HANDHELD FIRE EXTINGUISHER (HFE) HALON REPLACEMENT PROGRAM FOR ARMY GROUND VEHICLES, STATUS AND SUCCESSES

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ABSTRACT

The research program to identify alternatives to Halon 1301 used in fire extinguishing systems of Army ground vehicles is complete. Three programs of record are in various stages of completeness, crew compartment, hand held and engine compartment. This paper focuses on the hand-held (portable) fire extinguisher (HFE) replacement program and its status.

Several different portable design solutions were identified that could satisfy the requirements of the HFE replacement program. Several of the designs tested, claimed by their vendors to be a "drop-in" replacement for the Halon 1301 HFE, however, no systems tested as a direct size, weight and effectiveness replacement for the existing vehicle mounted portable bottles.

Two candidates, carbon dioxide (CO_2) and water with additives (H_20+) emerged as replacements for the existing HFE.

The HFE replacement is complete for most Army vehicles. This presentation will review the research and update the attendees on the progress of the installations.

INTRODUCTION

Halon 1301 has been used for decades as the primary fire and explosion extinguishing material for a multitude of industrial and military applications. However, halons have very high ozone depleting potentials and their production was stopped in 1994 in most of the world. The U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), the laboratory of the U.S. Army Tank-automotive and Armament Command (TACOM) that conducts research on issues affecting ground combat vehicles, initiated the Halon Replacement Program (HRP) to identify and develop replacement technologies to satisfy the performance and logistics requirements of fire protection for ground combat vehicles.

Early investigations indicated that a universal solution would not be available to the fire protection community for all the systems that used halon. Hence, multiple agents would probably be required to address the wide range of military applications currently satisfied by halon 1301.

This paper summarizes the results and findings of the HRP. It also addresses the halon elimination efforts in three separate ground combat vehicle applications: engine compartment fire suppression, crew compartment explosion suppression, and hand-held fire extinguishers.

PROGRAM

The US Army has relied on the 2.75-pound halon 1301 handheld fire extinguisher for decades. With the advent of environmental concerns related to the halons, however, the Army reverted back to the previous agent of choice – carbon dioxide. To date, more than 18,000 halon handhelds have been replaced with 2.5-pound CO_2 units in vehicles where crewmen are trained to exit the vehicle before fighting the fire from the outside (see Figure 1 below).

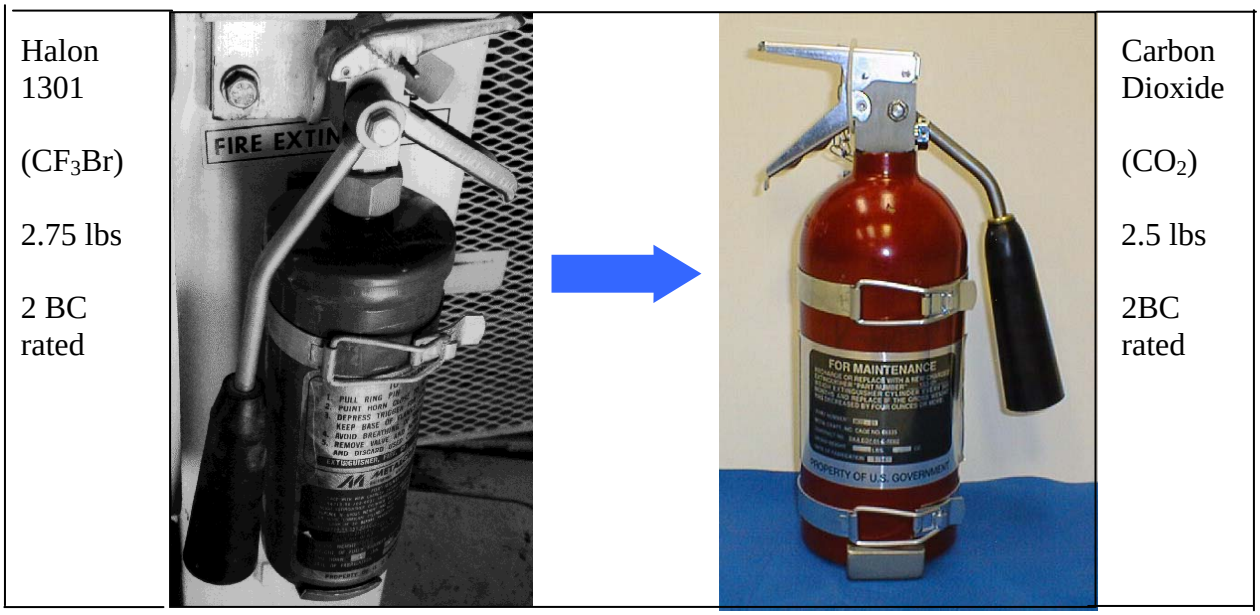

Figure 1. Halon 1301 and CO_2 Handheld Extinguishers

However, under some battlefield conditions the M1 Abrams tank crew may be required to stay under armor while fighting an internal fire. Under these circumstances, discharge of multiple CO_2 handhelds can result in potentially dangerous concentration levels. Therefore, due to these health concerns, the M1 retained the halon 1301 handhelds while research continued for an acceptable alternative.

A wide variety of alternatives have been evaluated for the M1, including HFCs, powder blends and water-based agents. FM-200 and FE-36 performed well at room temperature but exhibited poor low temperature performance and high byproduct levels. Certain halogenated alkanes were blended with the HFCs in attempts to improve performance but results were mixed. Two alternatives identified in the crew research underwent detailed evaluation: HFC-227ea with sodium bicarbonate

powder added to improve performance and minimize HF and a 50/50 blend of water and potassium acetate by weight to suppress the freeze point to below -60°F and enhance suppression capability. The water/acetate hand-held was down-selected for this application due to its lack of pyrolysis products and its ability to combat Class A vehicle filter fires experienced by the Abrams. This hand-held will begin to be introduced to the field later this year.

APPLICATIONS

The following table gives examples of alternatives to halon 1301 that have been applied to Army ground vehicles:

Application	Extinguisher type	Use example
Hand Held Extinguishers	**CO_2** **H_20 + acetate**	**Bradley** **Abrams**
Engine Compartment	FM-200 FE-25 Dry Powder	Bradley FV Stryker Abrams
Crew Compartment	FM-200 + powder	Stryker

Table 1. Halon 1301 Replacement Program Solutions

SUMMARY

The US Army has aggressively pursued alternatives to halon 1301 in its ground combat vehicles. Alternatives for all three ground vehicle applications, HFE, Crew and Engine, have been identified and fielded. As of now, only the crew compartment explosion suppression system of our legacy vehicles, Abrams, Bradley and FAASV, are still reliant on halon.

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