HISTORICAL PERSPECTIVE ON THE DEVELOPMENT OF CF_3I

Douglas S. Dierdorf
Applied Research Associates, Inc.
Gulf Coast Division
Panama City, FL USA

Juan A. Vitali
United States Air Force, AFRL/MLQC
Tyndall AFB, FL USA

ABSTRACT

CF_3I is unique among the commercially available halon options in being a chemically active agent with fire extinguishing mechanisms and effectiveness essentially equal to the halons it replaces. CF_3I is on the EPA SNAP list as a suitable replacement for Halon 1301 as a total-tlood agent for use in normally unoccupied areas. In addition. CF_3I is on the SNAP list as a Halon 121 l replacement for streaming application for nonresidential uses.

CF_3I was originally synthesized by the British fluorine chemist Emeléus in 1948. The first testing of CF_3I for fire extinguishing potential occurred during the Army–Purdue Study (publ. 1950). That study actually measured mass effectiveness for inhibiting ignition of heptane vapor, CF_3I was rated as rather poor performer compared to CF_3Br due to its higher molecular weight. CF_3Br, selected as the most promising compound, became the dominant fire extinguishing agent Halon 1301. Basic spectroscopic and thermodynamic properties for both CF_3I and CF_3Br were determined in the early 1950s. While CF_3Br was rapidly accepted for commercial application as a fire extinguishing agent. CF_3I remained essentially a laboratory reagent for synthesis of tritluoromethyl derivatives of a wide variety of compounds. In the early 1960s, Peninsular Chemical Research, Inc.. commercialized a very small-scale production route to fulfill these lab requirements. The successors of this firm continue to supply research quantities (typically 100 g) quantities to industry at very high prices.

The expansion of the Montreal Protocol to halt halon production and effectively ban HBFCs, large weight/volume penalties for HFCs, and the atmospheric lifetime concerns appearing for the PFCs, led NMERI and others to search for "second generation" halon replacements. The identification of CF_3I as the primary candidate for early scale-up for field-testing resulted in the formation of the "Ad Hoc CF_3I Working Group" (1993). This unprecedented alliance of end users, chemical producers, military. and academic labs resulted in a rapid assessment of key physical, chemical, and toxicological properties of CF_3I. By mid 1994. essential data had been obtained and cardiotoxicity concerns identified. While it was apparent that CF_3I would not he the "son of wonder gas" for occupied space flooding applications, two separate corporate organizations decided to attempt to commercialize CF_3I. Approximately the same time, CF_3I was identified as l of the 3-4 down-selected candidates for the aircraft engine and dry bay evaluation. These efforts have laid the groundwork for current applications of CF_3I in marine, aviation. and land based environments where the highest level of clean agent extinguishing effectiveness is still required.

The detailed presentation includes a review of the regulatory and commercial results that result in the ongoing efforts to broaden the range of CF_3I applications.