



Safety Issues of Alternative MAC Refrigerants in the United States

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EPA Global Risk Analysis is Complete

- Global Collaboration with Australia, EU, Japan & Canada
- Risk examined using:
 - Computational Fluid Dynamics (CFD) Modeling of reasonable worst-case scenario leak in passenger compartment
 - Fault Tree Analysis (FTA) of potential passenger and technician exposure
 - Previous Analyses
 - Summary of toxicity and flammability issues



Risk Analysis Assumptions

- Full system discharge from evaporator or evaporator input line into plenum at maximum leak rate
- Windows & doors closed
- 6 occupants—multiple exposure zones
- Large sedan with highest charge to interior volume ratio



Risk Analysis Findings

- CO₂ and HFC-152a have comparable risk
- Risk can be mitigated by engineering & training
- EPA will propose to approve both CO₂ and HFC-152a

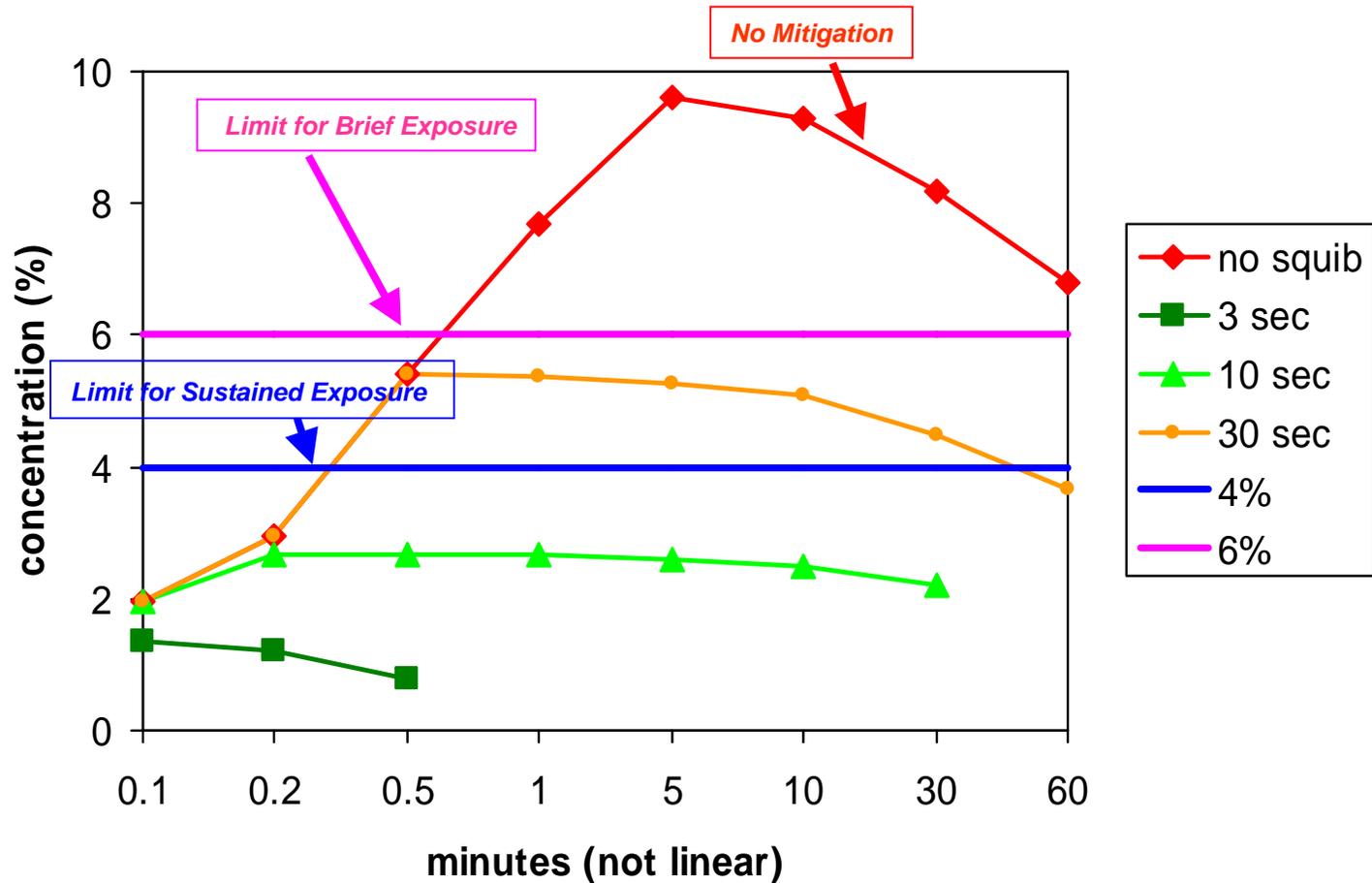


Details of CO₂ Findings

- CO₂ is toxic
- Limits for exposure
 - 4% limit for sustained exposure (one hour)
 - 6% limit for brief exposure (1-2 minutes)
- Human exposure data
 - Functional impairment (5% for ~1 hour)
 - Dizziness, muscle twitching, unconsciousness (7-10% exposure for a few minutes)
 - Unconsciousness/Death (18% for less than 1 minute)
- Passenger exposure can be reduced to acceptable level if safety mitigation technology applied to reduce total amount of refrigerant entering passenger compartment
- Technician exposure can be reduced to acceptable level with training and certification.



Benefits of CO₂ Charge Evacuation After Leak



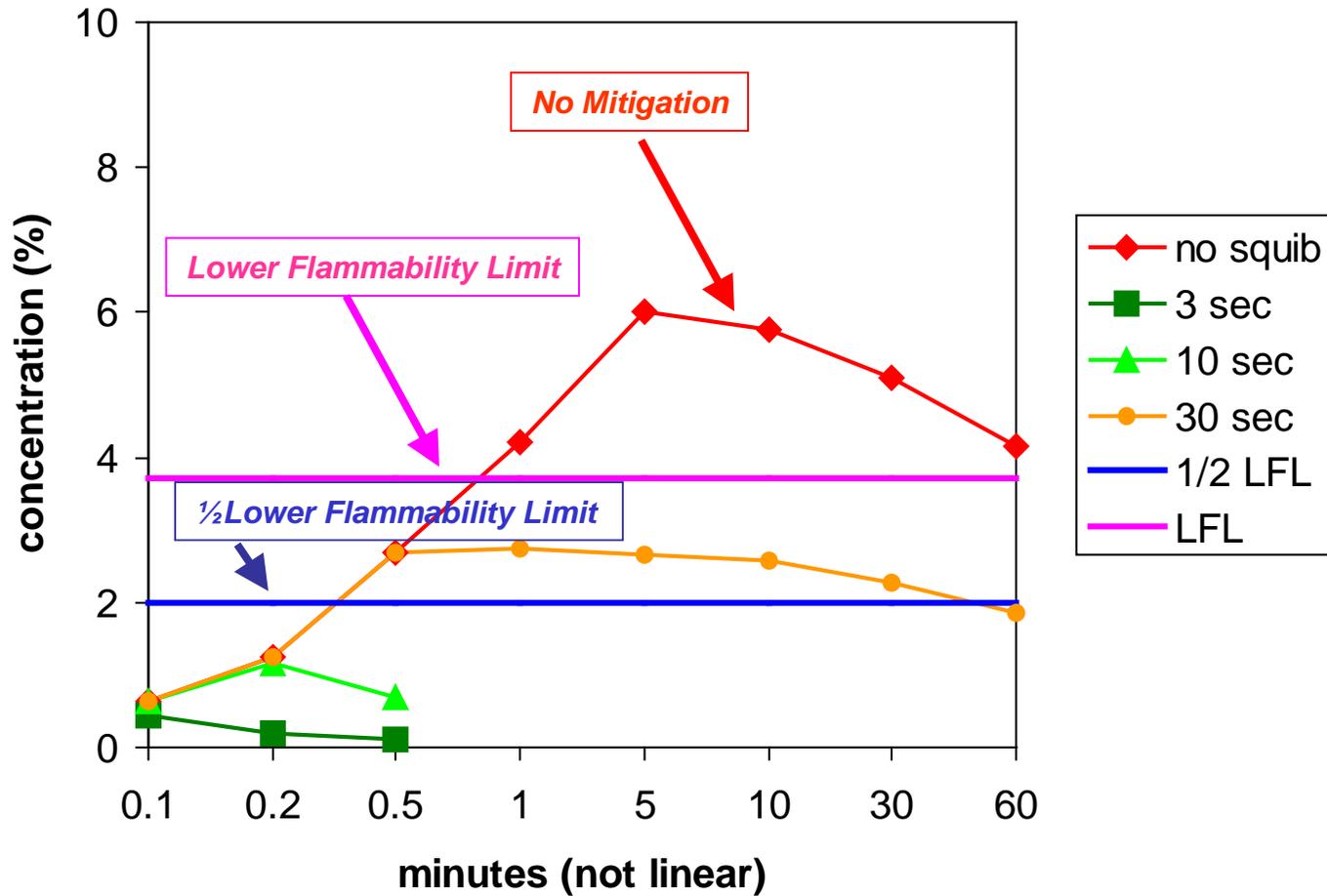


Details of HFC-152a Findings

- HFC-152a is flammable (3.7 to 20%)
- Exposure limit: 3.5%
- Only open flames (matches, butane lighters) are credible ignition sources in passenger compartment
- Passenger exposure can be reduced to acceptable level if safety mitigation technology applied to reduce total amount of refrigerant entering passenger compartment
- Technician exposure can be reduced to an acceptable level with training and certification.



Benefits of HFC-152a Charge Evacuation After Leak





Safety Mitigation for CO₂ and HFC-152a Systems

- Inherent
 - Secondary Loop
 - Small charge/restricted refrigerant flow to compartment leak
- Active
 - Detect and discharge

EPA welcomes additional technological approaches.



Mitigation Likely to Satisfy EPA Criteria

- Secondary loop CO₂ or HFC-152a
- Geometry to limit leak rate to occupied compartment, discharge upon detection of refrigerant in A/C system air distribution system
- Specifications for detection and discharge can be evidence that acceptable compartment concentration will not be exceeded
- EPA risk analysis did not determine whether any system with refrigerant inside the passenger compartment can be safely implemented without active mitigation



SNAP Approval

- Under Clean Air Act of 1990, Section 612, the Significant New Alternatives Policy (SNAP) Program approves substitutes for ozone depleting substances.
- Accepted alternatives are determined to reduce overall risk to the environment.
- Will likely find HFC-152a and CO₂ acceptable with risk mitigation devices, verification of specific design and component/system reliability.



SNAP Acceptability Notice Process

- Draft text
- Internal Review
- EPA General Counsel Review
- EPA Policy Office Review
- OMB Review
- Administrator Review
- Administrator Signature



Where Are We Now?

- EPA General Counsel Review
- Then submit rule package to EPA Policy Office
- Package goes to OMB
- OMB review for three months
- Administrator signature



How Can YOU help?

- Disclose mitigation system designs and test results
- Work with EPA to confirm CO₂ and HFC-152a transition costs for OEMs, component makers, and the service sector



For More Information

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