

STREAMING APPLICATIONS OF HFC-227ea

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While significant progress has been made towards the replacement of Halon 1301 in total flooding fire suppression applications, far less progress has been made in the development of viable alternatives for streaming applications. We report here the development of a novel, zero ODP portable extinguishing system; this novel design has resulted in a great enhancement of the performance of HFC-227ea in streaming applications. Most recently, employment of the unit has allowed for the achievement of a UL 5BC rating for a unit containing 5.75 lbs of HFC-227ea. The attainment of a 5BC rating renders the unit potentially attractive for use in aircraft cabins, where current FAA requirements call for a minimum 5BC rating. We report here the further development of this novel extinguishing unit, including its performance in Underwriters Laboratories tests, ground-based military applications, and commercial aircraft applications.

Streaming Agents: HCFC-123

- Scheduled for phase-out due to non-zero ODP
- Potent Cardiac Sensitizer
 - ✓ NOAEL = 1 % v/v
 - ✓ LOAEL = 2 % v/v
- Increased incidence of benign tumors in chronic studies
- Toxicity concerns led to further investigations
 - ✓ C₄ through C₆ Perfluorocarbons

Perfluorohexane

- Atmospheric Lifetime = **3100** years
 - **HGWP = 5200 (100 year ITH)**
 - No production bans
 - SNAP guidelines restrict use to applications where no other alternatives are technically feasible due to safety or performance requirements

Streaming Agents: Previous Studies

- Air Force Groups Meeting at Tyndall AFB April **1994**
- Concluded no near-term candidate was completely acceptable
- Air Force would retain Halon **1211** until a suitable replacement became available

Streaming Agent Candidates

- Requirement for clean extinguishment restricts choice to halogenated agents and inert gases
 - Storage volume requirements prohibit practical use of inert gases
 - Among the halocarbons, only **HFCs** and **PFCs** not subject to phaseout

Streaming Agent Comparison: Restrictions and Phaseout

Agent	Tradename	Subject to Use Restrictions?	Subject to Phaseout?
HCFC-123	FE-232	no	yes
HCFC Blend B	Halotron I	no	yes
HCFC Blend C	NAP P-III	no	yes
HCFC Blend D	NAF Blitz	no	yes
HCFC-124	FE-234	no	yes
PFC-5-1-14	CEA-614	yes	no
HFC-236fa	FE-36	proposed	no
HFC-227ea	FM-200	no	no

Streaming Performance of HFC-227ea

- In general, low boiling agents more suitable *for* total flooding applications

- MetalCraft/Great Lakes Chemical
 - ✓ joint development of novel extinguisher
 - ✓ enhanced streaming performance
 - ✓ UL 2B rating achieved for 2.5 lb unit
 - ✓ UL 3B rating achieved for 3.0 lb unit
 - ✓ UL 5B rating achieved for 5.7 lb unit

UL Testing of MetalCraft/GLCC 2.5 lb Unit

Fire Type	2B	2B	2B	2B
Fire size (ft ²)	5	5	5	5
Preburn (s)	60	60	60	60
Conditioning	normal	normal	normal	-40 °F
Pressurization (psig)	360	360	360	360
Agent Discharge (lb)	1.7	1.6	2.0	1.6

Streaming Agents: UL Ratings

Agent	Agent Requirement (lb)				
	Rating				
	2BC	3BC	5BC	1A:10BC	2A:10BC
Halotron I (HCFC-123)	2.5	-	5	12	20
Cleanguard (HFC-236fa)	-	-	6	10	14
FM-200 (HFC-227ea)	2.5	3	5.7	TBD	TBD

Conclusion

- Development of a novel extinguisher design has extended the streaming applications of HFC-227ea
- 2BC, 3BC and 5BC rating achieved for 2.5, 3 and 5.7 lb units, respectively
- 10BC rating in progress
- Renders HFC-227ea a viable option in streaming applications