

1. Keywords

APOGEE  
APS 94  
FPS 16  
FPS 33  
FPS 6  
M33  
MPJ  
MPQ 10  
MPQ 29  
PPS 4  
RADAR  
TPS 1  
TPS 33  
TRC 24

2. Start Date: FY 66 Quarter 3  
End Date: FY 66 Quarter 3

3. HQ Division: 42 - LASER MICROWAVE DIVISION

4. Phase:

5. Program NO: 24

6. Survey Type:

7. INSTALLATION OR SOURCE OF INFORMATION (CITY & STATE OR  
COUNTY ARE ESSENTIAL)  
XM - TEST & EVALUATION COMMAND

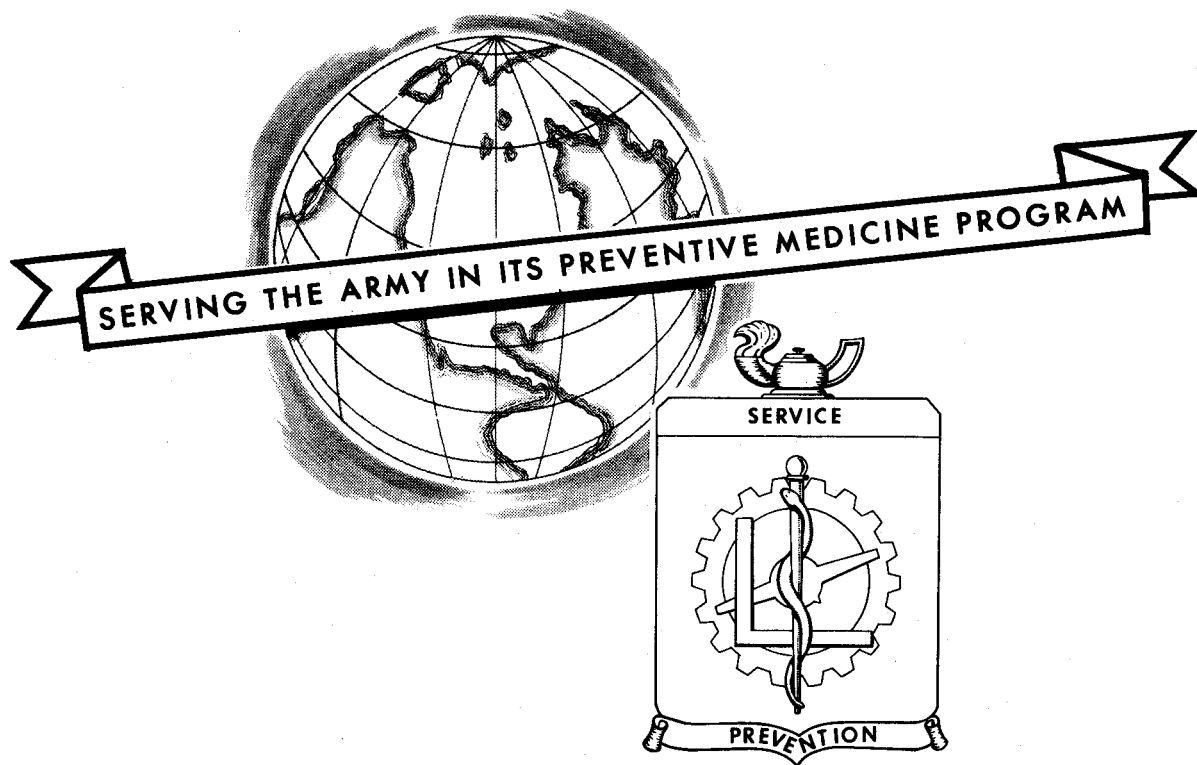
8. Authors:

9. ARLOC/Activity: 04289 006 - USA ELECTRONIC PG  
Location: FORT HUACHUCA  
State: AZ

10. Project Control Number: 5237R0676667

11. Document Type: 1

REPORT OF MICROWAVE SURVEY NO. 5237R67-66  
U. S. ARMY ELECTRONICS PROVING GROUND  
FORT HUACHUCA, ARIZONA  
20-22 April 1966



US ARMY  
ENVIRONMENTAL HYGIENE AGENCY  
EDGEWOOD ARSENAL, MD. 21010



DEPARTMENT OF THE ARMY  
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY  
EDGEWOOD ARSENAL, MARYLAND 21010

IN REPLY REFER TO:  
USAEHA-RE

13 JUL 1966

REPORT OF MICROWAVE SURVEY NO. 5237R67-66  
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1. AUTHORITY.

- a. AR 40-5, Chapter V.
- b. Letter, AMCAD-SE, Hqs US Army Materiel Command, Washington, D.C., 31 December 1964, subject: "AMC Requirements for Medical Support Services", to The Surgeon General, Department of the Army, Washington, D.C., and indorsement thereto.

2. PURPOSE. The purpose of this survey was to accomplish the following objectives:

- a. To evaluate the microwave radiation exposure to persons operating, and to those remaining in the vicinity of, the microwave radiation facilities at US Army Electronics Proving Ground, Fort Huachuca, Arizona.
- b. To make such recommendations as are necessary to protect personnel from needless exposure to microwave radiation.

3. STANDARDS. The publications which have been used as guides in determining the adequacy of the microwave radiation protection facilities and program are as follows:

- a. AR 40-583, Control of Potential Hazards to Health from Microwave Energy, 1 October 1962.
- b. TB MED 270, Control of Hazards to Health from Microwave Radiation, 6 December 1965.

4. INSTRUMENTATION. The following radiation detection instruments were used:

- a. Ramcor Model 1200 Densimeter.
- b. Hewlett Packard Model 431A Power Meter.
- c. Narda Coaxial Attenuators (3, 6, 10 and 20 db).

- d. American Electronics Lab Model APN-101-A Log Periodic Antenna.
- e. Hewlett Packard Model 486A Thermistor Mount.

5. FACILITIES SURVEYED. The following microwave facilities of US Army Electronics Proving Ground, Fort Huachuca, Arizona, were surveyed:

- a. US Army Combat Surveillance School (USCSS).
- b. Contract Facilities (Bell Aero Systems).
- c. 52nd US Army Security Agency (ASA).
- d. Test Directorate.

6. FINDINGS.

a. US Army Combat Surveillance School (USACSS). This facility was last surveyed 20 April 1964, Report No. 4680R83-64/65. Equipment on hand at the present time consists of the following:

- 5 each, AN/MPQ-29 Tracking and Plotting Radars
- 16 each, AN/PPS-4 Ground Surveillance Radars
- 22 each, AN/TPS-33 Ground Surveillance Radars
- 1 each, M-33 Fire Control System
- 7 each, AN/APS-94 Airborne Radars

Pertinent hazard criteria for each of the above systems are detailed in following paragraphs a(1) thru a(4).

(1) MPQ-29's. These sets were installed and operated with no significant changes since the previous survey. Recommendations made in the previous report that the MPQ-29's in the outdoor area be operated with antennas at elevation angles more than 0 mils and those inside (Building 81103) be operated with their antennas at 1600 mils elevation angle had been complied with.

(2) PPS-4's and TPS-33's. These two systems do not radiate power density levels more than  $10 \text{ mw/cm}^2$  and constitute no potential hazard to personnel.

(3) M-33.

(a) Target Tracking Radar (TTR). The M-33 TTR radiates power density levels more than  $10 \text{ mw/cm}^2$  only in a small area between the antenna feed and "lens". Levels in this area would exceed  $40 \text{ mw/cm}^2$ .

(b) Acquisition Radar (ACQ). The M-33 ACQ radiates power density levels more than  $10 \text{ mw/cm}^2$  to a distance of approximately 175' along the main beam axis. Due to the height of the antenna above ground (12'), personnel at ground level would not be exposed to levels more than  $10 \text{ mw/cm}^2$ .

(4) APS-94. Although the APS-94 radiates a power density more than  $10 \text{ mw/cm}^2$ , it does not constitute a potential hazard to the aircraft crew when in flight. When the aircraft is on the ground, the transmitter is not allowed to radiate as damage would result to the receiver system due to strong reflections from the ground. When the equipment is used for instructional purposes in the classroom, a dummy load is used to prevent radiation into free space.

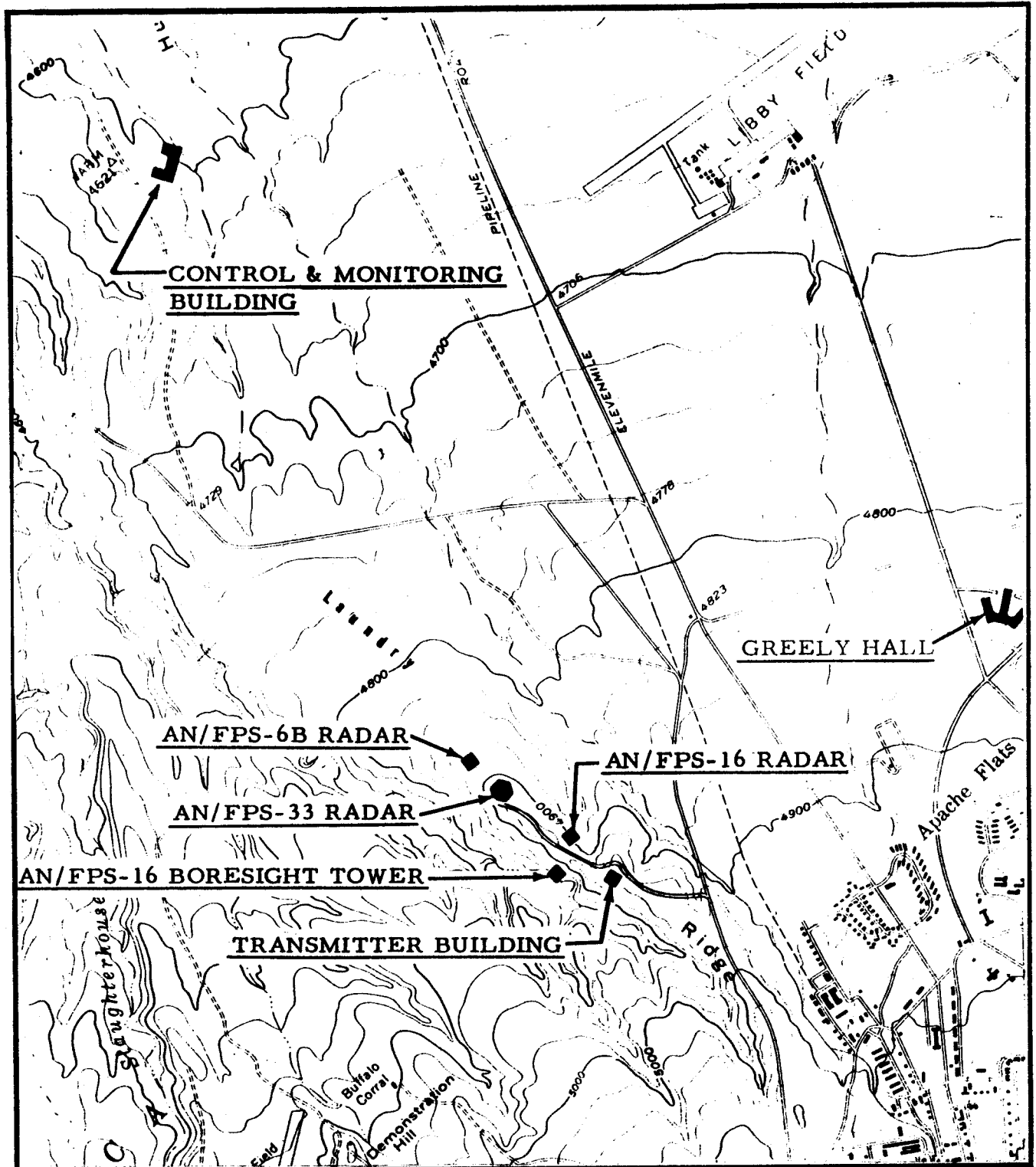
b. Contract Facilities (operated by Bell Aerosystems).

(1) Laundry Ridge Test Facility. Equipment installed at this facility consisted of an AN/FPS-16, an AN/FPS-33 and an AN/FPS-6B. See Plate R-739, page 4, for overall site plan.

(a) AN/FPS-16 Tracking Radar (Building 13582). The FPS-16 operated at 250 KW peak power output and an average power output of 125 watts. When operated at this power level, the set does not radiate power densities more than  $10 \text{ mw/cm}^2$ . The antenna is mounted on the roof of the building and is never depressed more than -25 mils in elevation. Even if the FPS-16 was operated at full power (1 megawatt peak) the radiated beam would not impinge upon the ground or any other occupied areas within the potentially hazardous range, (395 feet). Warning lights and signs were installed on the roof and stairway to warn personnel when the set was radiating. Plate R-740, page 5, shows layout of the FPS-16 and immediate area.

(b) AN/FPS-33 Surveillance Radar (Building 13590).  
The FPS-33 did not radiate power densities more than  $10 \text{ mw/cm}^2$ .

LAUNDRY RIDGE TEST FACILITY (overall Plan)



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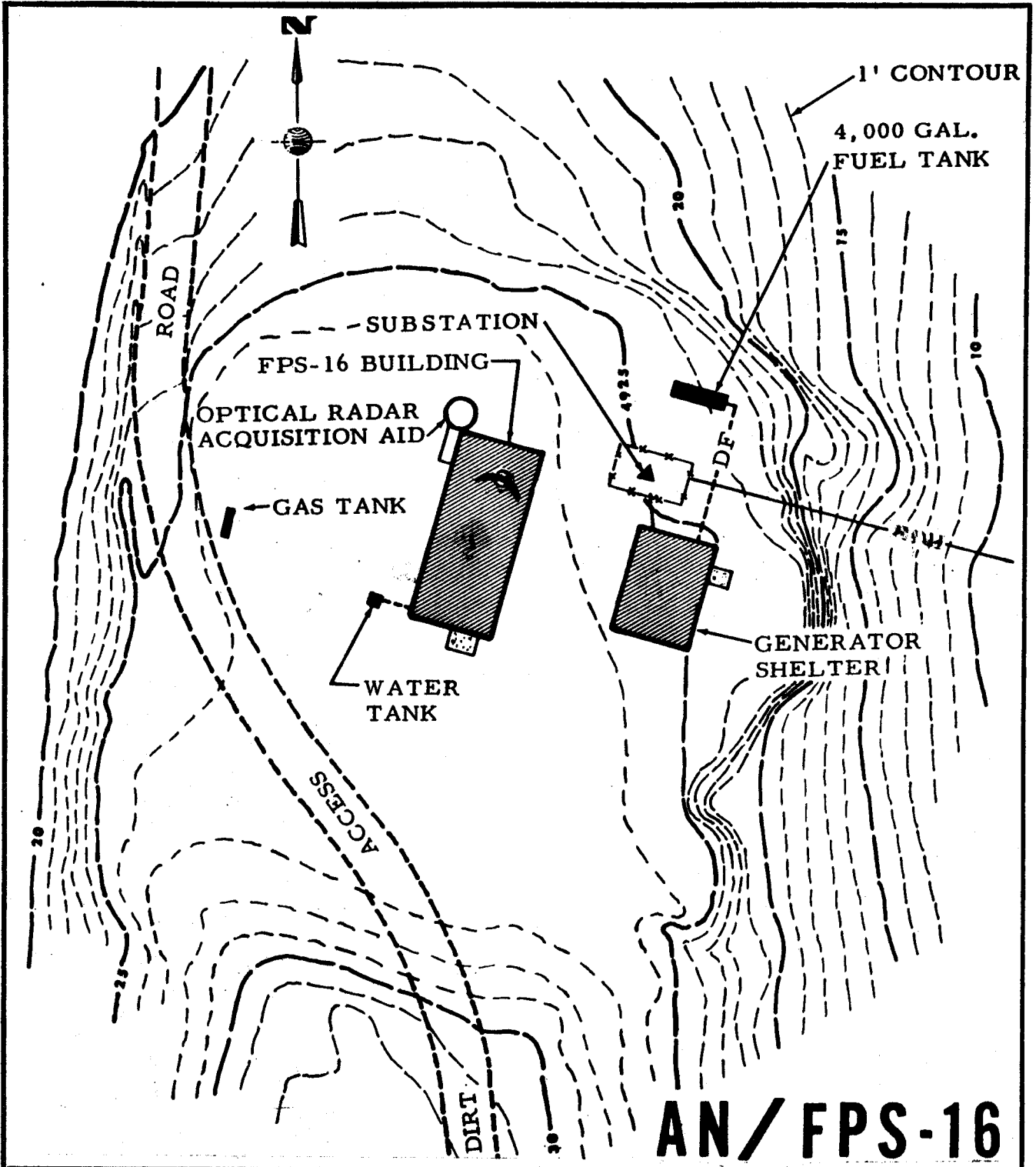
DRAWN DHS

APPROVED WAP *w.p.*

SCALE 1:24000

PLATE R-739

LAUNDRY RIDGE TEST FACILITY



**AN/FPS-16**

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DRAWN DHS

APPROVED WAP *W.P.*

SCALE 1" = 50'

PLATE B-740

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
 UNITED STATES ARMY MEDICAL SERVICE

(c) AN/FPS-6 Height Finder Radar. The FPS-6 was not in operation at the time of the survey. The FPS-6 when in operation radiates power densities more than  $10 \text{ mw/cm}^2$  to a distance of 380 feet. As the FPS-6 antenna is approximately 40' above ground the only area within this distance where personnel could be exposed to the radiated beam would be on the roof of the FPS-33, Building 13590, approximately 250' distant. If radiated by the FPS-6, the power density at this location would be approximately  $20 \text{ mw/cm}^2$ . See Plate R-741, page 7, for layout of FPS-6 and FPS-33 area.

(2) Oatman Mountain Radar Facility. This facility included an AN/TRC-29, an FPS-6B and an FPS-33 at the west knoll (see Plate R-742, page 8 ) and an MPS-26 at the east knoll (see Plate R-743, page 9 ).

(a) AN/FPS-6B. The FPS-6B operated at an average power output of 3.24 KW at a frequency of approximately 2.9 Gc (GHz). With the antenna pointed toward the roof of the FPS-33, the power density measured at the FPS-33 was  $10 \text{ mw/cm}^2$ .

(b) AN/FPS-33. The FPS-33 operated at an average power output of 1 KW at a frequency of approximately 1.3 Gc with a 43'x20' rotating rectangular antenna fixed at an elevation of 0 degrees. The radiated beam did not intersect any potentially occupied areas.

(c) AN/TRC-29. The AN/TRC-29, a communications set, did not present a hazard to personnel since the antennas were mounted on poles and did not radiate into occupied areas.

(d) AN/MPS-26. The AN/MPS-26 operated at an average power output of .4 KW with a 10' diameter antenna at a frequency of approximately 5.5 Gc. The power density measured in the main beam at the optical tracker (approximately 60' distant) was  $1.0 \text{ mw/cm}^2$ . The maximum power density at the antenna would not exceed  $9.4 \text{ mw/cm}^2$ .

c. 52nd US Army Security Agency. The following equipment capable of radiating potentially hazardous power density levels was on hand at the 52nd US Army Security Agency:

Target Transmitting System (APOGEE)

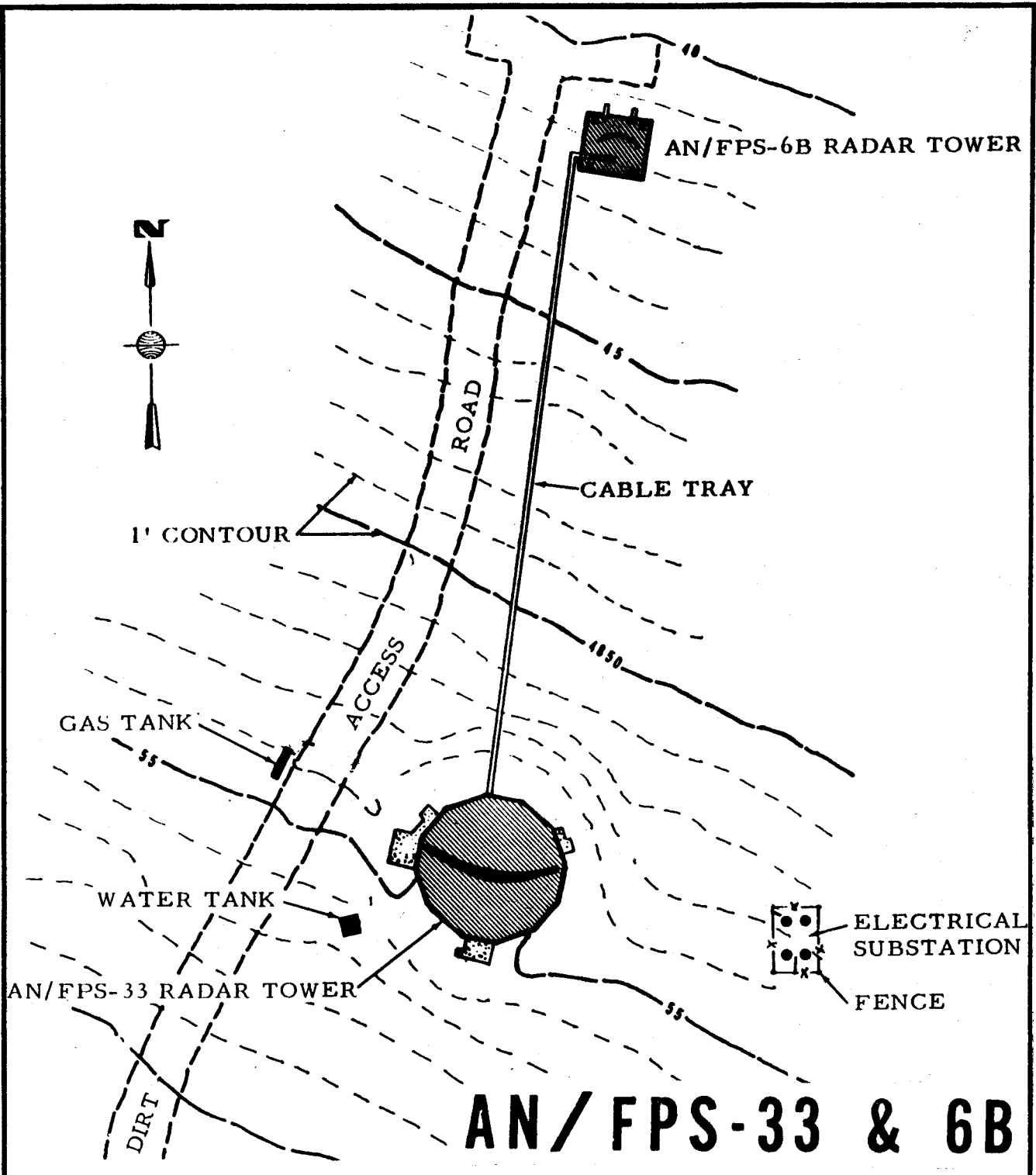
MPJ Operational Trainer

AN/TRC-24.

Due to security classification of either equipment or its use, only the



LAUNDRY RIDGE TEST FACILITY



# AN/FPS-33 & 6B

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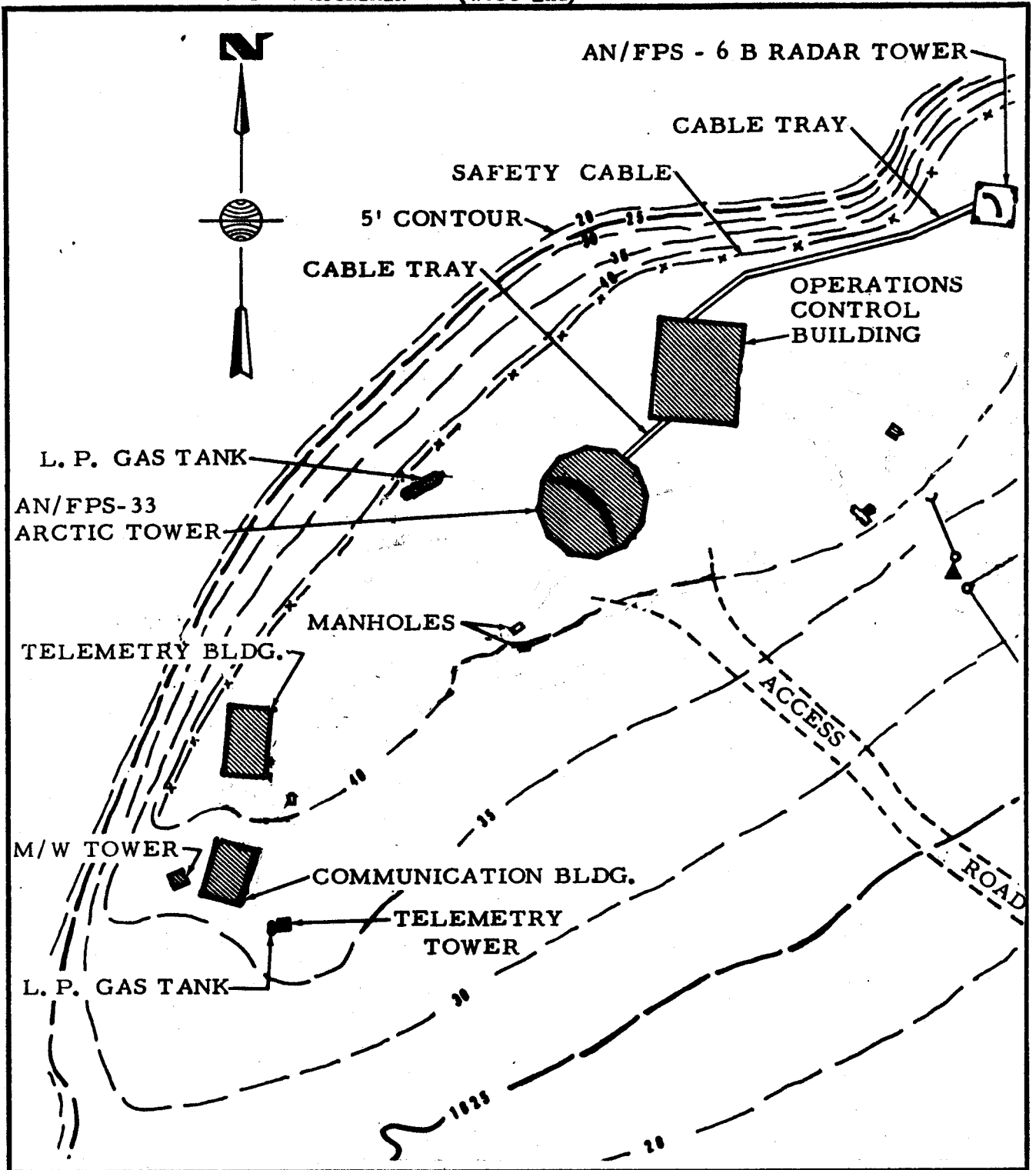
APPROVED WAP w.p.

SCALE 1" = 50'

PLATE R-741

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
**UNITED STATES ARMY MEDICAL SERVICE**

OATMAN MOUNTAIN (West End)



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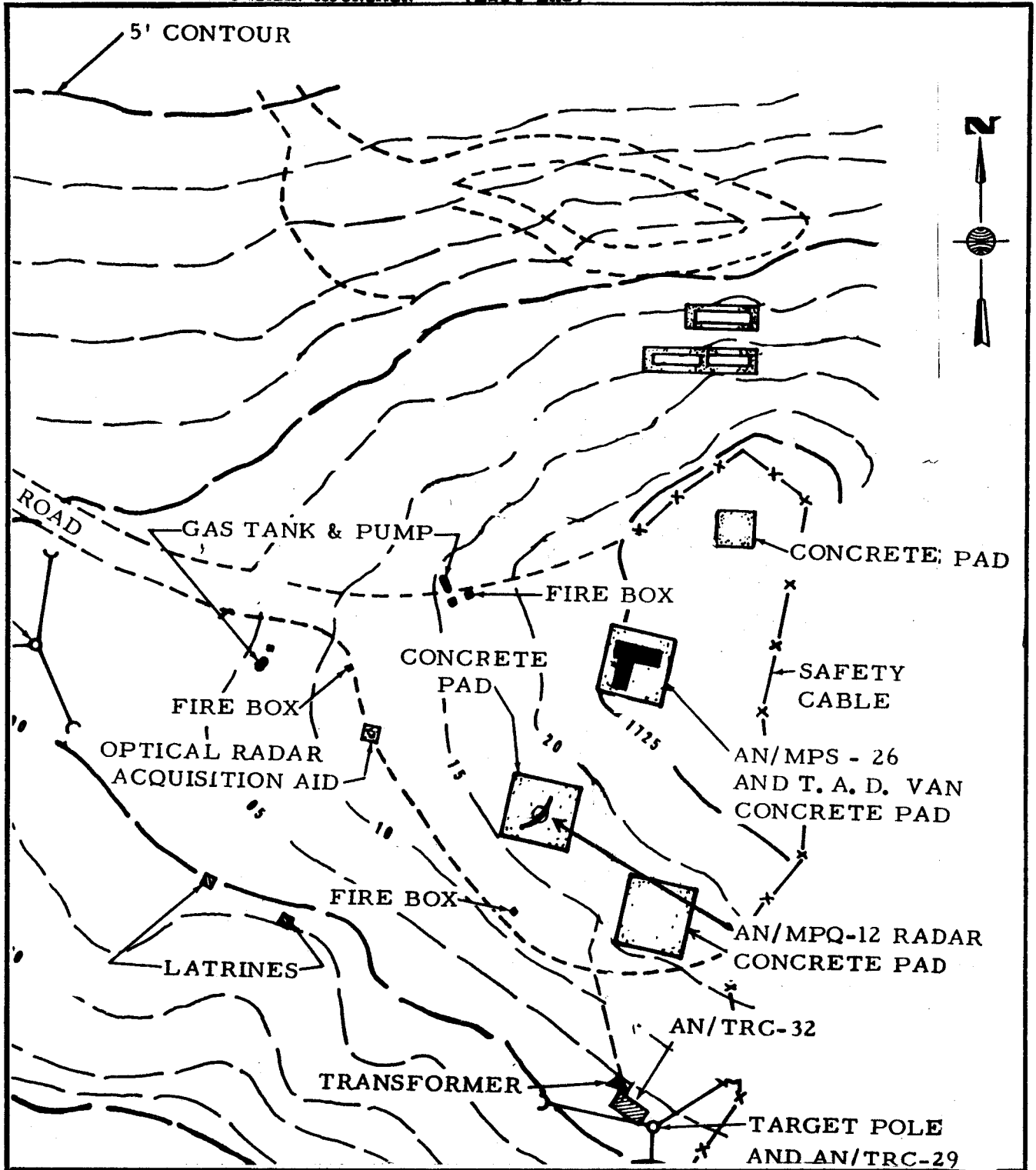
SCALE 1" = 50'

PLATE R-742

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**

**UNITED STATES ARMY MEDICAL SERVICE**

OATMAN MOUNTAIN (East End)



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DRAWN DHS

APPROVED WAP *W.P.*

SCALE 1" = 50'

PLATE R-743

**U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY**  
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maximum power density radiated at equipment antennas and the distance where levels would be less than  $10 \text{ mw/cm}^2$  are given. This data is listed in following paragraphs c(1) thru c(3). All data given is based on "worst case" conditions with maximum transmitter output to antennas.

(1) APOGEE.

Set No.	<u>APOGEE</u>	
	Maximum Power Density ( $\text{mw/cm}^2$ )	Distance from Antenna to $10 \text{ mw/cm}^2$ (ft)
1	28.5	2.53
2	158.0	3.25
3	870.0	4.17
4	1370.0	3.12
5	1300.0	5.36
6	840.0	2.95
7	139.0	1.15
8	26.0	1.15
9	45.0	1.15
10	54.8	1.15
11	65.0	.89
12	92.5	.65

(2) MPJ. Two MPJ's were in operation at the time of the survey. Measurements were made on both systems. The highest levels measured on either set under highest output conditions were as follows:

<u>Distance from Antenna (inches)</u>	<u>Power Density (mw/cm<sup>2</sup>)</u>
6	22.3
8	10.0
12	7.1
24	3.3

As the antennas are mounted on the roof of the MPJ approximately 9' above ground, no potential hazard would exist to personnel on the ground or at distances more than 8" from the antenna on the roof.

(3) AN/TRC-24. The maximum power density radiated by the TRC-24 at the antenna would be 70 mw/cm<sup>2</sup> and the distance from the antenna where the power density would be less than 10 mw/cm<sup>2</sup> would be 2 - 6 feet. As the antenna is normally atop a 45' mast, no potential hazard would exist to personnel at ground level.

d. Test Directorate (Surveillance Division). The Surveillance Division had the following radars in use at the time of survey:

3 each, AN/MPQ-10's.

2 each, AN/TPS-1D's.

2 each, AN/TPS-33's.

These radars are used in a mobile configuration at varying field locations which change from day to day. Pertinent hazard criteria for each system are as follows:

(1) AN/MPQ-10. The maximum power density radiated by this set at the antenna is 26 mw/cm<sup>2</sup>, and the distance from the antenna where the power density would be less than 10 mw/cm<sup>2</sup> would be 37 feet.

(2) AN/TPS-1D. The TPS-1D radiates a maximum power density of 15 mw/cm<sup>2</sup> in front of the antenna. The distance beyond which the power density is below 10 mw/cm<sup>2</sup> is 33 feet along the main beam axis. However, since the antenna axis is 10 feet above ground no potential hazard would exist to personnel standing on level terrain.

(3) AN/TPS-33. The TPS-33 does not present a hazard to personnel, since the maximum power density radiated in front of the antenna is 6.2 mw/cm<sup>2</sup>.

7. RECOMMENDATIONS.

a. US Army Combat Surveillance School (USACSS).

- (1) MPQ-29's. None.
- (2) PPS-4's and TPS-33's. None.
- (3) M-33.

(a) TTR. It is recommended that personnel not be permitted between the antenna feed and the "lens".

(b) ACQ. None.

- (4) APS-94. None.

b. Contract Facilities.

(1) Laundry Ridge Test Facility.

(a) AN/FPS-16. None.

(b) AN/FPS-33. None.

(c) AN/FPS-6. It is recommended that personnel not be allowed on the roof of the FPS-33, Building 13590, when the FPS-6 is radiating in that direction.

(2) Oatman Mountain Radar Facility. None.

c. 52nd US Army Security Agency.

(1) APOGEE. It is recommended that personnel not be permitted within the distances listed in the APOGEE table in paragraph 6c(1) when the antenna is radiating.

(2) MPJ. It is recommended that no personnel be permitted within 8" of the antenna when radiating.

- (3) AN/TRC-24. None.

d. Test Directorate (Surveillance Division).

(1) AN/MPQ-10. It is recommended that no personnel be permitted within 37' of the antenna along the main beam axis when the antenna is radiating. If maintenance or mission should require personnel within this area, occupancy should be restricted to no more than 9 minutes in any one hour period.

(2) AN/TPS-1D. It is recommended that no personnel be permitted within 33 feet of the antenna along the main beam axis while the antenna is radiating. Should maintenance or mission require personnel within this distance, occupancy should be restricted to no more than 26.5 minutes in any one hour period.

(3) AN/TPS-33. None.

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