-02	-0.
7	-0.	8.151E-02	1.022E-01	-0.
8	9.180E-02	1.297E-01	1.658E-01	1.961E-01
9	-0.	1.340E-01	1.613E-01	-0.
10	-0.	1.308E-01	1.758E-01	-0.
11	9.698E-02	1.223E-01	1.647E-01	2.087E-01
12	-0.	8.767E-02	1.297E-01	-0.
13	-0.	7.742E-02	9.906E-02	-0.
14	-0.	1.169E-01	1.304E-01	-0.
15	-0.	1.212E-01	1.405E-01	-0.
16	-0.	1.095E-01	1.223E-01	-0.
17	-0.	1.022E-01	1.265E-01	-0.
18	-0.	8.458E-02	9.678E-02	-0.
19	-0.	7.742E-02	9.802E-02	-0.
20	-0.	1.095E-01	1.319E-01	-0.
21	-0.	1.180E-01	1.277E-01	-0.
22	-0.	1.011E-01	1.287E-01	-0.
23	-0.	9.802E-02	1.223E-01	-0.
24	-0.	6.931E-02	9.802E-02	-0.
25	-0.	7.032E-02	9.906E-02	-0.
26	7.946E-02	9.802E-02	1.405E-01	1.680E-01
27	-0.	1.095E-01	1.319E-01	-0.
28	-0.	1.085E-01	1.340E-01	-0.
29	6.931E-02	8.664E-02	1.340E-01	1.758E-01
30	-0.	7.032E-02	1.001E-01	-0.
31	3.754E-02	4.734E-02	8.458E-02	-0.
32	-0.	6.729E-02	9.594E-02	-0.
33	-0.	7.742E-02	9.283E-02	-0.
34	-0.	7.844E-02	9.802E-02	-0.
35	-0.	6.527E-02	1.032E-01	-0.
36	4.243E-02	4.932E-02	8.458E-02	-0.
37	9.698E-02	1.191E-01	1.297E-01	1.297E-01

TABLE B.25 — EXPOSURE RATES FROM 42.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, PREMODIFICATION, SHELTERS REMOVED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	2.354E-02	3.174E-02	4.087E-02	9.803E-02
2	-0.	4.254E-02	6.376E-02	-0.
3	-0.	4.422E-02	6.462E-02	-0.
4	-0.	4.842E-02	5.776E-02	-0.
5	-0.	4.087E-02	6.204E-02	-0.
6	2.517E-02	3.091E-02	4.758E-02	1.440E-01
7	-0.	4.758E-02	5.861E-02	-0.
8	4.674E-02	6.721E-02	9.088E-02	1.107E-01
9	-0.	6.807E-02	8.556E-02	-0.
10	-0.	6.894E-02	9.445E-02	-0.
11	4.758E-02	6.033E-02	8.204E-02	1.107E-01
12	-0.	4.338E-02	6.635E-02	-0.
13	-0.	4.674E-02	5.861E-02	-0.
14	-0.	6.721E-02	8.380E-02	-0.
15	-0.	7.241E-02	8.556E-02	-0.
16	-0.	6.635E-02	7.503E-02	-0.
17	-0.	5.947E-02	7.590E-02	-0.
18	-0.	4.842E-02	5.691E-02	-0.
19	-0.	4.842E-02	5.861E-02	-0.
20	-0.	6.635E-02	8.204E-02	-0.
21	-0.	7.241E-02	8.116E-02	-0.
22	-0.	5.947E-02	7.659E-02	-0.
23	-0.	5.691E-02	7.415E-02	-0.
24	-0.	4.842E-02	5.861E-02	-0.
25	-0.	4.338E-02	5.605E-02	-0.
26	4.758E-02	4.842E-02	7.852E-02	9.445E-02
27	-0.	6.462E-02	7.765E-02	-0.
28	-0.	6.290E-02	8.116E-02	-0.
29	4.087E-02	5.265E-02	7.677E-02	9.624E-02
30	-0.	4.171E-02	5.691E-02	-0.
31	2.599E-02	3.174E-02	4.087E-02	1.098E-01
32	-0.	4.171E-02	5.096E-02	-0.
33	-0.	4.358E-02	5.011E-02	-0.
34	-0.	4.506E-02	5.181E-02	-0.
35	-0.	3.754E-02	5.011E-02	-0.
36	2.763E-02	3.091E-02	4.171E-02	1.189E-01
37	5.776E-02	7.415E-02	8.222E-02	8.645E-02
38	-0.	4.514E-01	6.346E-01	-0.

TABLE B.26 — EXPOSURE RATES FROM 63.7-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, PREMODIFICATION, SHELTERS REMOVED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.555E-02	1.733E-02	2.362E-02	5.018E-02
* 2	-0.	2.181E-02	3.005E-02	-0.
* 3	-0.	2.544E-02	3.005E-02	-0.
* 4	-0.	2.544E-02	3.005E-02	-0.
* 5	-0.	2.181E-02	3.005E-02	-0.
6	1.555E-02	1.733E-02	2.362E-02	5.018E-02
* 7	-0.	2.362E-02	3.005E-02	-0.
8	2.636E-02	3.662E-02	4.919E-02	5.516E-02
* 9	-0.	3.662E-02	4.527E-02	-0.
*10	-0.	3.662E-02	4.527E-02	-0.
*11	2.636E-02	3.568E-02	4.527E-02	5.516E-02
*12	-0.	2.362E-02	3.005E-02	-0.
*13	-0.	2.636E-02	3.192E-02	-0.
*14	-0.	3.662E-02	4.625E-02	-0.
15	-0.	4.140E-02	5.018E-02	-0.
*16	-0.	4.140E-02	4.919E-02	-0.
*17	-0.	3.662E-02	4.625E-02	-0.
*18	-0.	2.636E-02	3.192E-02	-0.
19	-0.	2.636E-02	3.192E-02	-0.
20	-0.	3.662E-02	4.625E-02	-0.
21	-0.	4.140E-02	4.919E-02	-0.
22	-0.	3.568E-02	4.821E-02	-0.
*23	-0.	3.662E-02	4.625E-02	-0.
*24	-0.	2.636E-02	3.192E-02	-0.
25	-0.	2.362E-02	3.005E-02	-0.
26	2.636E-02	3.568E-02	4.527E-02	5.516E-02
27	-0.	3.662E-02	4.527E-02	-0.
*28	-0.	3.662E-02	4.527E-02	-0.
29	2.636E-02	3.098E-02	4.430E-02	5.516E-02
*30	-0.	2.362E-02	3.005E-02	-0.
31	1.555E-02	1.733E-02	2.181E-02	5.018E-02
32	-0.	2.181E-02	3.005E-02	-0.
33	-0.	2.544E-02	3.005E-02	-0.
*34	-0.	2.544E-02	3.005E-02	-0.
*35	-0.	2.181E-02	3.005E-02	-0.
36	1.555E-02	1.733E-02	2.362E-02	5.018E-02
37	3.379E-02	4.333E-02	4.919E-02	5.415E-02
38	-0.	2.960E-01	4.472E-01	-0.

* Estimated by symmetry - not measured.

TABLE B.27 — EXPOSURE RATES FROM 127-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, PREMODIFICATION, SHELTERS REMOVED

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	9.184E-03	9.900E-03	1.351E-02	2.016E-02
* 2	-0.	1.424E-02	1.571E-02	-0.
* 3	-0.	1.279E-02	1.497E-02	-0.
* 4	-0.	1.279E-02	1.497E-02	-0.
* 5	-0.	1.424E-02	1.571E-02	-0.
6	9.184E-03	9.184E-03	1.279E-02	2.016E-02
* 7	-0.	1.424E-02	1.571E-02	-0.
8	1.424E-02	1.718E-02	2.241E-02	2.545E-02
* 9	-0.	1.792E-02	2.091E-02	-0.
*10	-0.	1.792E-02	2.091E-02	-0.
*11	1.424E-02	1.718E-02	2.241E-02	2.545E-02
*12	-0.	1.424E-02	1.571E-02	-0.
*13	-0.	1.424E-02	1.644E-02	-0.
*14	-0.	1.792E-02	2.091E-02	-0.
15	-0.	2.016E-02	2.241E-02	-0.
*16	-0.	2.016E-02	2.241E-02	-0.
*17	-0.	1.792E-02	2.091E-02	-0.
*18	-0.	1.424E-02	1.644E-02	-0.
19	-0.	1.424E-02	1.644E-02	-0.
20	-0.	1.792E-02	2.091E-02	-0.
21	-0.	2.016E-02	2.241E-02	-0.
22	-0.	1.718E-02	2.241E-02	-0.
*23	-0.	1.792E-02	2.091E-02	-0.
*24	-0.	1.424E-02	1.644E-02	-0.
25	-0.	1.424E-02	1.571E-02	-0.
26	1.424E-02	1.867E-02	2.016E-02	2.545E-02
27	-0.	1.792E-02	2.091E-02	-0.
*28	-0.	1.792E-02	2.091E-02	-0.
29	1.424E-02	1.497E-02	2.091E-02	2.545E-02
*30	-0.	1.424E-02	1.571E-02	-0.
31	9.184E-03	9.900E-03	1.134E-02	2.016E-02
32	-0.	1.134E-02	1.424E-02	-0.
33	-0.	1.279E-02	1.497E-02	-0.
*34	-0.	1.279E-02	1.497E-02	-0.
*35	-0.	1.134E-02	1.424E-02	-0.
36	-0.	9.900E-03	1.206E-02	-0.
37	1.644E-02	1.941E-02	2.241E-02	2.622E-02
38	-0.	1.890E-01	2.161E-01	-0.

* Estimated by symmetry - not measured.

TABLE B. 28 — EXPOSURE RATES FROM 42.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, POSTMODIFICATION, BEFORE CURTAIN WALL

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	2.252E-02	2.857E-02	4.161E-02	8.376E-02
2	3.238E-02	3.929E-02	5.488E-02	0.
3	3.631E-02	4.238E-02	5.409E-02	0.
4	3.155E-02	4.006E-02	5.725E-02	0.
5	3.009E-02	3.621E-02	5.567E-02	0.
6	2.403E-02	2.630E-02	4.316E-02	1.299E-01
7	4.161E-02	5.883E-02	7.887E-02	0.
8	4.394E-02	5.567E-02	7.725E-02	0.
9	3.775E-02	5.174E-02	7.725E-02	0.
10	3.238E-02	4.006E-02	5.883E-02	0.
11	3.391E-02	3.775E-02	4.783E-02	0.
12	4.394E-02	5.567E-02	7.240E-02	0.
13	4.783E-02	6.359E-02	8.376E-02	0.
14	4.238E-02	6.280E-02	8.294E-02	0.
15	3.775E-02	5.174E-02	7.725E-02	0.
16	3.775E-02	4.084E-02	5.331E-02	0.
17	3.775E-02	4.161E-02	4.939E-02	0.
18	4.238E-02	5.174E-02	6.759E-02	0.
19	4.006E-02	5.567E-02	6.999E-02	0.
20	4.939E-02	5.962E-02	7.402E-02	0.
21	4.161E-02	5.567E-02	7.563E-02	0.
22	3.775E-02	4.316E-02	4.705E-02	0.
23	3.162E-02	3.775E-02	4.549E-02	0.
24	3.775E-02	5.174E-02	6.599E-02	0.
25	3.238E-02	3.238E-02	5.174E-02	0.
26	4.006E-02	5.567E-02	6.519E-02	0.
27	3.162E-02	3.009E-02	0.	0.
28	4.238E-02	4.783E-02	6.519E-02	0.
29	3.315E-02	3.775E-02	4.705E-02	0.
30	2.478E-02	3.009E-02	4.783E-02	0.
31	3.009E-02	3.775E-02	5.962E-02	0.
32	2.026E-02	2.630E-02	3.775E-02	0.
33	1.876E-02	2.101E-02	3.391E-02	8.703E-02
34	2.403E-02	3.775E-02	5.567E-02	0.
35	2.478E-02	3.238E-02	4.705E-02	0.
36	1.502E-02	2.101E-02	3.162E-02	9.527E-02
37	1.876E-02	2.630E-02	4.006E-02	0.
38	3.777E-03	5.459E-03	6.660E-03	0.
39	4.738E-03	6.660E-03	7.461E-03	0.
40	3.296E-03	5.459E-03	7.061E-03	0.
41	2.736E-03	4.738E-03	7.461E-03	0.
42	2.095E-03	4.097E-03	6.660E-03	0.
43	2.656E-03	5.299E-03	6.981E-03	0.
44	2.976E-03	5.379E-03	6.580E-03	0.

TABLE B. 29 — EXPOSURE RATES FROM GROUND EXPOSURE,
NORMALIZED TO MR/HR PER MC/SQ FT, 2SB HOUSE,
POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.362E 00	2.712E 00	5.412E 00	0.
2	1.989E 00	2.848E 00	5.861E 00	0.
3	1.595E 00	2.577E 00	3.399E 00	0.
4	1.831E 00	1.989E 00	3.343E 00	0.
5	1.466E 00	2.042E 00	3.122E 00	0.
6	1.208E 00	1.259E 00	2.658E 00	0.
7	1.857E 00	2.848E 00	4.189E 00	0.
8	1.962E 00	2.442E 00	3.067E 00	0.
9	1.466E 00	2.042E 00	2.794E 00	0.
10	1.311E 00	0.	2.388E 00	0.
11	1.466E 00	1.700E 00	2.308E 00	0.
12	2.042E 00	2.577E 00	3.623E 00	0.
13	2.577E 00	3.260E 00	4.332E 00	0.
14	2.308E 00	3.594E 00	4.649E 00	0.
15	2.174E 00	3.122E 00	4.591E 00	0.
16	1.962E 00	2.361E 00	3.260E 00	0.
17	1.778E 00	2.308E 00	2.957E 00	0.
18	2.308E 00	2.903E 00	3.961E 00	0.
19	2.254E 00	3.177E 00	3.819E 00	0.
20	2.577E 00	3.122E 00	3.763E 00	0.
21	2.254E 00	2.930E 00	4.103E 00	0.
22	1.778E 00	2.121E 00	2.577E 00	0.
23	1.466E 00	1.989E 00	2.577E 00	0.
24	2.042E 00	2.848E 00	3.623E 00	0.
25	1.569E 00	1.726E 00	2.577E 00	0.
26	2.254E 00	0.	3.623E 00	0.
27	1.595E 00	1.700E 00	2.523E 00	0.
28	2.121E 00	2.712E 00	3.623E 00	0.
29	1.647E 00	1.989E 00	2.658E 00	0.
30	1.208E 00	1.517E 00	2.739E 00	0.
31	1.440E 00	2.174E 00	3.539E 00	0.
32	1.004E 00	1.388E 00	2.523E 00	0.
33	1.080E 00	1.131E 00	2.361E 00	0.
34	1.259E 00	2.121E 00	3.122E 00	0.
35	1.131E 00	1.647E 00	2.577E 00	0.
36	7.010E-01	1.004E 00	1.726E 00	6.012E 00
37	1.004E 00	1.259E 00	2.095E 00	0.
38	2.689E-01	4.296E-01	4.832E-01	0.
39	3.425E-01	4.966E-01	5.635E-01	0.
40	2.689E-01	4.564E-01	5.970E-01	0.
41	2.086E-01	4.430E-01	0.	0.
42	1.751E-01	4.229E-01	0.	0.
43	2.354E-01	4.698E-01	6.104E-01	0.
44	2.689E-01	4.229E-01	5.099E-01	0.

TABLE B. 30 — EXPOSURE RATES FROM 42.5-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, POSTMODIFICATION AFTER CURTAIN WALL

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	1.211E-02	1.564E-02	2.993E-02	8.471E-02
2	1.918E-02	2.705E-02	4.159E-02	0.
3	2.849E-02	3.428E-02	4.972E-02	0.
4	3.210E-02	3.719E-02	5.644E-02	0.
5	2.777E-02	3.574E-02	5.046E-02	0.
6	2.203E-02	2.418E-02	3.793E-02	1.311E-01
7	3.574E-02	4.897E-02	6.853E-02	0.
8	3.574E-02	4.232E-02	5.195E-02	0.
9	2.633E-02	3.501E-02	4.897E-02	0.
10	2.346E-02	2.705E-02	3.719E-02	0.
11	2.777E-02	3.138E-02	4.086E-02	0.
12	3.283E-02	3.866E-02	5.569E-02	0.
13	4.306E-02	5.719E-02	7.928E-02	0.
14	4.086E-02	5.944E-02	8.005E-02	0.
15	3.574E-02	5.046E-02	7.543E-02	0.
16	3.574E-02	4.159E-02	5.644E-02	0.
17	3.428E-02	4.159E-02	4.972E-02	0.
18	4.159E-02	4.897E-02	6.549E-02	0.
19	3.866E-02	5.344E-02	6.549E-02	0.
20	4.380E-02	5.046E-02	6.777E-02	0.
21	4.159E-02	5.121E-02	7.312E-02	0.
22	3.355E-02	4.749E-02	4.380E-02	0.
23	2.849E-02	3.574E-02	4.453E-02	0.
24	3.574E-02	4.972E-02	6.473E-02	0.
25	2.849E-02	3.283E-02	4.306E-02	0.
26	3.793E-02	5.195E-02	6.549E-02	0.
27	2.849E-02	2.921E-02	4.159E-02	0.
28	3.939E-02	4.527E-02	6.398E-02	0.
29	3.210E-02	3.647E-02	4.972E-02	0.
30	2.203E-02	2.921E-02	4.897E-02	0.
31	2.849E-02	3.501E-02	5.794E-02	0.
32	1.989E-02	2.777E-02	3.939E-02	0.
33	2.203E-02	2.132E-02	3.501E-02	8.861E-02
34	2.705E-02	3.793E-02	5.719E-02	0.
35	2.418E-02	3.428E-02	4.380E-02	0.
36	1.422E-02	2.132E-02	3.210E-02	9.647E-02
37	2.060E-02	2.489E-02	4.012E-02	0.
38	3.424E-03	5.319E-03	6.381E-03	0.
39	4.561E-03	6.457E-03	7.215E-03	0.
40	3.196E-03	5.319E-03	6.760E-03	0.
41	2.590E-03	4.561E-03	7.215E-03	0.
42	2.059E-03	3.954E-03	6.532E-03	0.
43	2.514E-03	5.092E-03	6.532E-03	0.
44	2.969E-03	5.092E-03	6.229E-03	0.

TABLE B. 31 — EXPOSURE RATES FROM 127-FT RADIUS
EXPOSURE, NORMALIZED TO MR/HR PER MC/FT, 2SB
HOUSE, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft			
	0.5	3.0	5.0	6.5
1	4.949E-03	6.347E-03	0.	0.
2	6.696E-03	8.794E-03	0.	0.
3	9.493E-03	1.159E-02	0.	0.
4	1.089E-02	1.369E-02	0.	0.
5	1.019E-02	1.159E-02	0.	0.
6	8.794E-03	9.493E-03	0.	0.
7	1.264E-02	1.579E-02	0.	0.
8	2.313E-02	1.299E-02	0.	0.
9	9.493E-03	1.124E-02	0.	0.
10	8.794E-03	9.493E-03	0.	0.
11	9.493E-03	1.054E-02	0.	0.
12	1.229E-02	1.509E-02	0.	0.
13	1.369E-02	1.718E-02	0.	0.
14	1.334E-02	1.823E-02	0.	0.
15	1.159E-02	1.613E-02	0.	0.
16	1.019E-02	1.334E-02	0.	0.
17	1.089E-02	1.369E-02	0.	0.
18	1.229E-02	1.648E-02	0.	0.
19	0.	0.	0.	0.
20	1.369E-02	1.858E-02	0.	0.
21	1.264E-02	1.753E-02	0.	0.
22	1.054E-02	1.439E-02	0.	0.
23	9.493E-03	1.334E-02	0.	0.
24	1.124E-02	1.544E-02	0.	0.
25	9.493E-03	1.229E-02	0.	0.
26	1.194E-02	1.648E-02	0.	0.
27	9.143E-03	9.493E-03	0.	0.
28	1.229E-02	1.579E-02	0.	0.
29	9.843E-03	1.264E-02	0.	0.
30	8.095E-03	1.019E-02	0.	0.
31	8.794E-03	1.299E-02	0.	0.
32	5.997E-03	9.143E-03	0.	0.
33	5.997E-03	8.444E-03	0.	0.
34	7.745E-03	1.229E-02	0.	0.
35	7.745E-03	1.124E-02	0.	0.
36	5.298E-03	7.745E-03	0.	0.
37	9.493E-03	0.	0.	0.
38	9.236E-04	1.529E-03	1.932E-03	0.
39	1.327E-03	1.831E-03	2.134E-03	0.
40	9.236E-04	1.428E-03	1.831E-03	0.
41	7.218E-04	1.226E-03	1.932E-03	0.
42	6.210E-04	9.236E-04	1.731E-03	0.
43	7.218E-04	1.327E-03	1.731E-03	0.
44	8.227E-04	1.327E-03	1.529E-03	0.

TABLE B. 32-- EXPOSURE RATES FROM 25.5-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Position	Height above floor, ft								
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	7.349E-02	-0.	-0.	9.465E-02	-0.	-0.	-0.	2.525E-01	-0.
2	1.042E-01	-0.	-0.	1.293E-01	-0.	-0.	-0.	2.971E-01	-0.
3	8.405E-02	-0.	-0.	1.132E-01	-0.	-0.	-0.	1.802E-01	-0.
5	1.185E-01	-0.	-0.	1.685E-01	-0.	-0.	-0.	3.804E-01	-0.
8	-0.	-0.	-0.	1.016E-01	-0.	-0.	-0.	2.858E-01	-0.
9	-0.	-0.	-0.	1.723E-01	-0.	-0.	-0.	3.067E-01	-0.
10	-0.	-0.	-0.	1.664E-01	-0.	-0.	-0.	3.291E-01	-0.
11	-0.	-0.	-0.	1.626E-01	-0.	-0.	-0.	2.993E-01	-0.
12	-0.	-0.	-0.	1.527E-01	-0.	-0.	-0.	2.418E-01	-0.
13	9.256E-02	9.787E-02	1.075E-01	-0.	1.239E-01	1.518E-01	-0.	1.833E-01	2.778E-01
20	7.989E-02	-0.	-0.	9.934E-02	-0.	-0.	-0.	2.914E-01	-0.
21	1.562E-01	-0.	-0.	1.706E-01	-0.	-0.	-0.	3.054E-01	-0.
22	1.960E-01	-0.	-0.	1.539E-01	-0.	-0.	-0.	2.697E-01	-0.
26	1.053E-01	-0.	-0.	1.610E-01	-0.	-0.	-0.	2.841E-01	-0.
27	6.726E-02	-0.	-0.	1.234E-01	-0.	-0.	-0.	1.631E-01	-0.
28	3.281E-02	4.138E-02	6.774E-02	-0.	7.141E-02	9.256E-02	-0.	1.330E-01	2.351E-01
29	1.084E-01	1.319E-01	1.464E-01	-0.	1.511E-01	1.744E-01	-0.	2.368E-01	3.774E-01
32	1.272E-01	1.218E-01	1.384E-01	-0.	1.631E-01	2.077E-01	-0.	2.552E-01	5.828E-01
33	-0.	-0.	-0.	1.314E-01	-0.	-0.	-0.	-0.	-0.
34	-0.	-0.	-0.	1.718E-01	-0.	-0.	-0.	-0.	-0.
4	1.519E-02	-0.	-0.	1.705E-02	-0.	-0.	-0.	1.854E-02	-0.
5	1.593E-02	-0.	-0.	1.443E-02	-0.	-0.	-0.	2.707E-02	-0.
6	1.752E-02	-0.	-0.	1.668E-02	-0.	-0.	-0.	3.205E-02	-0.
14	1.705E-02	-0.	-0.	2.089E-02	-0.	-0.	-0.	1.937E-02	-0.
15	-0.	-0.	-0.	1.513E-02	-0.	-0.	-0.	1.929E-02	-0.
16	-0.	-0.	-0.	1.909E-02	-0.	-0.	-0.	2.051E-02	-0.
17	-0.	-0.	-0.	2.089E-02	-0.	-0.	-0.	1.871E-02	-0.
18	-0.	-0.	-0.	2.661E-02	-0.	-0.	-0.	1.909E-02	-0.
19	-0.	-0.	-0.	3.334E-02	-0.	-0.	-0.	3.520E-02	-0.
23	1.479E-02	-0.	-0.	1.871E-02	-0.	-0.	-0.	2.363E-02	-0.
24	1.631E-02	-0.	-0.	1.976E-02	-0.	-0.	-0.	1.946E-02	-0.
25	2.164E-02	-0.	-0.	-0.	-0.	-0.	-0.	3.656E-02	-0.
30	-0.	-0.	-0.	1.901E-02	-0.	-0.	-0.	1.442E-02	-0.
31	5.032E-02	6.001E-02	6.069E-02	-0.	6.069E-02	5.482E-02	-0.	8.250E-02	-0.
35	-0.	-0.	-0.	8.128E-02	-0.	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	1.042E-01	-0.	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	1.327E-01	-0.	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	1.092E-01	-0.	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	1.454E-01	-0.	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	1.686E-01	-0.	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	8.518E-02	-0.	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	9.263E-02	-0.	-0.	-0.	-0.	-0.

TABLE B. 33 -- EXPOSURE RATES FROM 29.0-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Position	Height above floor, ft								
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
2	4.661E-02	-0.	-0.	7.460E-02	-0.	-0.	-0.	1.756E-01	-0.
3	6.991E-02	-0.	-0.	9.347E-02	-0.	-0.	-0.	2.128E-01	-0.
5	6.523E-02	-0.	-0.	8.166E-02	-0.	-0.	-0.	1.438E-01	-0.
7	7.460E-02	-0.	-0.	1.221E-01	-0.	-0.	-0.	2.404E-01	-0.
8	-0.	-0.	-0.	9.110E-02	-0.	-0.	-0.	2.404E-01	-0.
9	-0.	-0.	-0.	1.245E-01	-0.	-0.	-0.	2.354E-01	-0.
10	-0.	-0.	-0.	1.269E-01	-0.	-0.	-0.	2.460E-01	-0.
11	-0.	-0.	-0.	1.269E-01	-0.	-0.	-0.	2.126E-01	-0.
12	-0.	-0.	-0.	1.173E-01	-0.	-0.	-0.	2.103E-01	-0.
13	6.056E-02	7.460E-02	8.874E-02	-0.	1.006E-01	1.197E-01	-0.	1.414E-01	2.628E-01
20	6.757E-02	-0.	-0.	8.874E-02	-0.	-0.	-0.	2.178E-01	-0.
21	9.347E-02	-0.	-0.	1.245E-01	-0.	-0.	-0.	2.354E-01	-0.
22	7.695E-02	-0.	-0.	1.173E-01	-0.	-0.	-0.	1.278E-01	-0.
26	9.110E-02	-0.	-0.	1.197E-01	-0.	-0.	-0.	2.203E-01	-0.
27	4.429E-02	-0.	-0.	5.822E-02	-0.	-0.	-0.	1.366E-01	-0.
28	2.816E-02	4.198E-02	4.893E-02	-0.	6.523E-02	6.637E-02	-0.	1.245E-01	2.203E-01
29	8.637E-02	7.110E-02	1.077E-01	-0.	1.149E-01	1.317E-01	-0.	1.854E-01	3.254E-01
32	8.874E-02	9.347E-02	1.101E-01	-0.	1.245E-01	1.535E-01	-0.	1.929E-01	4.124E-01
33	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.	-0.
34	-0.	-0.	-0.	1.173E-01	-0.	-0.	-0.	-0.	-0.
4	6.189E-03	-0.	-0.	8.528E-03	-0.	-0.	-0.	9.856E-03	-0.
5	7.221E-03	-0.	-0.	9.057E-03	-0.	-0.	-0.	1.565E-02	-0.
6	6.189E-03	-0.	-0.	7.480E-03	-0.	-0.	-0.	1.452E-02	-0.
14	9.057E-03	-0.	-0.	1.205E-02	-0.	-0.	-0.	9.322E-03	-0.
15	-0.	-0.	-0.	1.202E-02	-0.	-0.	-0.	1.565E-02	-0.
16	-0.	-0.	-0.	1.257E-02	-0.	-0.	-0.	1.267E-02	-0.
17	-0.	-0.	-0.	1.257E-02	-0.	-0.	-0.	1.120E-02	-0.
18	-0.	-0.	-0.	1.480E-02	-0.	-0.	-0.	1.147E-02	-0.
19	-0.	-0.	-0.	1.737E-02	-0.	-0.	-0.	1.941E-02	-0.
23	6.961E-03	-0.	-0.	1.147E-02	-0.	-0.	-0.	1.422E-02	-0.
24	7.480E-03	-0.	-0.	1.066E-02	-0.	-0.	-0.	1.230E-02	-0.
25	1.257E-02	-0.	-0.	2.060E-02	-0.	-0.	-0.	2.640E-02	-0.
30	-0.	-0.	-0.	6.703E-03	-0.	-0.	-0.	6.169E-03	-0.
31	-0.	5.357E-02	4.893E-02	-0.	5.125E-02	4.661E-02	-0.	4.893E-02	-0.
35	-0.	-0.	-0.	6.056E-02	-0.	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	7.460E-02	-0.	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	9.584E-02	-0.	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	6.991E-02	-0.	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	7.347E-02	-0.	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	1.173E-01	-0.	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	6.523E-02	-0.	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	7.695E-02	-0.	-0.	-0.	-0.	-0.
	Height above floor, ft								
	1.0	3.0	5.0	7.0					
44	-0.	1.101E-01	1.487E-01	-0.					
45	-0.	9.584E-02	1.414E-01	-0.					
46	-0.	1.054E-01	1.609E-01	-0.					
47	-0.	1.125E-01	1.633E-01	-0.					
48	-0.	1.245E-01	1.805E-01	-0.					
49	-0.	1.535E-01	2.379E-01	-0.					
50	-0.	1.414E-01	2.228E-01	-0.					
51	-0.	1.149E-01	1.633E-01	-0.					

TABLE B. 34 -- EXPOSURE RATES FROM 32.5-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Height above floor, ft									
Position	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	4.068E-02	-0.	-0.	6.576E-02	-0.	-0.	-0.	1.477E-01	-0.
2	5.917E-02	-0.	-0.	7.933E-02	-0.	-0.	-0.	1.790E-01	-0.
3	6.962E-02	-0.	-0.	6.979E-02	-0.	-0.	-0.	1.260E-01	-0.
7	6.784E-02	-0.	-0.	1.087E-01	-0.	-0.	-0.	2.059E-01	-0.
8	-0.	-0.	-0.	7.488E-02	-0.	-0.	-0.	2.013E-01	-0.
9	-0.	-0.	-0.	1.097E-01	-0.	-0.	-0.	1.924E-01	-0.
10	-0.	-0.	-0.	1.163E-01	-0.	-0.	-0.	2.108E-01	-0.
11	-0.	-0.	-0.	1.127E-01	-0.	-0.	-0.	1.862E-01	-0.
12	-0.	-0.	-0.	9.889E-02	-0.	-0.	-0.	1.862E-01	-0.
13	5.326E-02	6.480E-02	7.398E-02	-0.	8.801E-02	1.052E-01	1.304E-01	1.249E-01	2.212E-01
20	6.014E-02	-0.	-0.	7.511E-02	-0.	-0.	-0.	1.869E-01	-0.
21	8.230E-02	-0.	-0.	1.154E-01	-0.	-0.	-0.	1.996E-01	-0.
22	6.783E-02	-0.	-0.	1.065E-01	-0.	-0.	-0.	1.781E-01	-0.
26	7.250E-02	-0.	-0.	1.107E-01	-0.	-0.	-0.	1.932E-01	-0.
27	3.497E-02	-0.	-0.	5.133E-02	-0.	-0.	-0.	1.243E-01	-0.
28	2.574E-02	3.329E-02	4.281E-02	-0.	5.317E-02	7.108E-02	-0.	1.174E-01	2.008E-01
29	7.091E-02	7.841E-02	9.046E-02	9.866E-02	1.041E-01	1.234E-01	-0.	1.624E-01	2.819E-01
32	7.746E-02	8.076E-02	9.534E-02	-0.	1.119E-01	1.143E-01	-0.	1.639E-01	3.085E-01
33	-0.	-0.	-0.	1.302E-01	-0.	-0.	-0.	-0.	-0.
34	-0.	-0.	-0.	1.057E-01	-0.	-0.	-0.	-0.	-0.
4	5.666E-03	-0.	-0.	8.034E-03	-0.	-0.	-0.	8.706E-03	-0.
5	6.588E-03	-0.	-0.	8.102E-03	-0.	-0.	-0.	1.351E-02	-0.
6	5.853E-03	-0.	-0.	6.968E-03	-0.	-0.	-0.	1.146E-02	-0.
14	8.297E-03	-0.	-0.	1.135E-02	-0.	-0.	-0.	2.545E-03	-0.
15	-0.	-0.	-0.	1.124E-02	-0.	-0.	-0.	1.376E-02	-0.
16	-0.	-0.	-0.	1.146E-02	-0.	-0.	-0.	1.146E-02	-0.
17	-0.	-0.	-0.	1.067E-02	-0.	-0.	-0.	1.047E-02	-0.
18	-0.	-0.	-0.	1.320E-02	-0.	-0.	-0.	1.104E-02	-0.
19	-0.	-0.	6.116E-03	1.606E-02	-0.	-0.	-0.	1.647E-02	-0.
23	6.588E-03	-0.	-0.	1.065E-02	-0.	-0.	-0.	1.539E-02	-0.
24	7.072E-03	-0.	-0.	9.563E-03	-0.	-0.	-0.	1.146E-02	-0.
25	1.155E-02	-0.	-0.	1.886E-02	-0.	-0.	-0.	-0.	-0.
30	-0.	-0.	-0.	6.399E-03	-0.	-0.	-0.	6.022E-03	-0.
31	3.979E-02	4.435E-02	4.274E-02	-0.	4.413E-02	3.987E-02	-0.	3.737E-02	-0.
35	-0.	-0.	-0.	5.221E-02	-0.	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	6.471E-02	-0.	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	8.295E-02	-0.	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	7.108E-02	-0.	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	8.147E-02	-0.	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	9.469E-02	-0.	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	5.221E-02	-0.	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	6.616E-02	-0.	-0.	-0.	-0.	-0.
Height above floor, ft									
	1.0	3.0	5.0	7.0					
44	-0.	9.512E-02	1.371E-01	-0.					
45	-0.	8.370E-02	1.318E-01	-0.					
46	-0.	9.811E-02	1.470E-01	-0.					
47	-0.	9.929E-02	1.499E-01	-0.					
48	-0.	1.146E-01	1.608E-01	-0.					
49	-0.	1.371E-01	2.070E-01	-0.					
50	-0.	1.297E-01	1.931E-01	-0.					
51	-0.	9.803E-02	1.477E-01	-0.					

TABLE B. 35 -- EXPOSURE RATES FROM 36.6-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Position	Height above floor, ft								
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5
1	5.256E-02	-0.	-0.	5.804E-02	-0.	-0.	-0.	1.257E-01	-0.
2	5.256E-02	-0.	-0.	7.184E-02	-0.	-0.	-0.	1.534E-01	-0.
3	4.847E-02	-0.	-0.	6.354E-02	-0.	-0.	-0.	1.013E-01	-0.
7	6.079E-02	-0.	-0.	5.565E-02	-0.	-0.	-0.	1.818E-01	-0.
8	-0.	-0.	-0.	6.768E-02	-0.	-0.	-0.	1.738E-01	-0.
9	-0.	-0.	-0.	9.848E-02	-0.	-0.	-0.	1.713E-01	-0.
10	-0.	-0.	-0.	1.042E-01	-0.	-0.	-0.	1.908E-01	-0.
11	-0.	-0.	-0.	9.848E-02	-0.	-0.	-0.	1.668E-01	-0.
12	-0.	-0.	-0.	9.142E-02	-0.	-0.	-0.	1.668E-01	-0.
13	4.711E-02	5.804E-02	6.768E-02	-0.	7.886E-02	9.565E-02	-0.	1.195E-01	1.969E-01
20	5.393E-02	-0.	-0.	6.768E-02	-0.	-0.	-0.	1.668E-01	-0.
21	7.462E-02	-0.	-0.	1.013E-01	-0.	-0.	-0.	1.818E-01	-0.
22	6.216E-02	-0.	-0.	9.565E-02	-0.	-0.	-0.	1.668E-01	-0.
26	6.907E-02	-0.	-0.	9.848E-02	-0.	-0.	-0.	1.803E-01	-0.
27	2.957E-02	-0.	-0.	4.984E-02	-0.	-0.	-0.	1.127E-01	1.923E-01
28	2.555E-02	3.225E-02	4.033E-02	-0.	-0.	5.256E-02	6.492E-02	1.084E-01	-0.
29	6.492E-02	7.045E-02	8.299E-02	-0.	9.424E-02	1.113E-01	-0.	1.505E-01	2.590E-01
32	6.768E-02	7.184E-02	8.299E-02	-0.	9.848E-02	1.214E-01	-0.	1.476E-01	-0.
33	-0.	-0.	-0.	7.462E-02	-0.	-0.	-0.	-0.	-0.
34	-0.	-0.	-0.	9.424E-02	-0.	-0.	-0.	-0.	-0.
4	3.720E-03	-0.	-0.	4.922E-03	-0.	-0.	-0.	5.843E-03	-0.
5	4.317E-03	-0.	-0.	5.380E-03	-0.	-0.	-0.	7.575E-03	-0.
6	3.868E-03	-0.	-0.	7.735E-03	-0.	-0.	-0.	7.415E-03	-0.
15	5.534E-03	-0.	-0.	7.735E-03	-0.	-0.	-0.	5.998E-03	-0.
16	-0.	-0.	-0.	7.735E-03	-0.	-0.	-0.	9.861E-03	-0.
16	-0.	-0.	-0.	7.735E-03	-0.	-0.	-0.	8.057E-03	-0.
17	-0.	-0.	-0.	7.256E-03	-0.	-0.	-0.	7.256E-03	-0.
18	-0.	-0.	-0.	8.707E-03	-0.	-0.	-0.	7.697E-03	-0.
19	-0.	-0.	-0.	1.104E-02	-0.	-0.	-0.	1.121E-02	-0.
23	4.317E-03	-0.	-0.	7.256E-03	-0.	-0.	-0.	1.053E-02	-0.
24	7.735E-03	-0.	-0.	6.466E-03	-0.	-0.	-0.	8.219E-03	-0.
25	8.057E-03	-0.	-0.	1.276E-02	-0.	-0.	-0.	1.360E-02	-0.
30	-0.	-0.	-0.	4.619E-03	-0.	-0.	-0.	4.167E-03	-0.
31	-0.	4.304E-02	3.898E-02	-0.	4.033E-02	3.898E-02	-0.	3.763E-02	-0.
35	-0.	-0.	-0.	4.575E-02	-0.	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	5.804E-02	-0.	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	7.601E-02	-0.	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	5.530E-02	-0.	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	7.323E-02	-0.	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	8.720E-02	-0.	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	4.984E-02	-0.	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	5.804E-02	-0.	-0.	-0.	-0.	-0.
Position	Height above floor, ft								
	1.0	3.0	5.0	7.0					
44	-0.	8.299E-02	1.257E-01	-0.					
45	-0.	7.860E-02	1.214E-01	-0.					
46	-0.	8.439E-02	1.358E-01	-0.					
47	-0.	9.001E-02	1.373E-01	-0.					
48	-0.	1.027E-01	1.476E-01	-0.					
49	-0.	1.228E-01	1.863E-01	-0.					
50	-0.	1.142E-01	1.728E-01	-0.					
51	-0.	8.720E-02	1.358E-01	-0.					

TABLE B.36 — EXPOSURE RATES FROM 42.5-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5
1	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5
2	3.763E-02	-0.	-0.	5.288E-02	-0.	-0.	-0.	1.086E-01
3	4.808E-02	-0.	-0.	6.201E-02	-0.	-0.	-0.	1.312E-01
4	4.303E-02	-0.	-0.	5.592E-02	-0.	-0.	-0.	1.003E-01
7	5.468E-02	-0.	-0.	8.316E-02	-0.	-0.	-0.	1.563E-01
8	-0.	-0.	-0.	5.909E-02	-0.	-0.	-0.	1.532E-01
9	-0.	-0.	-0.	8.628E-02	-0.	-0.	-0.	1.512E-01
10	-0.	-0.	-0.	8.753E-02	-0.	-0.	-0.	-0.
11	-0.	-0.	-0.	8.883E-02	-0.	-0.	-0.	1.444E-01
12	-0.	-0.	-0.	7.948E-02	-0.	-0.	-0.	1.450E-01
13	4.180E-02	5.220E-02	5.827E-02	-0.	6.826E-02	6.430E-02	-0.	1.027E-01
20	4.753E-02	-0.	-0.	5.840E-02	-0.	-0.	-0.	1.444E-01
21	6.520E-02	-0.	-0.	8.883E-02	-0.	-0.	-0.	1.557E-01
22	5.468E-02	-0.	-0.	8.303E-02	-0.	-0.	-0.	1.424E-01
26	5.784E-02	-0.	-0.	8.557E-02	-0.	-0.	-0.	1.550E-01
27	2.867E-02	-0.	-0.	4.261E-02	-0.	-0.	-0.	9.710E-02
28	2.210E-02	3.042E-02	3.663E-02	-0.	4.425E-02	5.660E-02	-0.	9.812E-02
29	5.729E-02	6.270E-02	7.190E-02	-0.	8.500E-02	9.523E-02	-0.	1.332E-01
32	5.896E-02	6.339E-02	7.147E-02	-0.	8.557E-02	1.021E-01	-0.	1.207E-01
33	-0.	-0.	-0.	6.477E-02	-0.	-0.	-0.	-0.
34	-0.	-0.	-0.	8.132E-02	-0.	-0.	-0.	-0.
4	4.016E-03	-0.	-0.	5.592E-03	-0.	-0.	-0.	6.219E-03
5	4.712E-03	-0.	-0.	5.861E-03	-0.	-0.	-0.	8.230E-03
6	4.274E-03	-0.	-0.	4.888E-03	-0.	-0.	-0.	7.766E-03
14	5.952E-03	-0.	-0.	8.321E-03	-0.	-0.	-0.	6.858E-03
15	-0.	-0.	-0.	8.416E-03	-0.	-0.	-0.	1.118E-02
16	-0.	-0.	-0.	8.511E-03	-0.	-0.	-0.	9.070E-03
17	-0.	-0.	-0.	7.860E-03	-0.	-0.	-0.	8.159E-03
18	-0.	-0.	-0.	9.544E-03	-0.	-0.	-0.	8.139E-03
19	-0.	-0.	-0.	1.186E-02	-0.	-0.	-0.	1.186E-02
23	4.798E-03	-0.	-0.	7.860E-03	-0.	-0.	-0.	1.176E-02
24	5.879E-03	-0.	-0.	7.125E-03	-0.	-0.	-0.	9.170E-03
25	8.695E-03	-0.	-0.	1.425E-02	-0.	-0.	-0.	1.736E-02
30	-0.	-0.	-0.	4.888E-03	-0.	-0.	-0.	-0.
31	3.096E-02	3.595E-02	3.352E-02	-0.	3.474E-02	3.217E-02	-0.	3.163E-02
35	-0.	-0.	-0.	4.003E-02	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	5.165E-02	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	6.576E-02	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	4.863E-02	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	6.520E-02	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	7.891E-02	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	4.058E-02	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	5.165E-02	-0.	-0.	-0.	-0.
Position	Height above floor, ft							
	1.0	3.0	5.0	7.0				
44	-0.	7.373E-02	1.118E-01	-0.				
45	-0.	6.770E-02	1.073E-01	-0.				
46	-0.	7.625E-02	1.189E-01	-0.				
47	-0.	7.878E-02	1.181E-01	-0.				
48	-0.	8.742E-02	1.243E-01	-0.				
49	-0.	1.060E-01	1.498E-01	-0.				
50	-0.	9.710E-02	1.471E-01	-0.				
51	-0.	8.392E-02	1.151E-01	-0.				

TABLE B.37 — EXPOSURE RATES FROM 63.7-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5
1	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5
2	3.238E-02	-0.	-0.	3.611E-02	-0.	-0.	-0.	6.893E-02
3	3.745E-02	-0.	-0.	4.325E-02	-0.	-0.	-0.	8.671E-02
7	2.905E-02	-0.	-0.	4.122E-02	-0.	-0.	-0.	6.433E-02
8	3.951E-02	-0.	-0.	6.154E-02	-0.	-0.	-0.	1.265E-01
9	-0.	-0.	-0.	3.850E-02	-0.	-0.	-0.	9.056E-02
10	-0.	-0.	-0.	6.222E-02	-0.	-0.	-0.	1.024E-01
11	-0.	-0.	-0.	6.154E-02	-0.	-0.	-0.	1.035E-01
12	-0.	-0.	-0.	6.154E-02	-0.	-0.	-0.	1.035E-01
13	3.442E-02	3.645E-02	3.951E-02	-0.	4.668E-02	5.527E-02	-0.	9.162E-02
20	2.938E-02	-0.	-0.	3.850E-02	-0.	-0.	-0.	6.962E-02
21	4.189E-02	-0.	-0.	6.258E-02	-0.	-0.	-0.	9.023E-02
22	4.053E-02	-0.	-0.	5.565E-02	-0.	-0.	-0.	1.043E-01
26	3.985E-02	-0.	-0.	5.701E-02	-0.	-0.	-0.	1.035E-01
27	2.403E-02	2.801E-02	-0.	4.033E-02	-0.	-0.	-0.	1.054E-01
28	1.969E-02	2.568E-02	2.969E-02	-0.	2.938E-02	4.122E-02	-0.	6.573E-02
29	3.951E-02	4.460E-02	4.905E-02	-0.	5.392E-02	6.534E-02	-0.	8.789E-02
32	4.456E-02	4.268E-02	5.111E-02	-0.	5.598E-02	7.581E-02	-0.	8.380E-02
33	-0.	3.975E-02	-0.	4.122E-02	-0.	-0.	-0.	1.301E-01
34	-0.	-0.	-0.	6.006E-02	-0.	-0.	-0.	-0.
4	4.127E-03	-0.	-0.	4.570E-03	-0.	-0.	-0.	4.828E-03
5	3.926E-03	-0.	-0.	4.415E-03	-0.	-0.	-0.	4.818E-03
6	4.858E-03	-0.	-0.	4.112E-03	-0.	-0.	-0.	5.733E-03
14	4.283E-03	-0.	-0.	5.992E-03	-0.	-0.	-0.	5.632E-03
15	-0.	-0.	-0.	6.541E-03	-0.	-0.	-0.	8.368E-03
16	-0.	-0.	-0.	5.992E-03	-0.	-0.	-0.	6.976E-03
17	-0.	-0.	-0.	5.906E-03	-0.	-0.	-0.	6.541E-03
18	-0.	-0.	-0.	7.164E-03	-0.	-0.	-0.	6.715E-03
19	-0.	-0.	-0.	7.903E-03	-0.	-0.	-0.	8.820E-03
23	3.755E-03	-0.	-0.	5.906E-03	-0.	-0.	-0.	9.185E-03
24	3.740E-03	-0.	-0.	5.906E-03	-0.	-0.	-0.	7.439E-03
25	6.614E-03	-0.	-0.	1.153E-02	-0.	-0.	-0.	1.064E-02
30	-0.	-0.	-0.	-0.	-0.	-0.	-0.	6.061E-03
31	1.850E-02	2.104E-02	2.202E-02	-0.	1.987E-02	1.637E-02	-0.	1.560E-02
35	-0.	-0.	-0.	2.676E-02	-0.	-0.	-0.	-0.
36	-0.	-0.	-0.	3.581E-02	-0.	-0.	-0.	-0.
37	-0.	-0.	-0.	4.527E-02	-0.	-0.	-0.	-0.
38	-0.	-0.	-0.	3.561E-02	-0.	-0.	-0.	-0.
39	-0.	-0.	-0.	4.548E-02	-0.	-0.	-0.	-0.
40	-0.	-0.	-0.	5.241E-02	-0.	-0.	-0.	-0.
41	-0.	-0.	-0.	3.015E-02	-0.	-0.	-0.	-0.
42	-0.	-0.	-0.	3.598E-02	-0.	-0.	-0.	-0.

TABLE B.38 — EXPOSURE RATES FROM 127-FT RADIUS EXPOSURE, NORMALIZED
TO MR/HR PER MC/FT, 2SWF HOUSE, PREMODIFICATION

	Height above floor, ft									
Position	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5	
	0.5	1.5	2.5	3.0	3.5	4.5	5.0	5.5	6.5	
1	9.003E-03	-0.	-0.	1.338E-02	-0.	-0.	-0.	2.541E-02	-0.	
* 2	9.545E-03	-0.	-0.	1.618E-02	-0.	-0.	-0.	3.081E-02	-0.	
* 3	9.003E-03	-0.	-0.	1.450E-02	-0.	-0.	-0.	2.365E-02	-0.	
* 7	2.016E-02	-0.	-0.	2.248E-02	-0.	-0.	-0.	4.393E-02	-0.	
* 8	-0.	-0.	-0.	1.562E-02	-0.	-0.	-0.	4.265E-02	-0.	
* 9	-0.	-0.	-0.	2.365E-02	-0.	-0.	-0.	4.201E-02	-0.	
10	-0.	-0.	-0.	2.424E-02	-0.	-0.	-0.	4.329E-02	-0.	
*11	-0.	-0.	-0.	2.541E-02	-0.	-0.	-0.	3.864E-02	-0.	
12	-0.	-0.	-0.	2.248E-02	-0.	-0.	-0.	3.884E-02	-0.	
*13	1.173E-02	1.450E-02	1.674E-02	-0.	1.731E-02	2.248E-02	-0.	2.720E-02	4.783E-02	
*20	1.228E-02	-0.	-0.	1.562E-02	-0.	-0.	-0.	4.074E-02	-0.	
*21	1.731E-02	-0.	-0.	2.424E-02	-0.	-0.	-0.	4.329E-02	-0.	
*22	1.450E-02	-0.	-0.	2.365E-02	-0.	-0.	-0.	3.884E-02	-0.	
*26	1.506E-02	-0.	-0.	2.365E-02	-0.	-0.	-0.	4.329E-02	-0.	
*27	6.855E-03	-0.	-0.	1.009E-02	-0.	-0.	-0.	2.132E-02	-0.	
28	6.322E-03	7.389E-03	8.464E-03	-0.	1.118E-02	1.506E-02	-0.	2.839E-02	5.045E-02	
29	1.394E-02	1.562E-02	1.788E-02	-0.	2.132E-02	2.839E-02	-0.	3.141E-02	4.458E-02	
*32	1.450E-02	1.562E-02	1.788E-02	-0.	2.190E-02	2.660E-02	-0.	3.325E-02	-0.	
*33	-0.	-0.	-0.	1.562E-02	-0.	-0.	-0.	-0.	-0.	
*34	-0.	-0.	-0.	2.074E-02	-0.	-0.	-0.	-0.	-0.	
4	9.429E-04	-0.	-0.	1.365E-03	-0.	-0.	-0.	1.472E-03	-0.	
* 5	1.048E-03	-0.	-0.	1.472E-03	-0.	-0.	-0.	1.901E-03	-0.	
6	9.429E-04	-0.	-0.	1.153E-03	-0.	-0.	-0.	1.365E-03	-0.	
*14	1.472E-03	-0.	-0.	2.009E-03	-0.	-0.	-0.	1.793E-03	-0.	
*15	-0.	-0.	-0.	2.118E-03	-0.	-0.	-0.	2.867E-03	-0.	
*16	-0.	-0.	-0.	2.118E-03	-0.	-0.	-0.	2.227E-03	-0.	
17	-0.	-0.	-0.	1.901E-03	-0.	-0.	-0.	2.118E-03	-0.	
*18	-0.	-0.	-0.	2.336E-03	-0.	-0.	-0.	2.118E-03	-0.	
19	-0.	-0.	-0.	2.887E-03	-0.	-0.	-0.	2.227E-03	-0.	
*23	1.793E-03	-0.	-0.	1.901E-03	-0.	-0.	-0.	2.867E-03	-0.	
*24	1.578E-03	-0.	-0.	1.793E-03	-0.	-0.	-0.	2.336E-03	-0.	
*25	2.118E-03	-0.	-0.	3.447E-03	-0.	-0.	-0.	4.361E-03	-0.	
30	-0.	-0.	-0.	1.259E-03	-0.	-0.	1.259E-03	-0.	-0.	
*31	7.926E-03	8.464E-03	7.926E-03	-0.	7.926E-03	7.926E-03	-0.	7.926E-03	-0.	
*35	-0.	-0.	-0.	1.009E-02	-0.	-0.	-0.	-0.	-0.	
*36	-0.	-0.	-0.	1.283E-02	-0.	-0.	-0.	-0.	-0.	
*37	-0.	-0.	-0.	1.674E-02	-0.	-0.	-0.	-0.	-0.	
*38	-0.	-0.	-0.	1.173E-02	-0.	-0.	-0.	-0.	-0.	
*39	-0.	-0.	-0.	1.618E-02	-0.	-0.	-0.	-0.	-0.	
*40	-0.	-0.	-0.	1.959E-02	-0.	-0.	-0.	-0.	-0.	
*41	-0.	-0.	-0.	1.009E-02	-0.	-0.	-0.	-0.	-0.	
*42	-0.	-0.	-0.	1.283E-02	-0.	-0.	-0.	-0.	-0.	
	Height above floor, ft									
	1.0	3.0	5.0	7.0						
*44	-0.	2.074E-02	2.839E-02	-0.						
*45	-0.	1.845E-02	2.720E-02	-0.						
46	-0.	2.132E-02	3.020E-02	-0.						
*47	-0.	2.190E-02	3.020E-02	-0.						
48	-0.	2.248E-02	3.202E-02	-0.						
*49	-0.	2.720E-02	3.759E-02	-0.						
50	-0.	2.482E-02	3.572E-02	-0.						
*51	-0.	2.248E-02	2.779E-02	-0.						

* Estimated from detector geometry and from 42.5-ft radius exposure.

TABLE B.39 — EXPOSURE RATES FROM 42.5-FT RADIUS EXPOSURE, NORMALIZED TO
MR/HR PER MC/FT, 2SWF HOUSE, POSTMODIFICATION, BEFORE CURTAIN WALL

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.5	6.5
1	3.274E-02	0.	0.	4.990E-02	0.	0.	1.137E-01	0.
2	4.730E-02	0.	0.	7.542E-02	0.	0.	1.174E-01	0.
3	3.956E-02	0.	0.	4.990E-02	0.	0.	7.900E-02	0.
7	0.	0.	0.	5.163E-02	0.	0.	0.	0.
8	0.	0.	0.	9.346E-02	0.	0.	0.	0.
9	0.	0.	0.	8.982E-02	0.	0.	0.	0.
10	0.	0.	0.	8.529E-02	0.	0.	0.	0.
11	0.	0.	0.	8.801E-02	0.	0.	0.	0.
12	4.644E-02	5.163E-02	6.124E-02	0.	8.349E-02	9.619E-02	1.212E-01	1.771E-01
18	2.345E-02	0.	0.	3.870E-02	0.	0.	7.619E-02	0.
19	4.042E-02	0.	0.	5.949E-02	0.	0.	1.008E-01	0.
20	2.429E-02	0.	0.	3.956E-02	0.	0.	0.	0.
21	5.599E-02	5.949E-02	7.542E-02	0.	8.801E-02	8.710E-02	1.268E-01	0.
26	2.766E-02	0.	0.	3.614E-02	0.	0.	1.274E-02	0.
27	5.424E-02	0.	0.	8.801E-02	0.	0.	1.449E-01	0.
28	7.452E-02	0.	0.	1.109E-01	0.	0.	1.801E-01	0.
29	7.452E-02	0.	0.	9.619E-02	0.	0.	1.722E-01	0.
30	0.	0.	0.	3.274E-02	0.	0.	0.	0.
31	0.	0.	0.	4.385E-02	0.	0.	0.	0.
32	0.	0.	0.	5.861E-02	0.	0.	0.	0.
33	7.542E-02	0.	0.	1.072E-01	0.	0.	1.741E-01	0.
34	7.631E-02	0.	0.	1.063E-01	0.	0.	1.702E-01	0.
35	6.653E-02	0.	0.	9.528E-02	0.	0.	1.653E-01	0.
36	5.774E-02	0.	0.	7.810E-02	0.	0.	1.316E-01	0.
37	2.429E-02	2.598E-02	2.598E-02	0.	2.682E-02	2.429E-02	2.766E-02	7.096E-02
38	5.250E-02	5.861E-02	7.185E-02	0.	8.259E-02	1.063E-01	1.297E-01	0.
39	5.774E-02	0.	0.	7.989E-02	0.	0.	1.240E-01	0.
40	4.990E-02	0.	0.	5.250E-02	0.	0.	9.437E-02	0.
25	8.495E-03	0.	0.	7.970E-03	0.	0.	7.970E-03	0.
4	3.816E-03	0.	0.	5.538E-03	0.	0.	5.882E-03	0.
5	4.505E-03	0.	0.	5.366E-03	0.	0.	6.055E-03	0.
6	4.332E-03	0.	0.	4.677E-03	0.	0.	7.260E-03	0.
13	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.
22	2.610E-03	0.	0.	3.816E-03	0.	0.	4.505E-03	0.
23	1.232E-03	0.	0.	2.093E-03	0.	0.	3.299E-03	0.
24	1.749E-03	0.	0.	2.955E-03	0.	0.	5.366E-03	0.

* Multiply all data by 0.88.

TABLE B. 40 — EXPOSURE RATES FROM ROOF EXPOSURE, NORMALIZED TO
MR/HR PER MC/SQ FT, 2SWF HOUSE, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.5	6.5
1	5.959E 00	0.	0.	6.844E 00	0.	0.	8.353E 00	0.
2	6.547E 00	0.	0.	7.895E 00	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	6.350E 00	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	8.404E 00	0.	0.	0.	0.
10	0.	0.	0.	8.098E 00	0.	0.	0.	0.
11	0.	0.	0.	8.608E 00	0.	0.	0.	0.
12	5.618E 00	6.399E 00	6.993E 00	0.	8.353E 00	9.434E 00	0.	0.
18	3.999E 00	0.	0.	5.377E 00	0.	0.	9.175E 00	0.
19	4.517E 00	0.	0.	6.252E 00	0.	0.	8.865E 00	0.
20	2.797E 00	0.	0.	4.945E 00	0.	0.	0.	0.
21	5.861E 00	5.959E 00	6.399E 00	0.	7.042E 00	6.596E 00	7.946E 00	8.506E 00
26	2.073E 00	0.	0.	2.570E 00	0.	0.	1.450E 00	0.
27	4.470E 00	0.	0.	5.861E 00	0.	0.	8.413E 00	0.
28	6.350E 00	0.	0.	7.794E 00	0.	0.	9.278E 00	0.
29	6.056E 00	0.	0.	7.042E 00	0.	0.	8.557E 00	0.
30	0.	0.	0.	2.389E 00	0.	0.	0.	0.
31	0.	0.	0.	3.256E 00	0.	0.	0.	0.
32	0.	0.	0.	4.945E 00	0.	0.	0.	0.
33	6.448E 00	0.	0.	7.442E 00	0.	0.	7.895E 00	0.
34	5.910E 00	0.	0.	6.695E 00	0.	0.	7.895E 00	0.
35	5.232E 00	0.	0.	6.646E 00	0.	0.	8.047E 00	0.
36	5.329E 00	0.	0.	6.350E 00	0.	0.	7.222E 00	0.
37	1.939E 00	1.760E 00	1.450E 00	0.	1.317E 00	1.229E 00	1.185E 00	0.
38	6.105E 00	6.105E 00	6.844E 00	0.	6.844E 00	7.492E 00	8.404E 00	8.557E 00
39	4.850E 00	0.	0.	5.618E 00	0.	0.	7.342E 00	0.
40	2.524E 00	0.	0.	3.533E 00	0.	0.	5.959E 00	0.
25	6.615E-01	0.	0.	9.304E-01	0.	0.	1.273E 00	0.
4	7.790E-01	0.	0.	1.073E 00	0.	0.	1.139E 00	0.
5	1.007E 00	0.	0.	1.106E 00	0.	0.	1.307E 00	0.
6	8.653E-01	0.	0.	9.741E-01	0.	0.	1.284E 00	0.
13	0.	0.	0.	1.386E 00	0.	0.	0.	0.
14	0.	0.	0.	1.431E 00	0.	0.	0.	0.
15	0.	0.	0.	1.409E 00	0.	0.	0.	0.
16	0.	0.	0.	1.363E 00	0.	0.	0.	0.
17	0.	0.	0.	1.895E 00	0.	0.	0.	0.
22	5.980E-01	0.	0.	7.897E-01	0.	0.	1.184E 00	0.
23	4.201E-01	0.	0.	6.828E-01	0.	0.	1.095E 00	0.
24	3.683E-01	0.	0.	6.191E-01	0.	0.	1.062E 00	0.

TABLE B. 41 — EXPOSURE RATES FROM 42.5-FT RADIUS EXPOSURE, NORMALIZED TO
MR/HR PER MC/FT, 2SWF HOUSE, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.5	6.5
1	3.103E-02	0.	0.	4.469E-02	0.	0.	1.044E-01	0.
2	4.125E-02	0.	0.	7.182E-02	0.	0.	0.	0.
3	3.272E-02	0.	0.	4.469E-02	0.	0.	7.094E-02	0.
7	0.	0.	0.	4.555E-02	0.	0.	0.	0.
8	0.	0.	0.	7.897E-02	0.	0.	0.	0.
9	0.	0.	0.	7.807E-02	0.	0.	0.	0.
10	0.	0.	0.	7.718E-02	0.	0.	0.	0.
11	0.	0.	0.	7.897E-02	0.	0.	0.	0.
12	4.125E-02	4.469E-02	5.771E-02	0.	7.361E-02	8.707E-02	1.137E-01	1.604E-01
18	1.843E-02	0.	0.	3.187E-02	0.	0.	8.707E-02	0.
19	3.954E-02	0.	0.	5.596E-02	0.	0.	9.343E-02	0.
20	1.926E-02	0.	0.	3.612E-02	0.	0.	0.	0.
21	4.814E-02	5.074E-02	6.210E-02	0.	8.979E-02	7.807E-02	1.146E-01	0.
26	2.344E-02	0.	0.	3.103E-02	0.	0.	2.512E-02	0.
27	4.555E-02	0.	0.	7.628E-02	0.	0.	1.306E-01	0.
28	5.771E-02	0.	0.	9.343E-02	0.	0.	1.565E-01	0.
29	5.859E-02	0.	0.	7.628E-02	0.	0.	1.458E-01	0.
30	0.	0.	0.	2.596E-02	0.	0.	0.	0.
31	0.	0.	0.	3.442E-02	0.	0.	0.	0.
32	0.	0.	0.	5.161E-02	0.	0.	0.	0.
33	5.335E-02	0.	0.	8.436E-02	0.	0.	1.212E-01	0.
34	4.814E-02	0.	0.	7.718E-02	0.	0.	1.044E-01	0.
35	4.211E-02	0.	0.	5.771E-02	0.	0.	1.044E-01	0.
36	3.612E-02	0.	0.	4.814E-02	0.	0.	8.346E-02	0.
37	2.260E-02	2.093E-02	2.260E-02	0.	2.428E-02	1.843E-02	2.260E-02	0.
38	4.383E-02	5.771E-02	6.122E-02	0.	5.771E-02	9.434E-02	1.128E-01	0.
39	3.272E-02	0.	0.	4.814E-02	0.	0.	9.799E-02	0.
40	1.593E-02	0.	0.	2.512E-02	0.	0.	6.034E-02	0.
25	5.732E-03	0.	0.	6.268E-03	0.	0.	5.464E-03	0.
4	3.499E-03	0.	0.	4.928E-03	0.	0.	5.643E-03	0.
5	4.213E-03	0.	0.	5.018E-03	0.	0.	6.000E-03	0.
6	3.767E-03	0.	0.	4.213E-03	0.	0.	6.715E-03	0.
13	0.	0.	0.	7.251E-03	0.	0.	0.	0.
14	0.	0.	0.	7.251E-03	0.	0.	0.	0.
15	0.	0.	0.	6.805E-03	0.	0.	0.	0.
16	0.	0.	0.	8.145E-03	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.
22	2.069E-03	0.	0.	3.409E-03	0.	0.	4.035E-03	0.
23	8.180E-04	0.	0.	1.712E-03	0.	0.	2.605E-03	0.
24	9.967E-04	0.	0.	2.248E-03	0.	0.	4.928E-03	0.
41	0.	0.	0.	7.094E-02	0.	0.	0.	0.
42	0.	0.	0.	7.005E-02	0.	0.	0.	0.
43	0.	0.	0.	7.539E-02	0.	0.	0.	0.
44	0.	0.	0.	7.094E-02	0.	0.	0.	0.
45	0.	0.	0.	4.814E-02	0.	0.	0.	0.

TABLE B.42 — EXPOSURE RATES FROM 127-FT RADIUS EXPOSURE, NORMALIZED TO
MR/HR PER MC/FT, 2SWF HOUSE, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.5	6.5
1	8.781E-03	0.	0.	1.473E-02	0.	0.	1.954E-02	0.
2	1.409E-02	0.	0.	2.324E-02	0.	0.	3.101E-02	0.
3	1.209E-02	0.	0.	1.564E-02	0.	0.	2.240E-02	0.
7	0.	0.	0.	1.436E-02	0.	0.	0.	0.
8	0.	0.	0.	2.542E-02	0.	0.	0.	0.
9	0.	0.	0.	2.679E-02	0.	0.	0.	0.
10	0.	0.	0.	2.505E-02	0.	0.	0.	0.
11	0.	0.	0.	2.542E-02	0.	0.	0.	0.
12	1.354E-02	1.592E-02	1.856E-02	0.	2.342E-02	2.652E-02	3.433E-02	4.594E-02
18	7.418E-03	0.	0.	1.236E-02	0.	0.	2.597E-02	0.
19	1.168E-02	0.	0.	1.646E-02	0.	0.	2.992E-02	0.
20	7.145E-03	0.	0.	0.	0.	0.	0.	0.
21	1.784E-02	1.710E-02	2.297E-02	0.	3.176E-02	2.522E-02	6.378E-02	4.474E-02
26	7.145E-03	0.	0.	1.004E-02	0.	0.	1.082E-02	0.
27	1.409E-02	0.	0.	2.195E-02	0.	0.	3.721E-02	0.
28	1.863E-02	0.	0.	2.791E-02	0.	0.	4.354E-02	0.
29	1.545E-02	0.	0.	2.488E-02	0.	0.	3.939E-02	0.
30	0.	0.	0.	7.542E-03	0.	0.	0.	0.
31	0.	0.	0.	1.071E-02	0.	0.	0.	0.
32	0.	0.	0.	1.702E-02	0.	0.	0.	0.
33	1.683E-02	0.	0.	2.617E-02	0.	0.	3.580E-02	0.
34	1.473E-02	0.	0.	0.	0.	0.	2.917E-02	0.
35	1.291E-02	0.	0.	1.609E-02	0.	0.	3.057E-02	0.
36	1.168E-02	0.	0.	1.409E-02	0.	0.	2.263E-02	0.
37	8.260E-03	5.337E-03	1.138E-02	0.	6.724E-03	4.940E-03	4.395E-03	0.
38	1.773E-02	1.537E-02	1.673E-02	0.	2.104E-02	2.542E-02	3.129E-02	4.392E-02
39	1.017E-02	0.	0.	1.409E-02	0.	0.	0.	0.
40	5.213E-03	0.	0.	7.269E-03	0.	0.	1.527E-02	0.
25	1.548E-03	0.	0.	2.103E-03	0.	0.	1.548E-03	0.
4	2.242E-03	0.	0.	2.797E-03	0.	0.	3.074E-03	0.
5	2.658E-03	0.	0.	2.658E-03	0.	0.	3.074E-03	0.
6	2.380E-03	0.	0.	2.797E-03	0.	0.	3.074E-03	0.
13	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	1.964E-03	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.
17	0.	0.	0.	0.	0.	0.	0.	0.
22	7.154E-04	0.	0.	9.929E-04	0.	0.	1.270E-03	0.
23	4.579E-04	0.	0.	5.767E-04	0.	0.	8.541E-04	0.
24	4.379E-04	0.	0.	5.767E-04	0.	0.	1.548E-03	0.
41	0.	0.	0.	1.184E-00	0.	0.	0.	0.
42	0.	0.	0.	1.384E-00	0.	0.	0.	0.
43	0.	0.	0.	1.090E-00	0.	0.	0.	0.
44	0.	0.	0.	1.043E-00	0.	0.	0.	0.
45	0.	0.	0.	1.023E-00	0.	0.	0.	0.

TABLE B.43 — EXPOSURE RATES FROM GROUND EXPOSURE, NORMALIZED TO
MR/HR PER MC/SQ FT, 2SWF HOUSE, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Height above floor, ft							
	0.5	1.5	2.5	3.0	3.5	4.5	5.5	6.5
1	1.623E 00	0.	0.	2.842E 00	0.	0.	5.592E 00	0.
2	2.433E 00	0.	0.	3.665E 00	0.	0.	0.	0.
3	2.271E 00	0.	0.	2.596E 00	0.	0.	4.080E 00	0.
7	0.	0.	0.	2.596E 00	0.	0.	0.	0.
8	0.	0.	0.	4.748E 00	0.	0.	0.	0.
9	0.	0.	0.	5.000E 00	0.	0.	0.	0.
10	0.	0.	0.	4.330E 00	0.	0.	0.	0.
11	0.	0.	0.	4.080E 00	0.	0.	0.	0.
12	2.433E 00	3.088E 00	3.252E 00	0.	4.080E 00	4.916E 00	6.444E 00	9.054E 00
18	1.462E 00	0.	0.	2.433E 00	0.	0.	5.592E 00	0.
19	2.842E 00	0.	0.	3.088E 00	0.	0.	5.253E 00	0.
20	1.462E 00	0.	0.	2.271E 00	0.	0.	0.	0.
21	2.842E 00	3.088E 00	3.665E 00	0.	3.913E 00	5.338E 00	7.719E 00	1.489E 01
26	1.462E 00	0.	0.	2.027E 00	0.	0.	2.842E 00	0.
27	3.252E 00	0.	0.	4.497E 00	0.	0.	6.787E 00	0.
28	3.913E 00	0.	0.	5.338E 00	0.	0.	9.230E 00	0.
29	8.221E-01	0.	0.	4.748E 00	0.	0.	8.789E 00	0.
30	0.	0.	0.	1.785E 00	0.	0.	0.	0.
31	0.	0.	0.	2.596E 00	0.	0.	0.	0.
32	0.	0.	0.	3.088E 00	0.	0.	0.	0.
33	3.252E 00	0.	0.	4.497E 00	0.	0.	7.478E 00	0.
34	2.678E 00	0.	0.	4.080E 00	0.	0.	6.615E 00	0.
35	2.596E 00	0.	0.	3.417E 00	0.	0.	6.873E 00	0.
36	2.027E 00	0.	0.	2.842E 00	0.	0.	5.169E 00	0.
37	1.462E 00	1.462E 00	1.623E 00	0.	1.222E 00	1.462E 00	2.271E 00	0.
38	2.596E 00	3.088E 00	3.334E 00	0.	4.080E 00	5.084E 00	6.358E 00	1.640E 01
39	2.027E 00	0.	0.	3.252E 00	0.	0.	6.615E 00	0.
40	1.222E 00	0.	0.	2.271E 00	0.	0.	5.507E 00	0.
25	3.475E-01	0.	0.	4.167E-01	0.	0.	5.619E-01	0.
4	2.263E-01	0.	0.	3.302E-01	0.	0.	4.081E-01	0.
5	3.302E-01	0.	0.	3.475E-01	0.	0.	4.860E-01	0.
6	2.263E-01	0.	0.	2.956E-01	0.	0.	6.917E-01	0.
13	0.	0.	0.	4.514E-01	0.	0.	0.	0.
14	0.	0.	0.	4.687E-01	0.	0.	0.	0.
15	0.	0.	0.	4.514E-01	0.	0.	0.	0.
16	0.	0.	0.	5.552E-01	0.	0.	0.	0.
17	0.	0.	0.	6.418E-01	0.	0.	0.	0.
22	1.398E-01	0.	0.	2.090E-01	0.	0.	2.437E-01	0.
23	7.056E-02	0.	0.	1.225E-01	0.	0.	1.744E-01	0.
24	1.225E-01	0.	0.	1.485E-01	0.	0.	2.756E-01	0.
41	0.	0.	0.	1.485E-01	0.	0.	0.	0.
42	0.	0.	0.	1.311E-01	0.	0.	0.	0.
43	0.	0.	0.	1.052E-01	0.	0.	0.	0.
44	0.	0.	0.	1.311E-01	0.	0.	0.	0.
45	0.	0.	0.	7.056E-02	0.	0.	0.	0.

TABLE B. 44 — NORMALIZED EXPOSURE RATES FOR POINT SOURCES
ON ROOF, POSTMODIFICATION, AFTER CURTAIN WALL

Position	Exposure rate, mr/hr per curie				
	At 0.5 ft	At 3 ft	At 5 ft	At 5.5 ft	At 6.5 ft
Two-story Wood Frame House					
1	9.9	12		13	
4	1.4	1.8		2.4	
5	2.2	2.3		2.6	
10		13			
13		2.3		Off scale	
14		2.5		Off scale	
15		2.9		Off scale	
16		2.8		3.6	
17		2.7		3.2	
22	1.3	1.7		1.8	
23	1.1	1.3		1.8	
24	0.6	0.9		2.1	
25	2.2	3.6		2.8	
26	1.6	2.3		3.0	
28	6.4	6.6		9.4	
34	7.8	8.4		11	
37	1.7	1.7		1.4	
40	1.0	2.8		9.0	
Two-story Brick House					
1			10.6		12.1
6	5.4	7.5	9.6		13.5
12	9.8	11.5	14.6		
15	7.7	8.7	12.5		
19	10.4	11.0	13.9		
20	16.3	16.9	16.3		
26	13.6		19.2		
27	6.4	11.1	11.3		
31	6.9	8.7	9.8		
33	6.9	8.3	7.3		
36	5.6	6.4	7.1		5.6
38	0.67	1.29	1.88		
39	1.38	2.08	2.52		
40	1.44	1.89	1.94		
41		1.37	1.62		
42	1.19	1.56			
43	1.15	1.62	2.02		
44	0.69	1.65	2.18		

TABLE B. 45 — NORMALIZED EXPOSURE RATES FROM FREE-FIELD
MEASUREMENTS OVER 24- BY 24-FT

Position	Exposure rate, mr/hr per mc/sq ft				
	At 3 ft	At 5 ft	At 7 ft	At 9 ft	At 11 ft
1		91	69	53	38
2		88			36
3		75			31
4	77	55	41	34	24
5					
6	73	53			24
7	70	47			23
8					
9	45	36	30	25	19
10	64	42			22
11	77	56			25
12	76	56	41	30	26
13		77			31
14		89			36
15		90			37
16		77			32
17	91	60			27

TABLE B. 46 — NORMALIZED EXPOSURE RATES FROM FREE-FIELD
MEASUREMENTS OVER 24- BY 36-FT

Position	Exposure rate, mr/hr per mc/sq ft				
	At 3 ft	At 5 ft	At 7 ft	At 9 ft	At 11 ft
1		112	84	66	52
2		112			50
3		105	82	63	45
4		99			43
5	95	65	49	40	33
6	84	65			31
7	84	57			27
8	53	44	33	29	25
9	82	62			29
10	90	60			34
11	95	73			35
12	94	70	54	41	37
13		96			43
14		97	79	62	44
15		110			50
16		112			50
17		101			45
18		93	73	55	43
19		87			42
20	105	73			34

Fig. B.1 — Dosimeter positions in RMB house, after basic modification.

Fig. B.2 — Dosimeter positions in PCC house, postmodification.

Fig. B. 3 — Dosimeter positions in WR house, premodification.

Fig. B. 4 — Dosimeter positions in WR house, postmodification.

Fig. B. 5 — Dosimeter positions in 2SB house, with old shelters in place.

Fig. B. 6 — Dosimeter positions in 2SB house, shelters removed.

Fig. B.7 — Dosimeter positions in 2SB house, shelter added.

Fig. B.8 — Dosimeter positions in 2SWF house, premodification.

Fig. B.9 — Dosimeter positions in 2SWF house, postmodification.

Fig. B.10 — Normalized data from simulated contamination on basement stairs of 2SWF house.

0 1 2 4 8
SCALE IN FEET

Fig. B.11 — Tubing layout for free-field measurements, 24 by 24 ft.

0 1 2 4 8
SCALE IN FEET

Fig. B.12 — Tubing layout for free-field measurements, 24 by 36 ft.

Fig. B.13 — Dosimeter positions for free-field measurements, 24 by 24 ft.

Fig. B.14 — Dosimeter positions for free-field area source, 24 by 36 ft.

Appendix C

PLAN AND SECTION DRAWINGS, FIVE HOUSES USED IN RADIATION-PROTECTION STUDIES

C.1 GENERAL

Holmes & Narver, Inc., conducted architectural and engineering studies of the structures used in this report. Plan and section drawings of these structures were furnished by Phillip Huff, Project Officer, Holmes & Narver, Inc., and are included in this report for reference.

1. MASONRY UNITS SHALL BE SAND GRAVEL AGGREGATE, LOAD BEARING TYPE, CONFORMING TO ASTM STANDARD SPECIFICATION DESIGNATION C-90-32 GRADE A. ALL CELLS SHALL BE FILLED WITH GROUT AND TAMPED.
2. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATION A-15-56T WITH A 306-57T DEFORMATIONS. LAP BAR SPICES 30 DIA.
3. MORTAR SHALL BE FRESHLY PREPARED AND UNIFORMLY MIXED IN RATIO OF 1 PART OF PORTLAND CEMENT, 1 1/2 PART LIME PUTTY, 3 1/2 PARTS MORTAR SAND WITH 45 QUART OF RED LABEL SUCONEM (OR EQUAL) AND SHALL CONFORM TO A.S.T.M. SPECIFICATION C 270-52 T.
4. GROUT SHALL CONSIST OF 1 PART PORTLAND CEMENT TO 3 PARTS SAND, AND NOT OVER 10% OF LIME MAY BE ADDED. GROUT SHALL ATTAIN A STRENGTH OF 2000 PSI IN 28 DAYS.
5. JOINTS HORIZONTAL & VERTICAL SHALL BE 3/8" THICK WITH FULL COVERAGE ON THE FACE & WEB SHELLS.
6. PATCH WITH CONCRETE ALL CHIPPED SURFACES OF EXISTING CONCRETE CAUSED BY REMOVAL OF WALLS.
7. CONCRETE SLAB SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 2000 PSI AT 28 DAYS.
8. NEW MASONRY WALLS WHICH SERVE TO INCREASE THE THICKNESS OF EXISTING WALLS SHALL BE SECURELY ANCHORED TO EXISTING WALLS. ALL OTHER NEW WALLS SHALL BE ANCHORED TO EXISTING FLOOR BY DRILLING AND GROUTING ANCHORS. SEE DETAILS N#1 & N#2.
9. CONTRACTOR SHALL VERIFY DIMENSIONS SHOWN FOR EXISTING STRUCTURE, BEFORE BEGINNING CONSTRUCTION.
10. TRANSIT PANNELLING SHALL BE SECURELY NAILED TO EXISTING MASONRY. NAIL HOLES IN TRANSITS SHALL BE PRE-DRILLED.

1. COMPLETE CONSTRUCTION AS SHOWN ON THIS DRAWING EXCEPT EXISTING BATHROOM WINDOW OPENING SHALL BE MASONRY BLOCKED HALF WAY UP. EVERY MASONRY WALL ON THE OUTSIDE SHALL BE CONSTRUCTED TO A HEIGHT OF THE SEMI-BLOCKED WINDOW.
2. MAKE RUN WITH C-60 SOURCE.
3. BLOCK UP UPPER HALF OF BATHROOM WINDOW WITH CONCRETE MASONRY BLOCKS AND EXTEND MASONRY WALL UP TO UNDER-SIDE OF ROOF OVERHANG.
4. MAKE RUN WITH C-60 SOURCE.

[illegible]

Fig. C.1 — Reinforced-masonry-block house.

DETAIL 1
ANCHOR - NEW & EXIST. WALLS

DETAIL 2
ANCHOR - WALL TO FLOOR

GENERAL NOTES

1. MASONRY UNITS SHALL BE SAND-GRAVEL AGGREGATE, LOAD BEARING TYPE, CONFORMING TO A.S.T.M. STANDARD SPECIFICATION DESIGNATION C90-52, GRADE A. CELLS OF ALL UNITS SHALL BE FILLED WITH GROUT AND TAMPED.
2. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATIONS A15-56T WITH A305-B7T DEFORMATIONS, LAP BAR SPLICES 30 DIA.
3. MORTAR SHALL BE FRESHLY PREPARED AND UNIFORMLY MIXED IN RATIO 1 PART PORTLAND CEMENT, 1/4 PART LIME PUTTY, 3 1/2 PARTS MORTAR SAND, WITH 4/5 QUART OF "RED LABEL SUONEM" (OR EQUAL), AND SHALL CONFORM TO A.S.T.M. SPECIFICATION C270-52T.
4. GROUT SHALL CONSIST OF 1 PART PORTLAND CEMENT TO 3 PARTS SAND, AND NOT OVER 10% OF LIME MAY BE ADDED. GROUT SHALL ATTAIN A STRENGTH OF 2000 PSI IN 28 DAYS.
5. JOINTS HORIZONTAL & VERTICAL, SHALL BE 3/8" THICK WITH FULL COVERAGE ON THE FACE & WEB SHELLS.
6. CONCRETE SLAB SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 2000 PSI AT 28 DAYS.
7. EXISTING HOLES IN ROOF AND PARTITIONS NEAR THE SHELTER AREA SHALL BE PATCHED WITH CONCRETE TO MATCH EXISTING CONSTRUCTION.
8. PATCH W/ CONCRETE CHIPPED SURFACE OF EXISTING CONCRETE CAUSED BY REMOVAL OF WALLS.
9. NEW MASONRY WALLS WHICH SERVE TO INCREASE THE THICKNESS OF EXISTING WALLS SHALL BE SECURELY ANCHORED TO EXISTING WALLS. ALL OTHER NEW WALLS SHALL BE ANCHORED TO EXISTING FLOOR BY DRILLING & GROUTING ANCHORS. SEE DETAILS NO. 1 & NO. 2.
10. CONTRACTOR SHALL VERIFY DIMENSIONS SHOWN FOR EXISTING STRUCTURE BEFORE BEGINNING CONSTRUCTION.

TEST AND CONSTRUCTION SEQUENCE

1. COMPLETE CONSTRUCTION AS SHOWN ON THIS DRAWING EXCEPT BATHROOM WINDOW OPENING SHALL BE MASONRY BLOCKED HALF WAY UP AND NEW MASONRY WALLS ON THE OUTSIDE SHALL BE CONSTRUCTED TO A HEIGHT OF EXISTING ROOF.
2. MAKE RUN WITH C-60 SOURCE.
3. BLOCK UP UPPER HALF OF BATHRM. WINDOW WITH CONG. MASONRY BLOCKS AND EXTEND NEW EXTERIOR MASONRY WALL UP TO UNDERSIDE OF ROOF OVERHANG - (SEE NOTE 1 ABOVE ON CONSTR. SEQUENCE).
4. MAKE RUN WITH C-60 SOURCE.

I.D. 961001			
AS BUILT - OMITTED DOORS, ADDED CEILING SUPPORTS CHANGED STATION AND DRAWING NUMBER AS PER WORK ORDER MARKED PRINT - (1)			
U. S. ATOMIC ENERGY COMMISSION LAS VEGAS RESEARCH OFFICE LAS VEGAS, NEVADA			
CETO PROJECT 59-7A MODIFICATION OF RESIDENCES - 1-STORY PRE-CAST CONCRETE HOUSE - PLAN & SECTS. STA. 001-31.152 AREA 1			
APPROVED J. E. Winters PROJECT & SUPERVISOR		APPROVED R. L. Canale AGENT	
HOLMES & NARVER, INC. ENGINEERS - CONSTRUCTORS 800 SO. PHOENIX STREET LOS ANGELES 17, CALIFORNIA		NTS 001-31.1 e2-S1 001-31.1-51	

Fig. C.2 — Precast concrete house.

GENERAL NOTES

1. MASONRY UNITS SHALL BE LIGHTWEIGHT, HOLLOW LOAD BEARING TYPE, CONFORMING TO A.S.T.M. STANDARD SPECIFICATION DESIGNATION C 90-52, GRADE A, SIZE 8"X8"X16"
2. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATION A-15-56T WITH A-305-57T DEFORMATIONS. LAP BAR SPLICES 30 DIAMETERS, EXCEPT WHERE OTHERWISE SHOWN. HOOKS, UNLESS OTHERWISE SHOWN, SHALL BE 90° CONFORMING TO A.C.I. SPECIFICATIONS.
3. MORTAR SHALL BE FRESHLY PREPARED AND UNIFORMLY MIXED IN RATIO 1 PART OF PORTLAND CEMENT, 1/4 PART LIME PUTTY, 3/4 PARTS MORTAR SAND, WITH 4/5 QUART OF "RED LABEL SUCONEM" (OR EQUAL), AND SHALL CONFORM TO A.S.T.M. SPECIFICATION C 270-52T
4. GROUT SHALL CONSIST OF 1 PART PORTLAND CEMENT TO 3 PARTS SAND, AND NOT OVER 10% OF LIME MAY BE ADDED. GROUT SHALL ATTAIN A STRENGTH OF 2000 PSI IN 28 DAYS.
5. JOINTS, HORIZONTAL & VERTICAL, SHALL BE 1/8" THICK WITH FULL COVERAGE ON THE FACE SHELLS AND ON THE WEBS SURROUNDING CELLS TO BE FILLED.
6. ALL DOWELS INSERTED IN THE EXISTING WALLS AND FLOORS SHALL BE SOLIDLY GROUTED IN PLACE.
7. VERTICAL REINFORCEMENT SHALL EXTEND THE FULL HEIGHT OF WALL WITHOUT A SPLICE AND SHALL BE ACCURATELY PLACED & HELD IN POSITION IN THE CENTER OF WALL.
8. CONCRETE SLAB SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 2,000 P.S.I. AT 28 DAYS.
9. EXISTING BASEMENT WINDOW WELLS SHALL BE FILLED WITH SAND BAGS SO THAT THE WINDOW APERTURE IS COMPLETELY BLOCKED.

REFERENCE DRAWINGS
STRUCTURAL—PLANS & SECTIONS—001-31.1B2-51

REVISIONS					LD. 961001		USER APPROVAL <i>R. K. Caselle</i>	
NO.	DATE	DESCRIPTION	CHK'D	APP.	<div>U. S. ATOMIC ENERGY COMMISSION ALBUQUERQUE OPERATIONS OFFICE</div> <div>HOLMES & NARVER, INC. ENGINEERS — CONSTRUCTORS A. E. C. FACILITIES DIVISION 840 SO. BROADWAY LOS ANGELES 14, CALIFORNIA</div> <div>MODIFICATION OF RESIDENCES PLANS & SECTIONS STA. 31.1A2 AREA 1</div>			
1	5-16-60	DELETED CURTAIN WALL	<i>C.W.</i>	<i>W.B.</i>				
2	6-2-61	AS BUILT <i>REVISED</i> R2-BAR SARKINE	<i>J.C.</i>	<i>W.B.</i>				
					DRAWN <i>HONG</i> CHECKED <i>R. K.</i> APPROVED: H. H. <i>W. H. H.</i>			
					DATE 5/31/60 SITE <i>LITS</i>			
					APPROVED: A. E. <i>W. H. H.</i> DRAWING NO. <i>001-31.1A2-51</i>			
					DESIGN <i>W. H. H.</i>			
					CONSTRUCTION <i>W. H. H.</i>

GENERAL NOTES

1. MASONRY UNITS SHALL BE SAND-GRAVEL AGGREGATE, LOAD BEARING TYPE, CONFORMING TO A.S.T.M. STANDARD SPECIFICATION DESIGNATION C-90-52, GRADE A, SIZE 8X8X16.
2. REINFORCING STEEL SHALL CONFORM TO A.S.T.M. SPECIFICATION A-15-56T WITH A-305-57T DEFORMATIONS. LAP BAR SPLICES 30 DIAMETERS EXCEPT WHERE OTHERWISE SHOWN. HOOKS, UNLESS OTHERWISE SHOWN, SHALL BE 90° CONFORMING TO A.C.I. SPECIFICATIONS.
3. MORTAR SHALL BE FRESHLY PREPARED AND UNIFORMLY MIXED IN RATIO 1 PART OF PORTLAND CEMENT, 1/4 PART LIME PUTTY, 3 1/2 PARTS MORTAR SAND, WITH 1/5 QUART OF "RED LABEL" (OR EQUAL) AND SHALL CONFORM TO A.S.T.M. SPECIFICATION C-270-52T.
4. GROUT SHALL CONSIST OF 1 PART PORTLAND CEMENT TO 3 PARTS SAND, AND NOT OVER 10% OF LIME MAY BE ADDED. GROUT SHALL ATTAIN A STRENGTH OF 2000 P.S.I. IN 28 DAYS.
5. JOINTS HORIZONTAL & VERTICAL, SHALL BE 3/8" THICK WITH FULL COVERAGE ON THE FACE SHELLS AND ON THE WEBS SURROUNDING CELLS TO BE FILLED.
6. ALL DOWELS INSERTED IN THE EXISTING WALLS AND FLOORS SHALL BE SOLIDLY GROUTED IN PLACE.
7. VERTICAL REINFORCEMENT SHALL EXTEND THE FULL HEIGHT OF WALL WITHOUT A SPLICE AND SHALL BE ACCURATELY PLACED & HELD IN POSITION IN THE CENTER OF WALL.
8. CONCRETE SLAB SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 2,000 P.S.I. AT 28 DAYS.
9. EXISTING BASEMENT WINDOW WELLS SHALL BE FILLED WITH SAND BAGS SO THAT THE WINDOW APERTURE IS COMPLETELY BLOCKED.

REFERENCE DRAWINGS
STRUCTURAL— PLANS & SECTIONS — 001-31.1A2-31

Fig. C.5 — Two-story wood frame house.

REVISIONS					I.D. 961001		USER APPROVAL <i>R.H. Coe</i>	
NO.	DATE	DESCRIPTION	CHK'D	APP.				
<i>1</i>	5-16-60	DELETED CURTAIN WALL	<i>W.B.</i>	<i>M.B.</i>				
<i>2</i>	6-2-61	AS-BUILT <i>REVISED REBAR SPACING</i>	<i>J.C.</i>	<i>M.B.</i>				

CIVIL EFFECTS TEST OPERATIONS REPORT SERIES (CEX)

Through its Division of Biology and Medicine and Civil Effects Test Operations Office, the Atomic Energy Commission conducts certain technical tests, exercises, surveys, and research directed primarily toward practical applications of nuclear effects information and toward encouraging better technical, professional, and public understanding and utilization of the vast body of facts useful in the design of countermeasures against weapons effects. The activities carried out in these studies do not require nuclear detonations.

A complete listing of all the studies now underway is impossible in the space available here. However, the following is a list of all reports available from studies that have been completed. All reports listed are available, at the prices indicated, from the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Va.

- CEX-57.1, The Radiological Assessment and Recovery of Contaminated Areas, C. F. Miller, 1960, \$0.75.
- CEX-58.1, Experimental Evaluation of the Radiation Protection Afforded by Residential Structures Against Distributed Sources, J. A. Auxier, J. O. Buchanan, C. Eisenhauer, and H. E. Menker, 1959, \$2.75.
- CEX-58.2, The Scattering of Thermal Radiation into Open Underground Shelters, T. P. Davis, N. D. Miller, T. S. Ely, J. A. Basso, and H. E. Pearse, 1959, \$0.75.
- CEX-58.7, AEC Group Shelter, AEC Facilities Division, Holmes & Narver, Inc., 1960, \$0.50.
- CEX-58.8, Comparative Nuclear Effects of Biomedical Interest, C. S. White, I. G. Bowen, D. R. Richmond, and R. L. Corsbie, 1961, \$1.00.
- CEX-58.9, A Model Designed to Predict the Motion of Objects Translated by Classical Blast Waves, I. G. Bowen, R. W. Albright, E. R. Fletcher, and C. S. White, 1961, \$1.25.
- CEX-59.1, An Experimental Evaluation of the Radiation Protection Afforded by a Large Modern Concrete Office Building, J. F. Batter, Jr., A. L. Kaplan, and E. T. Clarke, 1960, \$0.60.
- CEX-59.4, Aerial Radiological Monitoring System. I. Theoretical Analysis, Design, and Operation of a Revised System, R. F. Merian, J. G. Lackey, and J. E. Hand, 1961, \$1.25.
- CEX-59.4 (Pt.II), Aerial Radiological Monitoring System. Part II. Performance, Calibration, and Operational Check-out of the EG&G Arms-II Revised System, J. E. Hand, R. B. Guillou, and H. M. Borella, 1962, \$1.50.
- CEX-59.4 (Pt.III), Aerial Radiological Monitoring System, Part III. Electronic Processing of ARMS-II Data, J. E. Hand and H. M. Borella, 1965, \$1.00.
- CEX-59.7B (Pt.II), Experimental Radiation Measurements in Conventional Structures. Part II. Comparison of Measurements in Above-ground and Below-ground structures from Simulated and Actual Fallout Radiation, Z. G. Burson, 1964, \$1.50.
- CEX-59.7B (Pt.III), Experimental Radiation Measurements in Conventional Structures. Part III. The Attenuation of Air-scattered Radiation in a Basement, Z. G. Burson, 1965, \$1.00.
- CEX-59.7C, Methods and Techniques of Fallout Studies Using a Particulate Simulant, W. Lee and H. Borella, 1962, \$0.50.
- CEX-59.13, Experimental Evaluation of the Radiation Protection Afforded by Typical Oak Ridge Homes Against Distributed Sources, T. D. Strickler and J. A. Auxier, 1960, \$0.50.
- CEX-59.14, Determinations of Aerodynamic-drag Parameters of Small Irregular Objects by Means of Drop Tests, E. P. Fletcher, R. W. Albright, V. C. Goldizen, and I. G. Bowen, 1961, \$1.75.
- CEX-60.1, Evaluation of the Fallout Protection Afforded by Brookhaven National Laboratory Medical Research Center, H. Borella, Z. Burson, and J. Jacovitch, 1961, \$1.75.
- CEX-60.3, Extended- and Point-source Radiometric Program, F. J. Davis and P. W. Reinhardt, 1962, \$1.50.
- CEX-60.5, Experimental Evaluation of the Fallout-radiation Protection Afforded by a Southwestern Residence, Z. Burson, D. Parry, and H. Borella, 1962, \$0.50.
- CEX-60.6, Experimental Evaluation of the Radiation Protection Provided by an Earth-covered Shelter, Z. Burson and H. Borella, 1962, \$1.00.
- CEX-61.1 (Prelim.), Gamma Radiation at the Air-Ground Interface, K. O'Brien and J. E. McLaughlin, Jr., 1963.
- CEX-61.4, Experimental Evaluation of the Fallout-radiation Protection Provided by Selected Structures in the Los Angeles Area, Z. G. Burson, 1963, \$2.25.
- CEX-62.01, Technical Concept—Operation BREN, J. A. Auxier, F. W. Sanders, F. F. Haywood, J. H. Thorngate, and J. S. Cheka, 1962, \$0.50.
- CEX-62.02, Operation Plan and Hazards Report—Operation BREN, F. W. Sanders, F. F. Haywood, M. I. Lundin, L. W. Gilley, J. S. Cheka, and D. R. Ward, 1962, \$2.25.
- CEX-62.03, General Correlative Studies—Operation BREN, J. A. Auxier, F. F. Haywood, and L. W. Gilley, 1963, \$1.00.
- CEX-62.2, Nuclear Bomb Effects Computer (Including Slide-rule Design and Curve Fits for Weapons Effects), E. R. Fletcher, R. W. Albright, R. F. D. Perret, Mary E. Franklin, I. G. Bowen, and C. S. White, 1963, \$1.00.
- CEX-62.11, Distribution of Weapons Radiation in Japanese Residential Structures, J. S. Cheka, F. W. Sanders, T. D. Jones, and W. H. Shinpaugh, 1965, \$1.00.
- CEX-62.13, Post Pulse Gamma-radiation Spectrum—Operation BREN, J. H. Thorngate and E. T. Loy, 1966, \$1.00.
- CEX-62.14, An Experimental Investigation of the Spatial Distribution of Dose in an Air-over-Ground Geometry, F. F. Haywood, J. A. Auxier, and E. T. Loy, 1964, \$4.00.
- CEX-62.50, Neutron-field and Induced-activity Measurements—Operation BREN, F. M. Tomnovec and J. M. Ferguson, 1965, \$1.00.
- CEX-62.81 (Prelim.), Ground Roughness Effects on the Energy and Angular Distribution of Gamma Radiation from Fallout, C. M. Huddleston, Z. G. Burson, R. M. Kinkaid, and Q. G. Klinger, 1963, \$1.25.
- CEX-63.3, Barrier Attenuation of Air-scattered Gamma Radiation, Z. G. Burson and R. L. Summers, 1965, \$1.00.
- CEX-63.7, A Comparative Analysis of Some of the Immediate Environmental Effects at Hiroshima and Nagasaki, C. S. White, I. G. Bowen, and D. R. Richmond, 1964, \$2.00.
- CEX-63.11, Mobile Radiological Measuring Unit: Description and Operating Information, Z. G. Burson, R. L. Summers, and J. T. Brashears, 1965, \$1.00.
- CEX-64.3, Ichiban: The Dosimetry Program for Nuclear Bomb Survivors of Hiroshima and Nagasaki—A Status Report as of April 1, 1964, J. A. Auxier, 1964, \$0.50.
- CEX-64.7, Neutron and Gamma-ray Leakage from the Ichiban Critical Assembly, J. H. Thorngate, D. R. Johnson, and P. T. Perdue, 1966, \$1.00.
- CEX-65.01, Feasibility Study: Intense 14-Mev Neutron Source for Operation HENRE, T. G. Provenzano, E. J. Story, F. F. Haywood, and H. T. Miller, 1966, \$1.00.
- CEX-65.02, Technical Concept—Operation HENRE, S. F. Haywood and J. A. Auxier, 1965, \$1.00.
- CEX-65.03, Operations Plan—Operation HENRE, Technical Director's Staff, 1965, \$1.00.
- CEX-65.4, Biological Tolerance to Air Blast and Related Biomedical Criteria, C. S. White, I. Gerald Bowen, and D. R. Richmond, 1965, \$2.75.