



US DEPARTMENT OF DEFENSE

BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

Injury Risk Assessment and Criteria Development

Health Hazard Analyses and Blast Overpressure Assessments Performed During the Acquisition of Army Weapon Systems

The U.S. Army Public Health Center (USAPHC; Aberdeen Proving Ground, MD) performed Blast Overpressure (BOP) Analyses on six weapon systems during FY18. These BOP Analyses support the Health Hazard Assessments (HHAs) associated with each weapon system. The following weapon systems were assessed to determine their BOP effects: the XM1287 Armored Multi-Purpose Vehicle Mortar Carrier, the M821A3E1 81 Millimeter (mm) Enhanced Mortar Cartridge, the Lightweight Multi-Role Anti-Armor Anti-Personnel Weapon System M3E1 Carl Gustaf 84mm Recoilless Rifle (Figure 1), the XM111 and XM112 Offensive Hand Grenades, and the XM1147 120mm Advanced Multi-Purpose Cartridge. Each of these weapon systems or cartridges provides a unique capability to produce large blast events designed to enhance the lethality of warfighters and to protect them during combat.

To determine the blast to which Soldiers using these systems would be exposed, BOP data were collected for each weapon system. Data were collected at Yuma Test Center (YTC; Yuma, AZ) and U.S. Army Aberdeen Test Center (ATC; Aberdeen Proving Ground, MD) with blast test devices at crew positions simulating the location of personnel during firing events. Different conditions were tested for each weapon system using variations in charge, elevation, hatch and ramp configuration, zone, line of fire, round conditioning temperature, firing postures, cartridge types, and location of the blast event depending on the properties of the weapon system.

These data were then sent to the USAPHC and analyzed using the BOP-HHA software version 2.1. This software was developed by the USAMRMC under a contract with JAYCOR Corporation (now L-3 Technologies). It uses an algorithm based on a biomechanical model of the thorax that calculates the amount of “push,” or mechanical work, imparted to the thorax by a blast pressure wave. The BOP-HHA algorithm uses the calculated work values and information about injuries from over 1,000 blast-exposed animal specimens to estimate lung injury risk and to determine the allowable number of rounds (ANORs) to which a Soldier can be exposed in a single 24-hour period without damaging one percent or more of the surface area of her or his lungs. The ANOR, as well as quantitative probabilities of lung injury for all lung injury severity levels, were determined for the conditions tested by ATC/YTC for each crew position specific to each weapon system. The hazard probabilities and severities were used to assign Risk Assessment Codes to each weapon system for BOP exposure.

BOP Analyses are published by the USAPHC in the HHA Reports used by Safety and Occupational Health professionals during the acquisition process. The results of BOP analyses are included in standard operating procedures that commanders use to make decisions about blast exposures when planning missions.





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FIGURE 1: M3 Multi-Role Anti-Armor Anti-Personnel Weapon System (MAAWS) M3E1 Carl Gustaf 84mm Recoilless Rifle

