DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MARYLAND 21010-5403

2 3 OCT 2013

MCHB-IP-OHH

MEMORANDUM FOR Product Manager (SFAE-CSS-FP-C/Mr. Jeramie Childers), Combat Engineer/Material Handling Equipment, 6501 East 11 Mile Road, Mail Stop 401, Warren, Michigan 48397-5000

SUBJECT: Health Hazard Assessment Report (RCS MED-388) No. S.0002299-13, Asphalt Mixing Plant, 16 July 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.m.foutz.civ@mail.mil.

FOR THE DIRECTOR:

Encl

DONNA M. DOGANIERO, CIH
Portfolio Director
Occupational Health Sciences

MCHB-IP-OHH
SUBJECT: Health Hazard Assessment Report (RCS MED-388) No. S.0002299-13, Asphalt Mixing Plant, 16 July 2013

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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.0002299-13
ASPHALT MIXING PLANT
16 JULY 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: Jul 13. Requests for this document must be referred to the Product Manager (SFAE-CSS-FP-C), Combat Engineer/Material Handling Equipment, 6501 East 11 Mile Road, Mail Stop 401, Warren, Michigan 48397-5000.

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
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5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND MARYLAND 21010-5403

MCHB-IP-OHH

EXECUTIVE SUMMARY
HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0002299-13
ASPHALT MIXING PLANT
16 JULY 2013

1. PURPOSE. The Product Manager, Combat Engineer/Material Handling Equipment, Manager at Warren, Michigan, requested that the Army Institute of Public Health provide a Health Hazard Assessment Report (HHAR) for the Asphalt Mixing Plant (AMP). This HHAR supports Type Classification and related procurement requirements.

2. CONCLUSIONS. Risk Levels. This HHAR identifies one high risk (musculoskeletal trauma (lift and carry)), one serious risk (acoustic energy (steady-state noise)), and one low risk (chemical substances (engine combustion products)) potential health hazards associated with the use and/or maintenance of the AMP.

3. RECOMMENDATIONS.

a. Acoustic Energy (Steady-state Noise). A risk assessment code (RAC) of Serious (hazard severity (HS) 2, hazard probability (HP) C) is assigned. A residual RAC of Medium (HS 2, HP E) is assigned for compliance with the following recommendations:

(1) Require single hearing protection to be worn by all personnel within the 85 decibel A-weighting (dBA) contour distances specified in paragraph 6.a.(1) of the full report.

(2) Describe the noise hazard in training and operator manuals including the requirement for wearing single hearing protection during operation when within the 85 dBA contours.

(3) Label the AMP with warning signs alerting personnel to the noise hazard.

b. Chemical Substances (Engine Combustion Products). A RAC of Low (HS 4, HP D) is assigned. A RAC of Eliminated (HS 4, HP F) is assigned for compliance with the following recommendation: Conduct air sampling after the fresh air damper is added to ensure the performance of the environmental control unit is sufficient to adequately clear the Motor Control Center of the engine combustion products.

c. Musculoskeletal Trauma (Lift and Carry). A RAC of High (HS 2, HP B) is assigned.

(1) A residual RAC of Low (HS 4, HP C) is assigned for compliance with the following recommendations:

(a) Change out the large and medium cables for cables with one inch diameters.

(b) Redesign the AMP system to decrease or eliminate the necessity of laying out large, high voltage cables as well as small cables in high, inaccessible areas.

(2) A residual RAC of Medium (HS 4, HP B) is assigned for compliance with the following recommendation: Introduce a separate vehicle with a bucket-type man lift to decrease lifting above shoulder height. This vehicle could also assist with the carrying and laying out of various cables.

(3) A residual RAC of Serious (HS 3, HP B) is assigned for compliance with either of the following recommendations:

(a) Use seven male Soldiers for all lift and carry tasks.

(b) Use material handling devices similar to those used in the utility and telecommunications industries, such as large wooden cable reels or cable reels on wheels to move cables between connection points during the AMP set up.

d. Oxygen Deficiency (Confined Spaces). No recommendations are required.

e. Temperature Extremes (Heat Stress). No recommendations are required.

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A. REFERENCES A-1

HEALTH HAZARD ASSESSMENT REPORT (RCS MED-388)
NO. S.0002299-13
ASPHALT MIXING PLANT
16 JULY 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 Asphalt Mixing Plant (AMP). The HHAR will support the AMP 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 (references 7 through 9).

a. System Purpose. The AMP (Figure 1) will replace the legacy M081 AMP and be introduced into a theater of operations to provide hot mix asphalt for use in preparing main supply routes, logistical facilities, bituminous roads, helipads, airfields, and landing strips, motor pools, parking areas, and other horizontal construction projects in support of military or other national goals and objectives.

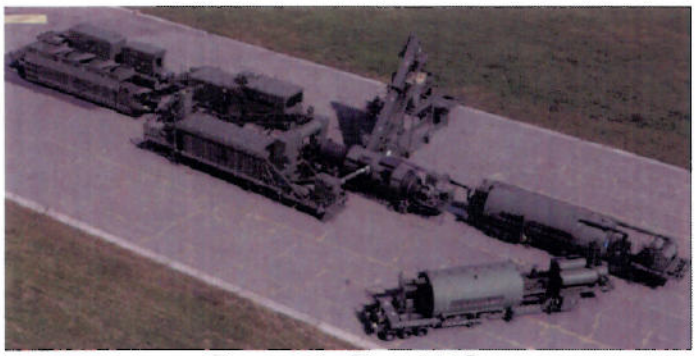

Figure 1. The AMP

b. System Description.

(1) The AMP is a portable, drum-type, electric-motor driven facility designed for self-erection of its major components and operation without support from permanent type footings. It can be operated by 3 personnel, but requires 11 personnel for setting up and taking down the system. Maintenance support will be provided by contractors. The AMP consists of nine separate sections. Each section is mounted on its own custom-designed trailer.

(2) The Motor Control Center (MCC). The MCC is a climate controlled shelter that contains the operator controls and computers that monitor the AMP operations and provide diagnostic and troubleshooting capabilities.

(3) The Power Load Assembly (PLA). Two generators are supplied to completely power the AMP. The PLA contains a 275 kilowatt (kW) downtime generator and a 900 kW operating generator. The 275 kW generator is used for non-operating times. It provides electric power to the MCC for computer power and to the helical storage tank (Heli-Tank) to maintain viscous liquid asphalt cement. It also provides power for nighttime lighting. The 900 kW generator supplies the AMP with operating power for hot mix asphalt production.

(4) The Heli-Tank (20,000 gallons). The Heli-Tank is part of the asphalt cement feed section. It stores and heats the asphalt cement.

(5) The De-drummer Assembly. The de-drummer assembly heats the asphalt cement stored in 55-gallon drums and transfers it to the Heli-Tank by means of a pump.

(6) The Cold Feed Assembly. The cold feed assembly consists of four bins that store dry, pre-screened aggregate. A collector conveyor accepts the feed from each bin and delivers the aggregate to the scalping screen and incline conveyor assembly.

(7) The Scalping Screen and Inclined Conveyor Assembly. The scalping screen separates out oversized aggregate allowing properly sized aggregate to pass to the incline conveyor. The incline conveyor measures the feed rate while transporting the screened aggregate to the Double Barrel® (Registered Trademark by Astec, Inc.) Drum Mixer for mixing.

(8) The Double Barrel® Drum Mixer Assembly. Aggregate is fed into the dryer portion of the Double Barrel Drum Mixer and dried. It then moves from the dryer portion to the drum mixer where it is combined with asphalt cement.

(9) The Baghouse Assembly. The baghouse assembly is an air pollution control system that is attached to the exhaust end of the Double Barrel® Drum Mixer. As the exhaust passes through the bags inside the assembly compartment, particulates are trapped, collected, and added back into the Double Barrel® Drum Mixer for inclusion into the hot mix asphalt. The baghouse assembly is self-cleaning. No personnel will be required to manually clean this component.

(10) The Self-Erecting Surge Bin (SEB). The SEB batches, weighs, and loads the hot mix asphalt from the Double Barrel® into trucks.

c. Previous Assessment. A previous HHAR was completed on the legacy system, the M081 AMP (reference 10).

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 (Engine Combustion Products).

c. Musculoskeletal Trauma (Lift and Carry).

d. Oxygen Deficiency (Confined Spaces).

e. Temperature Extremes (Heat 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 11 and 12). Every effort should be made to eliminate or control hazards through design.

a. Acoustic Energy (Steady-state Noise).

(1) Assessment. The AMP has several potential noise-producing sources. The Aberdeen Test Center (ATC) located in Aberdeen, Maryland, collected steady-state

noise data for the non-asphalt producing AMP (reference 13). Measurements were recorded at 21 locations around and between the AMP sections to determine an 85 decibel A-weighting (dBA) contour around the equipment. The 85 dBA contours were recorded at distances as great as 33 feet (ft) around the generator trailer, 18 ft around the asphalt-producing sections, and 10.4 ft from the hydraulic cart which is stored in the baghouse. Maximum levels were not reported, but these data adequately demonstrate that noise hazards with this system can be mitigated with single hearing protection.

(2) Recommendations. A risk assessment code (RAC) of Serious (hazard severity (HS) 2, hazard probability (HP) C) is assigned. A residual RAC of Medium (HS 2, HP E) is assigned for compliance with the following recommendations:

(a) Require single hearing protection to be worn by all personnel within the 85 dBA contour distances specified paragraph 6.a.(1).

(b) Describe the noise hazard in training and operator manuals including the requirement for wearing single hearing protection during operation when within the 85 dBA contours.

(c) Label the AMP with warning signs alerting personnel to the noise hazard.

b. Chemical Substances (Engine Combustion Products).

(1) Assessment. The primary source of potential exposure to chemical substances is engine combustion products from idling trucks stationed outside of the MCC. After trucks are loaded at the SEB with hot mix asphalt, the drivers are required to check out at the MCC window. Trucks are pulled up to within reaching distance of the MCC window so the driver can obtain a ticket from the MCC operator. Although the duration of each driver checking out is short, there can be several trucks lined up at a time continuously throughout a typical workday (references 14 and 15). Air sampling and ventilation testing were not performed to address this issue (reference 16). The environmental control unit (ECU) that sits on the top of the MCC only re-circulates air which is not in accordance with the Military Standard (MIL-STD) 1472G (references 17 and 18). However, a fresh air damper will be added to the unit in order to meet the MIL-STD-1472G ventilation requirement of introducing fresh air into manned enclosures (references 17 through 19).

(2) Recommendations. A RAC of Low (HS 4, HP D) is assigned. A RAC of Eliminated (HS 4, HP F) is assigned for compliance with the following recommendation: Conduct air sampling after the fresh air damper is added to ensure the performance of the ECU is sufficient to adequately clear the MCC of the engine combustion products.

c. Musculoskeletal Trauma (Lift and Carry).

(1) Assessment. The potential musculoskeletal health hazard associated with the AMP comes from trauma induced by forceful exertions and non-neutral postures encountered while lifting, lowering, and carrying the electrical power and control cables.

(a) The system developer identified several high voltage electrical cables with weights that exceed the 35 pound mixed gender carrying threshold. All cables are at least 75 ft in length. The base area needed to set up the AMP is 150 ft by 260 ft. Once each section has been erected, there are 30 to 40 electrical cables manually carried and connected to each trailer. The MIL-STD-1472G, paragraph 5.8.6.3.8, describes the maximum design weight limits for carrying objects over 33 ft using a mixed gender lifting team (reference 17).

(b) This assessment was calibrated to predict the potential adverse health effects that may be encountered by a young, healthy Soldier possessing the strength capacity that is at least equal to the 50th percentile individual from the appropriate population performing unencumbered manual material handling.

(c) Assumptions made for this assessment include personnel performing AMP deployment and cable management tasks are trained on proper lifting techniques and wear gloves whenever there is significant risk of injury from direct mechanical insult. Failure to meet any of these requirements could increase injury risk. There are three deployment concerns involving cabling the AMP: Cable Weight, Cable Placement, and Cabling Time.

(d) Cable weight. The system developer identified three large voltage cables each having 7.75 inches in diameter and weighing 590 pounds. Also, six medium-sized and several smaller cables were identified.

i. Force/Weight Lift/Carry risk. Static muscle loading occurs when personnel carry an object. Using MIL-STD-1472G, paragraph 5.8.6.3.8, for carrying an object 33 ft or more as a guide, an object weighing 590 pounds would require a 17-person, mixed gender team for lifting and carrying. This exceeds the AMP design requirements of

deploying the system with 11 personnel. A male-only lift and carry team carrying an object less than 33 ft would reduce the number required of personnel to 7. The MIL-STD-1472G does not provide criteria for male-only lifting at distances that exceed 33 ft.

ii. Contact Stress/Hand Strain risk. There are three types of cables with varying diameter sizes: small, medium, and large. Personnel can be at a mechanical disadvantage to manipulate cables or groups of cables with small diameters. Large diameter cables can also present a mechanical disadvantage if the fingers of personnel cannot wrap around the cable and be locked by the thumb in a power grip. Without this reinforcement, the strain placed on each lifter's fingers sharply increases.

(e) Cable Placement.

i. Cabling Procedure. During set up of the AMP, a forklift lifts the large and medium diameter size cables from their transport storage area and lowers them to the ground between the positioned sections. The cables are stretched out to full length and lifted and carried by personnel to the designated plug-in sockets located on each trailer. Once these cables have been connected, several lighter cables with smaller diameters are placed along the sides of and in between the sections. Most of these cables are placed into designated cable trays, some of which are located 5 ft above the ground, the maximum design height for an overhead lift according to MIL-STD-1472G.

ii. Position/Posture risks. The MIL-STD-1472G, paragraph 5.8.6.3.1, outlines the maximum design weight limits for lifting an object equal to or greater than 5 ft above the ground, approximately shoulder height and above. Lifting above shoulder height puts stress on the upper back, shoulders, and arms.

(f) Cabling Time.

i. Cable Deployment. Cabling time represents approximately one half of the total deployment time for setting up the AMP. A 100-hour set up time is allocated for the AMP. The time to place and connect all of the cables is approximately 50 hours.

ii. Duration/Repetition risk. The extended duration and repetition to place, lift, carry, and connect all of the cables to the AMP presents the greater ergonomic risk. The MIL-STD-1472G outlines standards for lifting frequencies stating that if the frequency of the lift exceeds 20 lifts per 8 hours, then the permissible weight limit shall be reduced. The lifting frequency was not measured for cable deployment. Maximum

lifting and carrying capacity decreases as duration and repetition increase. Material handling devices should be employed to reduce the risk of injury.

(2) Recommendations. A RAC of High (HS 2, HP B) is assigned.

(a) A residual RAC of Low (HS 4, HP C) is assigned for compliance with the following recommendations:

i. Change out the large and medium cables for cables with one inch diameters.

ii. Redesign the AMP system to decrease or eliminate the necessity of laying out large, high voltage cables as well as smaller cables in high, inaccessible areas.

(b) A residual RAC of Medium (HS 4, HP B) is assigned for compliance with the following recommendation: Introduce a separate vehicle with a bucket-type man lift to decrease lifting above shoulder height. This vehicle could also assist with the carrying and laying out of various cables.

(c) A residual RAC of Serious (HS 3, HP B) is assigned for compliance with the following recommendations:

i. Use seven male Soldiers for all lift and carry tasks.

ii. Use material handling devices similar to those used in the utility and telecommunication industries, such as large wooden cable reels or cables between connection points during the AMP set up.

d. Oxygen Deficiency (Confined Spaces).

(1) Assessment. Work that is performed in confined spaces can potentially expose workers to an oxygen deficient atmosphere. Areas associated with the AMP that are considered confined spaces include the Double Barrel® Drum Mixer Assembly, Baghouse Assembly, and Heli-Tank. However, only under maintenance would these areas be occupied by personnel. Maintenance will only be performed by AMP contractors and not Soldiers (reference 20).

(2) Recommendations. No recommendations are required.

e. Temperature Extremes (Heat Stress).

(1) Assessment.

(a) The AMP is required to work in all dry weather conditions and in all temperatures from a minimum of 40 degrees Fahrenheit (°F) to 120 °F (references 21 and 22). The MCC is equipped with an ECU capable of heating and cooling the interior (reference 9). The MIL-STD-1472G provides heating and cooling system performance requirements and was used to assess the temperature extreme, heat stress, potential health hazard (reference 17).

(b) Exposure to excessive heat can lead to a variety of illnesses including heat cramps, heat exhaustion, and heat stroke, in addition to decrements in alertness and performance. Temperature testing was conducted to ensure the ECU met MIL-STD-1472G requirements of lowering the internal temperature of the MCC from 120 °F to 85 °F. The ECU was able to cool the MCC from 120 °F to 85 °F (reference 23). This meets the requirement provided in MIL-STD-1472G; therefore, no recommendations are required.

(2) Recommendations. No recommendations are required.

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.m.foutz.civ@mail.mil. This Institute's Army Hearing Program (Mr. Charles Jokel), Ergonomics Program (Mr. Kevin Purcell), and Industrial Hygiene Field Services Program (Mr. John Cambre) 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-C, 14 Jun 12, subject: Request for Health Hazard Assessment for the Asphalt Mixing Plant.

8. Safety Assessment Report for the Asphalt Mixing Plant, D & R Technical Solutions, Inc., 6 Apr 12.

9. Detailed Test Plan, Engineering Design Test of the Asphalt Mixing Plant, U.S. Army Aberdeen Test Center, 16 May 12.

10. Memorandum, U.S. Army Environmental Hygiene Agency, HSHB-MO-A, 24 Nov 93, subject: Health Hazard Assessment Report (RCS MED 388) on the M081 Asphalt Mixing Plant, 69-37-X26B-94.

11. Department of Defense Instruction 6055.1, DOD Safety and Occupational Health (SOH) Program, 19 Aug 98.

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

13. Human Factors Engineering Report, 12-HF-E9152-029 subtest 2.2, U.S. Army Aberdeen Test Center, undated.

14. E-mail, Product Manager Combat Engineer and Material Handling Equipment (SFAE-CSS-FP-C), Mr. Jeramie Childers, 9 Apr 13, subject: AMP Clarification.

15. Asphalt Mixing Plant Operational Mode Summary Mission Profile, 1 Aug 91.

16. E-mail, U.S. Army Aberdeen Test Center (TEDT-AT-WFS), Mr. Wayne Noble, 14 May 13, subject: AMP Ventilation.

17. Military Standard 1472G, Department of Defense Design Criteria Standard: Human Engineering, 11 Jan 12.

18. Technical Specifications on the GQ4SD Series Single Packaged Heat Pump 13 SEER, Nordyne, Feb 07.

19. E-mail, Product Manager Combat Engineer and Material Handling Equipment, (SFAE-CSS-FP-C), Mr. Jeramie Childers, 10 Jul 13, subject: Fresh Air Ventilation.

20. E-mail, Product Manager Combat Engineer and Material Handling Equipment, (SFAE-CSS-FP-C), Mr. Jeramie Childers, 3 Apr 13, subject: AMP Operator/Maintenance Manuals.

21. Test and Evaluation Master Plan for the Asphalt mixing Plant, 16 Apr 09.

22. Army Regulation 70-38, Research, Developmental, Test and Evaluation of Materiel for Extreme Climatic Conditions, 15 Sep 79.

23. E-mail, U.S. Army Aberdeen Test Center (TEDT-AT-WFE), Mr. Eric Persak, 10 Apr 13, subject: AMP HVAC specifications.