Halon Replacement for Airplane Portable Fire Extinguishers - Progress Report

International Aircraft Systems Fire Protection Working Group Meeting

Bremen, Germany
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Objective

Provide a progress report on the development of BTP (2-bromo-3,3,3-trifluoropropene), a promising new environmentally progressive Halon 1211 replacement agent for handheld fire extinguishers

Agenda

- Steps to Commercialization
- BTP Development Time Line
- Current Progress
- Future
- Questions

Steps to Commercialization

- ✓ Cup burner testing - 2002
- ✓ Initial toxicity tests (Ames, cardiotox…) - 2002
- ✓ 2-Dimensional Ozone Depleting Potential (ODP), Global Warming Potential (GWP), atmospheric lifetime - 2004
- ✓ Prototype extinguisher, near drop-in replacement for Boeing 1211 extinguisher - 2009
- ✓ Underwriters' Laboratory (UL) 711 5B pan fire tests - 2009
- ✓ UL 711 cold temperature pan fire test - 2009
- ✓ Federal Aviation Administration (FAA) Minimum Performance Standard (MPS) AR-01/37 hidden fire tests - 2009
- ✓ 3-Dimensional model analysis of ODP and GWP - 2010
- ✓ FAA MPS AR-01/37 seat fire toxicity tests - 2011
- ✓ American Society for Testing and Materials (ASTM) flammability tests (per NFPA 704) - 2011
- ✓ Airplane material compatibility tests - 2011
- ✓ Synthesis of BTP for toxicology testing - 2011
- ✓ Publication of 3D ODP/GWP scientific paper - 2011
- ✓ Additional BTP physical properties testing – 2011
- ✓ Physiologically based pharmacokinetic (PBPK) testing and modeling –2013
- ✓ Toxicology testing – 2013
- ✓ Provide PBPK data to FAA for inclusion in Advisory Circular (AC) 20-42D & FAA/AR-08/3 – 2013
- ✓ US EPA Significant New Alternatives Policy (SNAP) application – 2013
- ✓ EU Registration, Evaluation, Authorization & Restriction of Chemicals (REACH) application - 2014
- ❑ US EPA Toxic Substances Control Act (TSCA) Inventory listing
- ❑ EPA SNAP approval
- ❑ European Chemicals Agency (ECHA) REACH registration
- ❑ ASTM standard for BTP
- ❑ 3.25" diameter bottle for Boeing retrofit
- ❑ UL 2129 fire extinguisher bottle tests and UL listing

BTP Development Time Line

Prototype developed

Passed FAA MPS seat fire tests

FAA 747 hidden fire tests

Start toxicity testing

PBPK Submittal To FAA

Start Boeing airplane install drawings

Boeing Fire extinguisher procurement contract

777 production incorporation

787 production incorporation

737 production incorporation

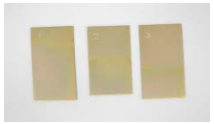
747 production incorporation

2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016

Contract with American Pacific

UL 711, and FAA MPS hidden fire tests

Boeing material compatibility tests



Meeting with EPA

NFPA 704 flammability tests F=0

3D ODP and GWP published .0028 ODP .26 GWP

Meeting with EPA

EU EASA Halon Replacement Rulemaking Group

SNAP/REACH applications submittal

FAA Halon Replacement Aviation Rulemaking Committee

Toxicology testing report

EPA TSCA/SNAP, EU REACH Approvals (estimated)

BTP UL5BC fire extinguishers available (estimated)

ASTM Standard development

EU deadline (new type cert)

ICAO deadline

Hong Kong AN 60A & Singapore AC SAR-1

Red box indicates critical milestone that could affect follow-on events

BTP Current Progress

❑ **TOXICOLOGY TESTING:**

✓ **COMPLETED : Additional reproductive screen - long term worker exposure:**

- ✈ **6 hours/day, 7 days/week exposure.**
- ✈ **No test substance related clinical or macroscopic findings were noted in any of the test exposure groups.**
- ✈ **No adverse clinical or reproductive effects on parents or offspring were noted at the 100 ppm exposure, so the no-observed-adverse-effect-level (NOAEL) is considered to be 100 ppm.**
- ✈ **Tentative 8 hour Allowable Exposure Level (AEL) will be 30 ppm (subject to EPA input/concurrence).**
- ✈ **Tentative ECHA Derived No Effect Level (DNEL) will be 11 ppm.**

Proposed AEL of 30 ppm

BTP Current Progress

❑ **TOXICOLOGY TESTING:**

✓ **COMPLETED : Additional reproductive screen - acute exposure:**

- ✈ **5 minutes/day, 7 days/week exposure.**
- ✈ **Exposure level 10,000 ppm (1% cardiotoxicity LOAEL) for full 5 minutes plus ramp up time.**
- ✈ **No persistent clinical or macroscopic findings were noted.**
- ✈ **No exposure related effects on male and female reproductive indices were observed.**
- ✈ **No reproductive effects were noted for parents or offspring.**

Acute exposures - no reproductive effects

BTP Current Progress

❑ **US EPA SNAP/TSCA and EU ECHA/REACH Applications:**

✓ **COMPLETED**

- ✈ **SNAP application was submitted to EPA December 2013.**
- ✈ **SNAP and TSCA are currently reviewing the application/data.**
- ✈ **TSCA review period extended - response is due end of May?**
- ✈ **REACH Registration dossier submitted in March.**

✓ **May 8 ECHA letter stated "registration was considered complete"**

REACH registered - waiting for EPA approval

Future

- **Boeing will proceed with implementation planning of BTP fire extinguishers**
- **American Pacific will be drafting the proposed ASTM standard for BTP**
- **UL 2129 testing will be completed after EPA approval**
- **Further updates will be provided at the Fall FAA IASFPWG**

Non-ODS BTP drop-in fire extinguisher with GWP < 1

Questions?

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