# DECOMPOSITION PRODUCT ANALYSIS OF HALON REPLACEMENTS: AN INTERLABORATORY COMPARISON

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Research has been sponsored by the **U.S.** Environmental Protection Agency (EPA), the U.S. Air Force, North Slope oil and gas producers, and the U.S. Coast Guard, at the New Mexico Engineering Research Institute (NMERI) to investigate Halon 1301 replacements. The research has focused on perfluorocarbons (FCs), hydrofluorocarbons (HFCs), and hydrochlorofluorocarbons (HCFCs); however, serious trade-offs were found to exist for each of the candidates identified. Subsequently, the research was expanded to include other classes ofhalocarbons that were anticipated to have low ozone-depleting characteristics and superior fire and explosion protection capabilities. These other classes of compounds included bromoethers, fluoroiodocarbons haloethcrs, and haloalkenes. **While** NMERI wasperformingthe EPA and USAF efforts, Hughes Associates, Inc. (HAI) was investigating potential halon substitutes through U.S. Navy and NASA sponsored research activities. During these efforts several halon-like compounds were identified as potential halon replacements. As a result, laboratory, intermediate-, and large-scale firesuppression testing has been performedon anumberofcompounds by both, NMERI and Hughes. Fourier Transform Infrared (FTIR) Spectroscopy has been used to measure agent concentration and decomposition product formation during these tests. Recent papers have been written by both NMERI and HAI presenting the decomposition result for the compounds approved for occupied space use by the National Fire Protection Association (NFPA) in their standard NFPA 2001. These compounds include: HFC-23, **HFC-227ea,** FC-3-1-10, and HCFC Blend A (NAF SIII). The decomposition results generated by NMERI and HAI have been compared to each other and to other results in the literature. Theotherdecomposition data have been presented by Great Lakes Chemical. Du Pont, 3M, the University of Lund, Naval Research Laboratory, and the Federal Aviation Administration. Data indicate that the design concentrations being consideredin NFPA 2001 (cup burner plus 20%), in most cases, were adequate to extinguish the fire but the level of toxic decomposition by-product formationmay be excessive. In general, if the amount of agent was increased above the "design concentrations," to cup burner plus 40% and the extinguishment time was short (<5 seconds), decomposition products were kept to a minimum. No substantial fire extinguishment performance differences were observed between the candidates tested. However. the candidates generated a 10-fold increase in HF concentrations whencompared with Halon 1301 even at a cup burnerplus 40% concentration. Also, significant $COF_2$ was observed with NFPA 2001 agents at concentrations less than the cup burner plus 40%; no $COF_2$ was detected with Halon 1301 in any of the fire suppression tests. An interlaboratory comparison of available decomposition data will be presented and discussed.