



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

MCHB-IP-OHH

11 APR 2013

MEMORANDUM FOR Product Manager (SFAE-CSS-FP-SK/Mr. Larry Rigsby), Sets, Kits, Outfits, and Tools, 29661 George Avenue, Harrison Township, Michigan 48054

SUBJECT: Health Hazard Assessment Report (RCS MED-388) No. S.0011424-13, Armament Repair Shop Set, 26 February 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, Ms. Ruth Foutz, at commercial 410-436-2925, DSN 584-2925, or e-mail: ruth.foutz@us.army.mil.

FOR THE DIRECTOR:

Encl


DONNA M. DOGANIERO, CH
Portfolio Director
Occupational Health Sciences

MCHB-IP-OHH

SUBJECT: Health Hazard Assessment Report (RCS MED-388) No. S.0011424-13,
Armament Repair Shop Set, 26 February 2013

CF: (w/encl)

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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.0011424-13

ARMAMENT REPAIR SHOP SET

26 FEBRUARY 2013

PHC FORM 433-E (MCHB-CS-IP), NOV 12

Distribution authorized to U.S. Government Agencies only; protection of privileged information evaluating another command: Feb 13. Requests for this document must be referred to the Product Manager (SFAE-CSS-FP-SK), Sets, Kits, Outfits, and Tools, 29661 George Avenue, Harrison Township, Michigan 48054.

Use of trademarked names does not imply endorsement by the U.S. Army but is intended only to assist in the identification of a specific product.

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

MCHB-IP-OHH

EXECUTIVE SUMMARY
HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S0011424-13
ARMAMENT REPAIR SHOP SET
26 FEBRUARY 2013

1. **PURPOSE.** The Sets, Kits, Outfits, and Tools Product Manager at Harrison Township, Michigan, requested that the Army Institute of Public Health provide a Health Hazard Assessment Report (HHAR) for the Armament Repair Shop Set (ARSS). This HHAR will support Milestone C and related procurement requirements.

2. **CONCLUSIONS.**

a. Risk Levels. This HHAR identifies three medium risk (acoustic energy (steady-state noise), temperature extremes (heat stress), and temperature extremes (cold stress)) potential health hazards associated with the use and/or maintenance of the ARSS. These hazards will convert to one low risk potential health hazard and two eliminated hazards if the preferred recommendations listed in the HHAR are applied.

b. Manpower and Personnel Integration (MANPRINT). According to Army Regulation 602-2, potential health hazards with no immediate strategy for mitigation or control equate to critical hazards for the MANPRINT Program. Those with an acceptable strategy equate to major hazards. Those requiring additional data or information for an assessment equate to concern hazards. The potential health hazards identified above equate to three major hazards (acoustic energy (steady-state noise), temperature extremes (heat stress), and temperature extremes (cold stress)) for the MANPRINT Program.

3. **RECOMMENDATIONS.**

a. Acoustic Energy (Steady-state Noise). A risk assessment code (RAC) of Medium (hazard severity (HS) 3, hazard probability (HP) D) is assigned. A residual RAC of Low (HS 4, HP D) is assigned if the following recommendations are implemented:

(1) Label the ARSS with a warning sign of the potential noise hazard stating that single-hearing protection is required for personnel inside the ARSS when machinery is being operated, and include this warning in training and operational materials.

(2) Label the tactical quiet generator (TQG) with a warning sign of the potential noise hazard stating that single-hearing protection is required for personnel maintaining the TQG, and include this warning in training and operational materials.

(3) Enroll personnel assigned to the ARSS in the Army Hearing Program as a precautionary measure.

b. Chemical Substances (Generator Combustion Products). No recommendations are required.

c. Oxygen Deficiency (Ventilation). No recommendations are required.

d. Temperature Extremes (Heat and Cold Stress).

(1) Heat Stress.

(a) A RAC of Medium (HS 3, HP C) is assigned. A residual RAC of Medium (HS 3, HP D) is assigned for compliance with the following recommendation: Include a warning in the ARSS technical manuals that a work, rest, and water consumption cycle referenced in Field Manual 4-25.12 should be adhered to during extreme hot climate conditions.

(b) A residual RAC of Eliminated (HS 3, HP F) is assigned for compliance with the following recommendation: Provide data to this Institute showing the Environmental Control Unit (ECU) can maintain a temperature below 82.4 degrees Fahrenheit (°F) in extreme hot weather conditions.

(2) Cold Stress.

(a) A RAC of Medium (HS 3, HP D) is assigned. A RAC of Medium (HS III, HP E) is assigned for compliance with the following recommendation: Include a warning in the ARSS technical manuals for potential cold stress injury and require the use of cold weather clothing during extreme cold climate conditions including provisions for keeping the hands warm for fine work.

(b) A RAC of Eliminated (HS 3, HP F) is assigned for compliance with the following recommendation: Provide data to this Institute showing the ECU can maintain a temperature greater than 60.8 °F in extreme cold weather conditions.

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HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0011424-13
ARMAMENT REPAIR SHOP SET
26 FEBRUARY 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 Armament Repair Shop Set (ARSS). The HHAR will support the ARSS safety confirmation for fielding 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 (reference 7).

a. System Purpose. The ARSS will provide increased on-site maintenance and equipment repair capability of armaments with increased mobility and deployability.

b. System Description. The ARSS is a one-sided expandable shelter mounted on a seven and a half ton containerized chassis trailer (Figure 1). Tool load configurations based on the Military Occupational Specialties 91A, 91C, 91F, 91G, 91K, 91M, 91P, and 91S are assembled and packaged in the ARSS. The ARSS has a crew of two personnel for operation. It is equipped with a 10 kilowatt tactical quiet generator (TQG) and a 36,000 British Thermal Unit (BTU) Environmental Control Unit (ECU).

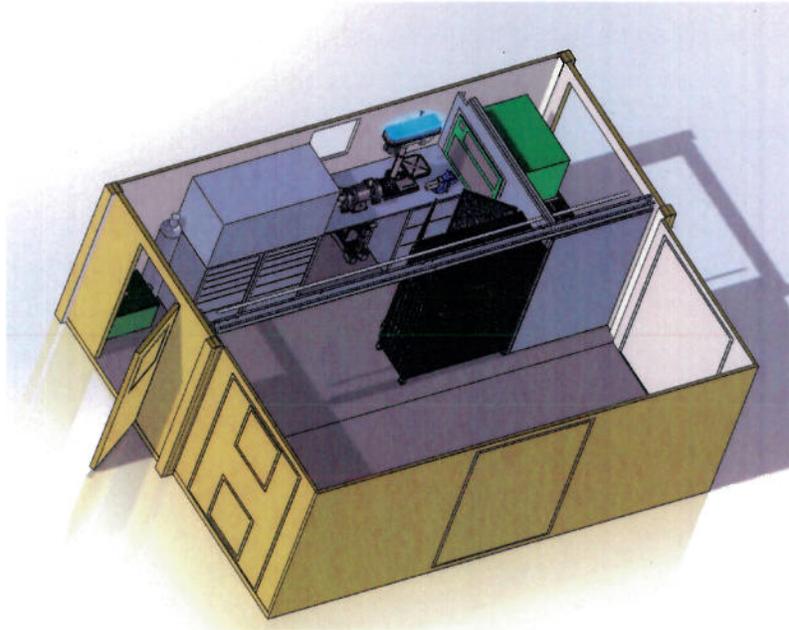


Figure1. The ARSS

c. Previous Assessment. There have been no previous HHARs on the ARSS.

5. IDENTIFICATION OF HEALTH HAZARD ISSUES. 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>.

- a. Acoustic Energy (Steady-state Noise).
- b. Chemical Substances (Generator Combustion Products).
- c. Oxygen Deficiency (Ventilation).
- d. Temperature Extremes (Heat and Cold Stress).

6. HEALTH HAZARD ISSUES: ASSESSMENT AND RECOMMENDATIONS. 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 8 and 9). Every effort should be made to eliminate or control hazards through design.

a. Acoustic Energy (Steady-state Noise).

(1) Assessment. The ARSS TQG and associated machinery used inside the ARSS have the potential to emit hazardous levels of steady-state noise (references 10 and 11). An exterior 85 decibels A-weighting (dBA) contour distance was measured at no more than 0.2 meters around the ARSS. Interior noise was measured at each workstation. No hazardous noise levels were measured. However, it is possible that sound levels above 85 dBA may be encountered during maintenance of the TQG, and possibly, during operation of some of the shop equipment due to interaction between the tools used and the work pieces. This was not included in the sound level measurement effort, and generally it is not included in measurement requirements. Therefore, the ARSS is a potential noise hazard, and conservative and protective action should be taken.

(2) Recommendations. A risk assessment code (RAC) of Medium (hazard severity (HS) 3, hazard probability (HP) D) is assigned. A residual RAC of Low (HS 4, HP D) is assigned if the following recommendations are implemented:

(a) Label the ARSS with a warning sign of the potential noise hazard stating that single-hearing protection is required for personnel inside the ARSS when machinery is being operated, and include this warning in training and operational materials.

(b) Label the TQG with a warning sign of the potential noise hazard stating that single-hearing protection is required for personnel maintaining the TQG, and include this warning in training and operational materials.

(c) Enroll personnel assigned to the ARSS in the Army Hearing Program as a precautionary measure.

b. Chemical Substances (Generator Combustion Products).

(1) Assessment.

(a) The primary source of potentially hazardous chemical substances associated with the ARSS is combustion products from the diesel powered, 10 kilowatt TQG. The location of the TQG is in the back end compartment of the ARSS (Figure 2a). When in operation or during maintenance, the TQG is pulled out from the compartment to the

exterior of the ARSS where combustion products are vented (Figure 2b). To determine if exhaust gases could enter the interior of the ARSS through the ECU air intake, air samples were collected inside the ARSS. Air samples were collected for carbon monoxide (CO), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂). The presence of these gases inside the ARSS would indicate a potential hazard to personnel occupying the ARSS.

(b) The sampling survey was conducted by the AIPH, Industrial Hygiene Field Services Program. Results after one hour of sampling for CO, SO₂, and NO₂ were below occupational exposure limits outlined in the American Conference of Governmental Industrial Hygienists (ACGIH[®]) Threshold Limit Values (TLVs[®]) (Table 1) (references 12 and 13).



Figure 2a. The ARSS TQG

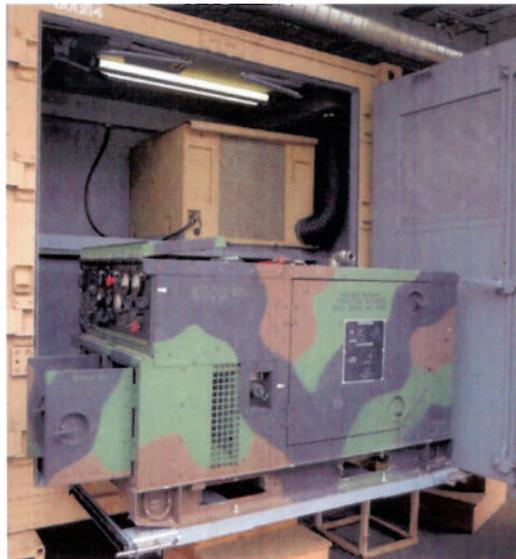


Figure 2b. The ARSS TQG Pulled Out

Table 1. Exposure Criteria and Sampling Results

Continuous Measurements		
Compound	ACGIH® TLV® (ppm)	Peak Exposure Limits (ppm)
NO2	TWA = 0.2	0.0
SO2	STEL = 0.25	0.0
CO	TWA = 25	17.6

LEGEND: ppm – parts per million, TWA – Time Weighted Average, STEL – Short Term Exposure Limit (15-minute average)

(2) Recommendations. No recommendations are required.

c. Oxygen Deficiency (Ventilation).

(1) Assessment. The ARSS has an internal dimension of 16 feet by 20 feet by 8 feet equaling an internal volume of 2,560 cubic feet (ft³). Based on the use scenario, the ARSS will be occupied by two persons. The Military Standard 1472G states that adequate ventilation shall be provided to indoor environments where personnel are performing work (reference 14). The recommended minimum fresh air supply for enclosures of 2,560 ft³ is 10 cubic feet per minute fresh outside air. Ventilation measurements were not taken; however, the AIPH, Industrial Hygiene Field Services Program measured oxygen (O₂) levels and carbon dioxide levels (CO₂) while conducting a sampling survey. The O₂ levels remained at 20.9 percent, the concentration of normal air, and CO₂ levels remained below the occupational exposure limit outlined in the ACGIH® TLVs® (references 12 and 13).



Figure 3a. The ARSS ECU Interior View

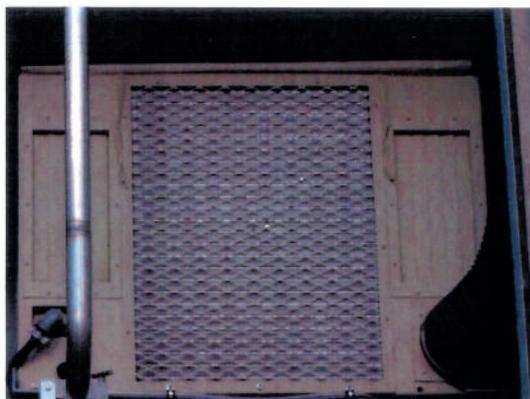


Figure 3b. The ARSS ECU Exterior View

(2) Recommendations. No recommendations are required.

d. Temperature Extremes (Heat and Cold Stress).

(1) Assessment. The ARSS is required to operate in ambient temperatures between -25 degrees Fahrenheit (°F) and 120 °F, and is intended to operate anywhere in the world (reference 16). The ARSS is equipped with an ECU capable of heating and cooling the interior of the ARSS. The ECU has a nominal cooling capacity of 40,000 BTU per hour and a nominal heating capacity of 31,200 BTU per hour (reference 15). Performance testing under extreme climatic conditions was not conducted for ARSS (reference 17). Similar ECUs have been fielded with mobile shelters and have been assessed in previous HHARs (references 18 and 19).

(a) Heat Stress. Personnel exposure to excessive heat can cause a variety of illnesses including heat cramps, heat exhaustion, and heat stroke, in addition to decrements in alertness and performance. Radiant heat and heat given off by personnel and machinery within the ARSS have the potential to add to the temperature inside the ARSS in hot climate conditions. The ACGIH[®] TLV[®] for Chemical Substances and Physical Agents provides screening criteria for evaluating the possibility of a heat stress environment (reference 12). The TLV[®] for moderate work is not greater than a Wet Bulb Globe Temperature (WBGT) of 82.4 °F. The specifications of the ECU suggest it will be able to maintain an internal temperature that meets the ACGIH[®] TLV[®] criteria. However, the ECU was not tested to ensure it is capable of maintaining a WBGT below 82.4 °F, thus the potential exists that the ECU may not perform optimally when integrated into the ARSS. To prevent heat injury, a work, rest, and water consumption cycle outlined in the Field Manual 4-25.12, paragraph 2-44 should be implemented if the WBGT is greater than 82.4 °F (reference 20).

(b) Cold Stress. Exposure to cold climate conditions causes most of the body's energy to be used to keep the body core warm. As the duration of cold exposure increases, blood flow shifts from the extremities and outer skin to the core causing the extremities to cool quicker and be at risk for frostbite and other cold injury. The TLV[®] for cold stress is a temperature not less than 60.8 °F. If the temperature becomes less than 60.8 °F, provisions should be established for keeping the bare hands of personnel performing fine work warm. The ECU was not tested to ensure it is capable of maintaining a temperature greater than 60.8 °F in extreme cold climates.

(2) Recommendations.

(a) Heat Stress.

i. A RAC of Medium (HS 3, HP C) is assigned. A residual RAC of Eliminated (HS 3, HP F) is assigned for compliance with the following recommendation: Provide data to this Institute showing the ECU can maintain a temperature below 82.4 °F in extreme hot weather conditions.

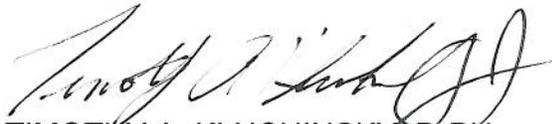
ii. A residual RAC of Medium (HS 3, HP D) is assigned for compliance with the following recommendation: Include a warning in the ARSS technical manuals that a work, rest, and water consumption cycle referenced in Field Manual 4-25.12 should be adhered to during extreme hot climate conditions.

(b) Cold Stress.

i. A RAC of Medium (HS 3, HP D) is assigned. A RAC of Eliminated (HS 3, HP F) is assigned for compliance with the following recommendation: Provide data to this Institute showing the ECU can maintain a temperature greater than 60.8 °F in extreme cold weather conditions.

ii. A RAC of Medium (HS 3, HP E) is assigned for compliance with the following recommendation: Include in a warning in the ARSS technical manuals for potential cold stress injury and require the use of cold weather clothing during extreme cold climate conditions including provisions for keeping the hands warm for fine work.

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 Ms. Ruth Foutz, commercial 410-436-2925, DSN 584-2925, or e-mail: ruth.foutz@us.army.mil. This Institute's Industrial Hygiene Field Services Program (Mr. Shawn Hueth) and Army Hearing Program (Mr. Charles Jokel) contributed to this HHAR. This Institute's Occupational Medicine Program reviewed the medical aspects of this assessment.


TIMOTHY A. KLUCHINSKY, DrPH
Manager
Health Hazard Assessment Program

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, Program Executive Office Combat Support and Combat Service Support, SFAE-CSS-FP-SK, 19 Oct 12, subject: Request for an Initial Health Hazard Assessment (HHA) for the Armament Repair Shop Set (ARSS).
8. Department of Defense Instruction 6055.1, DOD Safety and Occupational Health (SOH) Program, 19 Aug 98.
9. Army Regulation 40-5, Preventive Medicine, 25 May 07.
10. Technical Manual 9-6115-642-10, Operator's Manual for Generator Set, Skid Mounted, Tactical Quiet, 10 KW, 60 HZ MEP-803A (NSN 6115-01-275-5061) (EIC VG3), 15 Sep 10.
11. E-mail, Product Manager Sets, Kits, Outfits, and Tools (SFAE-CSS-FP-SK), Mr. Larry Rigsby, 5 Feb 15, subject: ARSS Inventory.

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26 February 2013

12. American Conference of Governmental Industrial Hygienists (ACGIH®), Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, 2012.
13. DRAFT Memorandum, U.S. Army Institute of Public Health, MCHB-TS-OFS, 7 Jan 13, subject: Industrial Hygiene Field Survey NO WBS S.0011424.2 Armament Repair Shop Set (ARSS).
14. Military Standard 1472G, Department of Defense Design Criteria Standard: Human Engineering, 11 Jan 12.
15. Technical Manual 9-4120-425-14&P, Operator's, Unit, Direct Support and General Support Maintenance Manual for Air Conditioner, Horizontal, Compact, 36,000 BTU/HR, 208 Volt, Three Phase, 50/60 Hertz, 1 Oct 02.
16. Army Regulation 70-38, Research, Developmental, Test and Evaluation of Materiel for Extreme Climatic Conditions, 15 Sep 79.
17. E-mail, Aberdeen Test Center (TEET-AT-WFE), Mr. Travis Cimino, 4 Feb 13, subject: ARSS Temperature Testing.
18. Memorandum, U.S. Army Center for Health Promotion and Preventive Medicine, MCHB-TS-OHH, 1 May 09, subject: Health Hazard Assessment Report (RCS MED-388) No. 69-MP-0BH2-09, Warfighter Information Network-Tactical, Increment-1.
19. Memorandum, U.S. Army Center for Health Promotion and Preventive Medicine, MCHB-TS-OHH, 4 Feb 05, subject: Updated Health Hazard Assessment Report (HHAR) for the Petroleum Quality Analysis (PQAS), Project No. 69-MP-8372-05.
20. Field Manual 4-25.12, Unit Field Sanitation Team, 25 Jan 02.