DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MARYLAND 21010-5403

19 JUN 2013

MCHB-IP-OHH

MEMORANDUM FOR Directorate for Safety (AMSEL-SF-SI/Mr. Kenneth Proctor), Communications-Electronics Command, Building 3200, Raritan Avenue, Room 3200, Aberdeen Proving Ground, Maryland 21005

SUBJECT: Health Hazard Assessment Report (RCS MED-388) No. S.0001848-13, AN/PRC-150A(C) Advanced Tactical High Frequency Radio, 22 April 2013

1. This memorandum contains a copy of the subject report with an Executive Summary.

2. The Health Hazard Assessment Report (HHAR) contains an assessment of the health hazards identified during normal operation and maintenance of the materiel system, not resulting from a potential mishap or failure. Accordingly, safety or other Manpower and Personnel Integration (MANPRINT) domain assessments may conclude with different risk levels.

3. Provide the enclosed HHAR to System Safety, MANPRINT and Environment, Safety, and Occupational Health coordinators. Incorporate the identified health hazards and associated recommendations into MANPRINT and System Safety issue/hazard tracking logs. Use the HHAR to update the Programmatic Environment, Safety, and Occupational Health Evaluation (PESHE) and the Safety and Health Data Sheets (SHDS).

4. Provide the Army's Health Hazard Assessment (HHA) Program at this Institute with the results of risk mitigation and management decisions associated with the health hazards identified in this HHAR (e.g., SHDS, PESHE, MANPRINT Assessment, safety releases, and other appropriate documents).

5. Direct inquiries regarding the HHAR to the Army HHA Program Project Officer, Dr. Mohamed R. Mughal, commercial 410-417-2828, DSN 584-2828, or e-mail: mohamed.r.mughal.civ@mail.mil.

FOR THE DIRECTOR:

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U.S. ARMY PUBLIC HEALTH COMMAND

5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403

HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0001848-13
AN/PRC-150A(C) ADVANCED TACTICAL HIGH FREQUENCY RADIO
22 APRIL 2013

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Health Hazard Assessment Report: 500A

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DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MARYLAND 21010-5403

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EXECUTIVE SUMMARY
HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0001848-13
AN/PRC-150A(C) ADVANCED TACTICAL HIGH FREQUENCY RADIO
22 APRIL 2013

1. PURPOSE. The Communications-Electronics Command Directorate for Safety at Aberdeen Proving Ground, Maryland, requested that the Army Institute of Public Health provide a Health Hazard Assessment Report (HHAR) for the AN/PRC-150A(C) Advanced Tactical High Frequency Radio (ATHFR). This HHAR supports Type Classification and related procurement requirements.

2. CONCLUSIONS. Risk Levels. This HHAR identified one medium risk (Radio Frequency Radiation (RFR)) potential health hazard associated with the use and/or maintenance of the ATHFR.

3. RECOMMENDATIONS. Radio Frequency Radiation. A risk assessment code (RAC) of Medium (Hazard Severity (HS) 3, Hazard Probability (HP) C) is assigned. A residual RAC of Medium (HS 3, HP E) is assigned for compliance with the following:

a. Post a warning in user and maintenance manuals advising personnel to observe a 1 meter (m) RFR control distance from the antennas of the AN/VRC-104(V)6 150-Watt (W) vehicular radio.

b. Post a warning in user and maintenance manuals advising personnel to observe a 2.5 m RFR control distance from the antenna of the AN/TRC-210(V)3 400 W base station.

c. Post the standard RFR warning sign at the base of the antenna and/or nearby where the antenna is located for the 400 W radios. The message on the warning sign should direct personnel to maintain a 2.5 m distance from the antenna and warn about the potential for RFR shock/burn.

d. Ensure that the high voltage insulator shield for the transmission line connectors/antenna ports on the RF-382A-15 antenna coupler is properly installed before turning on the transmitter unit.

e. During repair and maintenance of the transmitter, specify the use of a dummy load/closed-loop test set instead of antenna whenever possible.

f. Include adequate warning messages for these radios and antennas in all technical manuals, field manuals, or standing operating procedures.

Health Hazard Assessment Report (RCS MED-388) No. S.0001848-13,
AN/PRC-150A(C) Advanced Tactical High Frequency Radio, 22 April 2013

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A. REFERENCES A-1

HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0001848-13,
AN/PRC-150A(C) ADVANCED TACTICAL HIGH
FREQUENCY RADIO
22 APRIL 2013

1. REFERENCES. Appendix A contains a list of references used in this Health Hazard Assessment Report (HHAR).

2. PURPOSE. To determine the potential health hazards associated with the AN/PRC-150A(C) Advanced Tactical High Frequency Radio (ATHFR). This HHAR supports Type Classification and related procurement requirements.

3. AUTHORITY. The Army's Health Hazard Assessment (HHA) Program is an Army Medical Department initiative in cooperation with and in support of the Army acquisition process. The primary objective of the program is to identify and eliminate or control potential health hazards associated with the life cycle management of weapons, equipment, clothing, training devices, and other materiel systems. The proponent of the HHA Program is The Surgeon General (TSG) of the Army; however, TSG has designated the Army Institute of Public Health (AIPH) as the Lead Agent. The HHA Program provides support to materiel acquisition programs to ensure compliance with requirements contained in references 1 through 6.

4. BACKGROUND (references 7 through 10).

a. System Purpose. The AN/PRC-150A(C) ATHFR is an advanced High Frequency (HF)/Very High Frequency (VHF) radio that provides reliable tactical communications through Type-1 encryption for enhanced secure voice and data performance, reduced size/weight, and extended battery life. Its applications include HF single side band (SSB) and VHF Frequency Modulation (FM) voice and data communications.

b. System Description.

(1) The AN/PRC-150A(C) can be configured for manpack, vehicular, or base station operations. These configurations include the AN/PRC-150A(C) 20 watt (W) manpack radio, the AN/VRC-104(V)5 20 W vehicular radio, the AN/VRC-104(V)6 150 W vehicular radio, AN/TRC-209B(C) 150 W base station, and the AN/TRC-210(V)3 400 W base station. The antennas used by the AN/PRC-150A(C) ATHFR and its various configurations include the AT-271A/PRC Whip Antenna, the RF-1944 Series Broadband Inverted Vee Antenna, the SB-V35FHV Antenna, the RF-1937 Whip Antenna, and the RF-1912T-AT002 Transportable Dipole Antenna.

The following paragraphs also describe the various components used throughout the configurations of the AN/PRC-150A(C) ATHFR. Some of the major differences in equipment between the various configurations are shown in Table 1.

Table 1. Differences Between Various Radio Configurations.

EQUIPMENT DESCRIPTION	AN/ PRC-150A(C)	AN/ VRC-104(V)5	AN/ VRC-104(V)6	AN/ TRC-209B(C)	AN/ TRC-210(V)3
150-W PA			X	X	
400-W PA					X
Antenna Coupler			X	X	X
Battery	X				
Power Supply				X	
Dual Power Supply and Pre/Post Selector					X
Manpack Antenna	X				
RF-1944-AT150 Antenna	X			X	X
RF-1944-AT400 Antenna					X
SB-V35FHV Antenna		X	X		
RF-1937 Antenna				X	X
RF-1912T Antenna				X	X

(2) The manpack configuration of the AN/PRC-150A(C) radio consists of the receiver/transmitter (R/T)-1694D(P)(C)/U unit, a battery box, a modified H-250/U handset, a backpack, cables, software, manuals, an assortment of manpack antennas, and other optional accessories. The AN/PRC-150A(C) receiver-transmitter unit operates between the frequencies of 1.6 Megahertz (MHz) to 30 MHz using Upper Sideband, Lower Sideband, Continuous Wave, and Amplitude Modulation Equivalent modes with selectable low (1 W), medium (5 W), and high (20 W) peak envelope power (PEP)/average power. The receiver-transmitter unit operates from 30 to 60 MHz in FM mode with a maximum output power of 10 W PEP/average.

(3) The AN/VRC-104(V)5 20 W vehicular radio kit reconfigures the AN/PRC-150A(C) manpack to a vehicular system. This radio also consists of a direct current (DC) power adapter, a DC power switch, and the SB-V35FHV vehicular whip antenna.

(4) The AN/VRC-104(V)6 150 W vehicular radio kit reconfigures the AN/PRC-150A(C) manpack to an amplified vehicular system. This radio also consists of a DC power switch, the 150-W RF-5833H power amplifier (PA), an external power coupler, and the SB-V35FHV vehicular whip antenna. This radio operates from 1.6 to 30 MHz at 150 W PEP/average in the high frequency single side band mode and from 30 to 60 MHz at 60 W PEP/average in the VHF FM band.

(5) The AN/TRC-209B(C) 150 W base station kit reconfigures the AN/PRC-150A(C) manpack to an amplified base station system. This radio also consists of a 150 W RF-5833H PA, an antenna coupler, and various antennas. This radio operates from 1.6 to 30 MHz at 150 W PEP/average in the HF SSB mode and from 30 to 60 MHz at 60 W PEP/average in the VHF FM band.

(6) The AN/TRC-210(V)3 400 W base station kit reconfigures the AN/PRC-150A(C) manpack to an amplified base station system. This radio also consists of a 400-W RF-5834H PA, RF-382A-15 coupler, pre/post selector, and various antennas. This radio operates over the 1.6 to 30 MHz frequency range at 400 W PEP/average.

(7) The AT-271A/PRC whip antenna is a standard lightweight, collapsible whip antenna kit for the AN/PRC-150A(C). The antenna is a multi-sectional 3 meter (m) long omnidirectional whip antenna capable of 20 W maximum operation from 2 to 60 MHz and is used for ground wave communications. The antenna is automatically tuned by the receiver/transmitter's internal antenna coupler.

(8) The RF-1944 antenna series are low-profile, lightweight, tactical broadband dipole antennas for operation in an inverted vee configuration. The RF-1944 antenna series consists of two antennas designed for two power levels: The RF-1944-AT150 for 150 W maximum operation and the RF-1944-AT400 for operation up to 400 W. The antenna provides instantaneous bandwidth performance over the entire 1.6 to 30 MHz frequency range by properly terminating the dipole ends. This bandwidth allows the antenna to operate with frequency agile waveforms because an antenna coupler is not required.

(9) The SB-V35FHV antenna is a self-supporting fiberglass HF whip antenna that is easily assembled and erected. It provides omnidirectional low-angle radiation patterns for ground and sky wave propagation from 2 to 30 MHz. Broadband operations

require the use of RF-382A-15 antenna couplers. The SB-V35FHV antenna consists of an antenna base and eight 1.2 m tapered sections for a total height of 9.8 m. The antenna mount incorporates a tilt adaptor mechanism to tilt the antenna at 0 degrees (vertical), 50, 70, and 90 degrees (horizontal). For stationary operations, the antenna will normally be operated in the vertical position. For on-the-move vehicular operations, the antenna can be tilted in the horizontal position across the vehicle and held down by a clamp. It is also possible that the antenna may be positioned horizontally away from the vehicle. When using the SB-V35 series antenna, it is recommended that the antenna be guyed if winds are expected to be in excess of 50 miles per hour or if the antenna is installed permanently.

(10) The RF-1937 whip antenna is a transportable, vertically-raised, ground stake antenna designed around the SB series whip antennas. The antenna is capable of 1 kilowatt (kW) maximum operation from 2 to 30 MHz and is used for ground wave or long distance sky wave communications. It can be set up with whip antenna heights between 5 m and about 10 m and requires the use of antenna coupler. The antenna is designed for ground level mounting. The base mount is installed on a base stake driven into the ground.

(11) The RF-1912T-AT002 transportable dipole antenna is a transportable fan dipole antenna that includes all the components for transporting and temporary installation. The element length and height above ground is designed for optimal HF propagation. The antenna can also be configured as a top-loaded monopole for ground wave and long range communications. The antenna has lightweight aluminum mast sections that are easy to assemble and disassemble. The antenna is capable of 1 kW maximum operation from 1.6 to 30 MHz and requires an antenna coupler. The antenna is also capable of performing both near vertical incidence skywave communications between 1.6 and 10 MHz and medium range communications out to 1,200 km for 10 to 30 MHz.

(12) RF-382A Series Antenna Couplers. The RF-382A series antenna couplers are electronic devices that efficiently and automatically match the output of 125 to 500 W transmitter units to a wide variety of whip, dipole, and long-wire antennas over the frequency range of 1.6 to 30 MHz. The antenna coupler requires a control cable and RF coax interface to connect to the associated transmitter unit. Separation can be up to 76 m. The couplers have two antenna ports: the E1 high voltage ceramic insulator assembly and the J3 50-Ohm N-connector antenna port for coaxial connection to a fixed site broadband or resonant antenna. A lever arm switches the antenna coupler's RF antenna connection between either E1 or J3. The coupler includes a high voltage (HV) insulator shield.

c. Previous Assessment. Assessments have been previously performed on AN/VRC-104(V) vehicular radios by the AIPH (reference 10). Even though AIPH's Nonionizing Radiation Program assessed other Army-fielded 400 W HF radio systems, no radio frequency radiation (RFR) power density measurements have been collected on 400 W configurations of the AN/PRC-150 radios.

5. IDENTIFICATION OF HEALTH HAZARD ISSUES. Radio Frequency Radiation. Data requirements, health effects, medical criteria, and references specific to the health hazard types identified in this HHAR may be found at the following website: http://phc.amedd.army.mil/topics/workplacehealth/hha/Pages/default.aspx.

6. HEALTH HAZARD ISSUES: ASSESSMENT AND RECOMMENDATIONS. Radio Frequency Radiation.

a. Department of Defense Instruction 6055.1 and Army Regulation 40-5 require that personnel not be exposed to health hazards in excess of the limits specified in the Department of Defense safety and occupational health standards or specialized standards applicable to military-unique equipment, systems, or operations (references 11 through 15). Every effort should be made to eliminate or control hazards through design.

b. Assessment.

(1) For personnel in a controlled environment, the most restrictive maximum permissible exposure (MPE) for the frequency of operation of the AN/PRC-150A(C) ATHFR is 10 watts per square meter (W/m^2) for both electric and magnetic fields. The most restrictive MPE for localized exposures is 200 W/m^2.

(2) Analysis and measurements indicated that the AN/PRC-150A(C) 20 W manpack radio and the AN/VRC-104(V)5 20 W vehicular radio are not able to produce field strength levels in excess of the spatially averaged MPEs. These radios are not subject to RFR controls (reference 7).

(3) Analysis and measurements indicated that the AN/VRC-104(V)6 150 W vehicular radio and AN/TRC-209B(C) 150 W base station are able to produce field strength levels in excess of the spatially averaged MPEs within a range of about 1 m from their associated antennas (references 7 and 8).

(4) Analysis indicated that the AN/TRC-210(V)3 400 W base station is able to produce field strength levels exceeding the 200 W/m^2 MPE for localized exposures to a

range of 0.5 m and decreasing to the 10 W/m² MPE to a range of 2.5 m from its associated antenna. No measurement data was collected for this evaluation of the AN/TRC-210(V)3 base station. The AIPH's Nonionizing Radiation Program had previously evaluated other 400 W HF radios using similar HF antennas. In lieu of missing measurement data, personnel should observe a control distance of at least 2.5 m from the antenna of the AN/TRC-210(V)3 400 W base station when this system is transmitting. Reportedly, the system operating software does not permit continuous operation, and limits the power output to the minimum needed to maintain communications.

c. Recommendations. A risk assessment code (RAC) of Medium (Hazard Severity (HS) 3, Hazard Probability (HP) C) is assigned. A residual RAC of Medium (HS 3, HP E) is assigned for compliance with the following:

(1) Post a warning in user and maintenance manuals advising personnel to observe a 1 m RFR control distance from the antennas of the AN/VRC-104(V)6 150-W vehicular radio.

(2) Post a warning in user and maintenance manuals advising personnel to observe a 2.5 m RFR control distance from the antenna of the AN/TRC-210(V)3 400 W base station.

(3) Post the standard RFR warning sign at the base of the antenna and/or nearby where the antenna is located for the 400 W radios. The message on the warning sign should direct personnel to maintain a 2.5 m distance from the antenna and warn about the potential for RFR shock/burn.

(4) Ensure that the high voltage insulator shield for the transmission line connectors/antenna ports on the RF-382A-15 antenna coupler is properly installed before turning on the transmitter unit.

(5) During repair and maintenance of the transmitter, specify the use of a dummy load/closed-loop test set instead of antenna whenever possible.

(6) Include adequate warning messages for these radios and antennas in all technical manuals, field manuals, or standing operating procedures.

7. PREPARER IDENTIFICATION. The AIPH, Aberdeen Proving Ground, MD 21010-5403, prepared this HHAR. The point of contact in the Army Health Hazard Assessment Program is Dr. Mohamed R. Mughal, commercial 410-417-2828, DSN 584-2828, or e-mail: mohamed.r.mughal.civ@mail.mil. This Institute's Nonionizing Radiation Program (Mr. Romeo Gallamoza) contributed to this HHAR. This Institute's Occupational Medicine Program reviewed the medical aspects of this assessment.

TIMOTHY A. KLUCHINSKY, DrPH
Manager
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APPENDIX A

REFERENCES

1. Army Regulation 40-10, Health Hazard Assessment Program in Support of the Army Acquisition Process, 27 Jul 07.

2. Army Regulation 70-1, Army Acquisition Policy, 22 Jul 11.

3. Army Regulation 385-10, The Army Safety Program, 23 Aug 07 (Rapid Action Revision 4 Oct 11).

4. Army Regulation 602-2, Manpower and Personnel Integration (MANPRINT) in the System Acquisition Process, 1 Jun 01.

5. Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System, 8 Dec 08.

6. Memorandum, Under Secretary of Defense, Acquisition, Technology, and Logistics, 23 Sep 04, subject: Defense Acquisition System Safety.

7. Memorandum, U.S. Army Institute of Public Health, MCHB-IP-ONR, undated, subject: Nonionizing Radiation Protection Study No. S.0001848 13, AN/PRC 150A(C) Advanced Tactical High Frequency Radio: Evaluation of Potential RFR Exposure, Aberdeen Proving Ground, MD, 14 Mar 13.

8. Memorandum, U.S. Army Center for Health Promotion and Preventive Medicine, MCHB-TS-ORF, 8 Nov 07, subject: Nonionizing Radiation Protection Study No. 24-ME-07GV-07, Light Armored Vehicle Command and Control Upgrade (LAV-C2U), Aberdeen Proving Ground, MD, 7 Jun 07.

9. Memorandum, U.S. Army Center for Health Promotion and Preventive Medicine, MCHB-TS-ORF, 7 Jan 08, subject: Nonionizing Radiation Protection Study No. 24-ME-07LF-07, Mine Resistant Ambush Protected Armored Vehicle Systems, Aberdeen Proving Ground, MD, 2 Jul 07.

10. Memorandum, U.S. Army Center for Health Promotion and Preventive Medicine, MCHB-TS-ORF, 8 Nov 07, subject: Nonionizing Radiation Protection Study No. 24-ME-07GV-07, Light Armored Vehicle Command and Control Upgrade (LAV-C2U), Aberdeen Proving Ground, MD, 7 June 07.

11. Department of Defense (DOD) Instruction 6055.11, Protecting Personnel from Electromagnetic Fields, 19 Aug 09.

12. Army Regulation 385–10, The Army Safety Program, 24 August 2007/Rapid Action Revision (RAR), 4 Oct 11.

13. Department of the Army Pamphlet 385–24, The Army Radiation Safety Program, 24 Aug 07 (Rapid Action revision 22 Sep 11).

14. Army Regulation 40-5, Preventive Medicine, 25 May 07.

15. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE) C95.1-2005, IEEE Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kilohertz to 300 gigahertz, 19 Apr 06.