NIOSH Fire Fighter Fatality Investigation and Prevention Program

SCBA FACEPIECE PRESENTATION

Steve Miles

Objectives

- **Present overview of findings from NIOSH fire fighter fatality investigations related to thermal degradation of Self-Contained Breathing Apparatus**

NIOSH Photo

Review of 8 recent fatalities in 6 separate events indicated the fire fighters' SCBA may have been thermally degraded while they were still "on air"

NIOSH Photos

NIOSH Fire Fighter Fatality
Investigation and Prevention Program

The possibility that the fire fighters were still “on air” when the lenses were thermally degraded was identified through

- A review of information in autopsies and medical examiner reports (and follow-up calls to the M.E. when possible)
- Radio transmissions (fire ground tapes)
- Examination of SCBA and personal protective clothing worn by the victims
- Witness reports

Review of these 8 fatalities indicate a need for further research into the thermal resistive performance of the SCBA face piece as well as testing conditions for the PPE envelope

FATALITY INFORMATION

#F-2005-31 PA

- Career fire officer (PA), died after being exposed to products of combustion
- Face piece lens was thermally degraded
- Victim was on air at the time of event

VICTIM'S FACE PIECE

NIOSH Photo

FATALITY INFORMATION

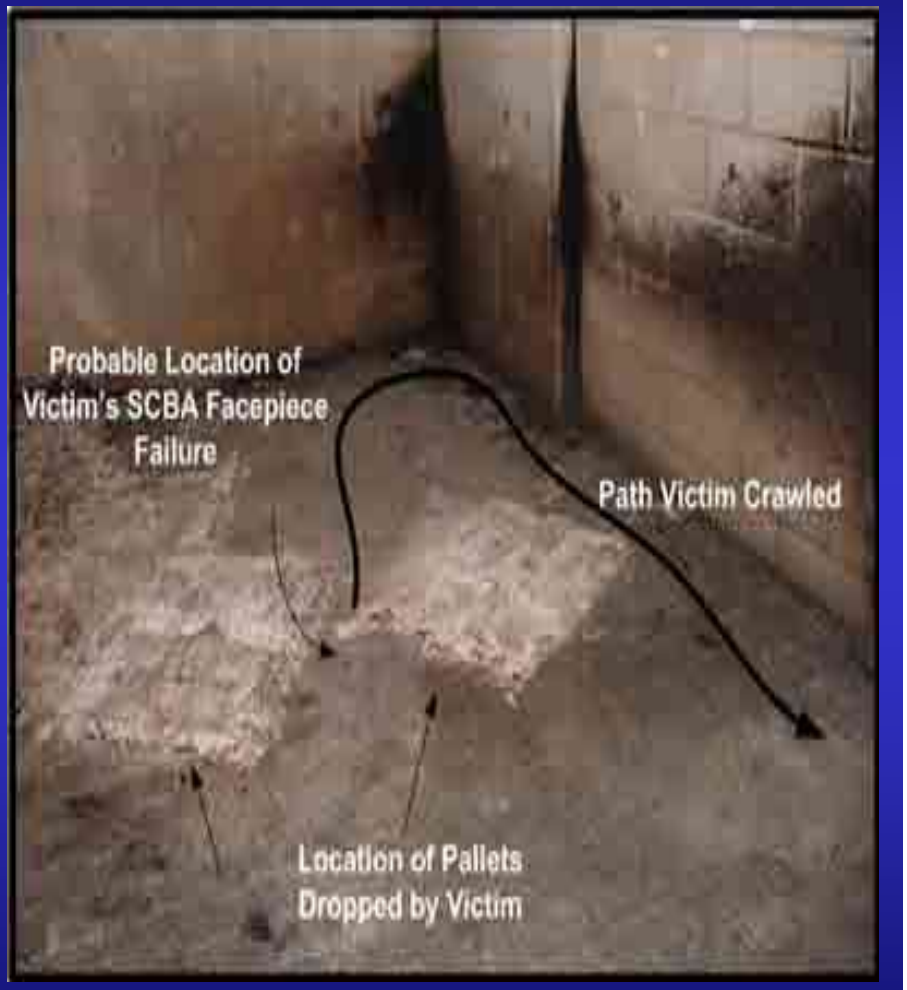
#F-2005-31 PA

- Victim was an instructor in a live burn exercise and had entered the burn room stacking pallets.
- “it is hypothesized that excessive heat in the burn room caused a catastrophic failure of the victim’s SCBA face piece lens.”

NIOSH Photo

FATALITY INFORMATION

- "The failure occurred as the victim was carrying pallets in the burn room to add to the existing fire."
- "The victim then struggled on the ground and crawled towards the exit."



NIOSH Photo

FATALITY INFORMATION

- “This failure was a result of the heat conditions within the burn room and not a problem with the face piece manufacture”
- The county coroner’s office reported the cause of death as thermal trauma

NIOSH Photo

ADDITIONAL DATA FOR F2005-31PA

- Mask conditions before event. Other masks at the facility exhibited signs of severe service and repeated exposure to high heat conditions
- Victim had reported conditions in basement as “hot as hell down there” just prior to event

NIOSH Photo

ADDITIONAL INFORMATION

- Additional information on the incident can be found in NIOSH report F2005-31PA
- Additional information on the victim's SCBA and 2 other SCBA submitted by the fire academy can be found in NIOSH NPPTL report Task No.14292 (May 1, 2007)
- NIST Report; *Fatal Training Fires: Fire Analysis For The Fire Service* by Daniel Madrzykowski

FATALITY INFORMATION

#F-2007-12 VA

VICTIM'S FACE PIECE

- Career fire fighter dies after being exposed to products of combustion during a residential fire
- SCBA face piece was still on the victim, but the lens and mask were thermally degraded

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FATALITY INFORMATION

- Victim initiated a mayday by radio emergency button and voice and advised "*mayday, mayday, mayday, Tower 512 bucket, I'm trapped inside, I don't know where I am, I'm somewhere in the stairwell, I need someone to come and get me out.*"

FATALITY INFORMATION

- Victim was still on air during the mayday transmission
- Victim was unable to escape a rapidly growing fire event
- Reports from medical examiner confirmed thermal injuries to respiratory system

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ADDITIONAL INFORMATION

- Additional information on the incident can be found in NIOSH report F2007-12VA and the fire department investigative report @ http://www.pwcgov.org/vpresentations/fnr/LODDReport.pdf
- Additional information on the victim's SCBA unit can be found in NIOSH NPPTL report Task No. TN-15210

FATALITY INFORMATION

#F-2008-34 AL

- Volunteer fire fighter dies after being exposed to products of combustion during a residential fire
- SCBA face piece and other equipment were found next to the victim possibly burned off, the lens and mask were thermally degraded

VICTIM'S FACE PIECE

NIOSH Photo

FATALITY INFORMATION

- Victim was able to call by radio “I’m hot, come get me, come get me”(victim still on air)
- Autopsy records and photos indicate thermal injuries to the respiratory system

Photo Courtesy of sheriff’s office

ADDITIONAL INFORMATION

- Additional information on the incident can be found in NIOSH report F2008-34
- NIOSH NPPTL is currently evaluating the victim's SCBA

NIOSH Photo

FATALITY INFORMATION

- #F-2002-34 FL
- 2 Fire Fighters Die During a Training Fire
- The fire fighters were caught in a flash over after a foam mattress was placed in the room they were to search

FATALITY INFORMATION

- NIST report indicates “the fire fighters’ self contained breathing apparatus (SCBA) face piece was compromised”
- NIST report indicates that the FL incident and the PA incident “were in part the result of fuel loads that generated levels of energy that exceeded the design capabilities of the protective equipment” and the need for further research on the impact of thermal conditions on SCBA face piece lenses under actual use conditions”

ADDITIONAL INFORMATION

- Additional information on the incident can be found in NIOSH report F2002-34FL
- NIST Report: *Fatal Training Fires: Fire Analysis For The Fire Service* by Dan Madrzykowski
- Bureau of Fire Standards and Training, Florida Division of State Fire Marshal. BFST Safety Investigative Report 02-01, July 30, 2002

FATALITY INFORMATION

#F-2009-11 TX

VICTIM'S FACE PIECES

- Career fire officer and fire fighter (TX), die after being exposed to products of combustion
- Face piece lenses were thermally degraded
- Victims were likely on air at the time of event

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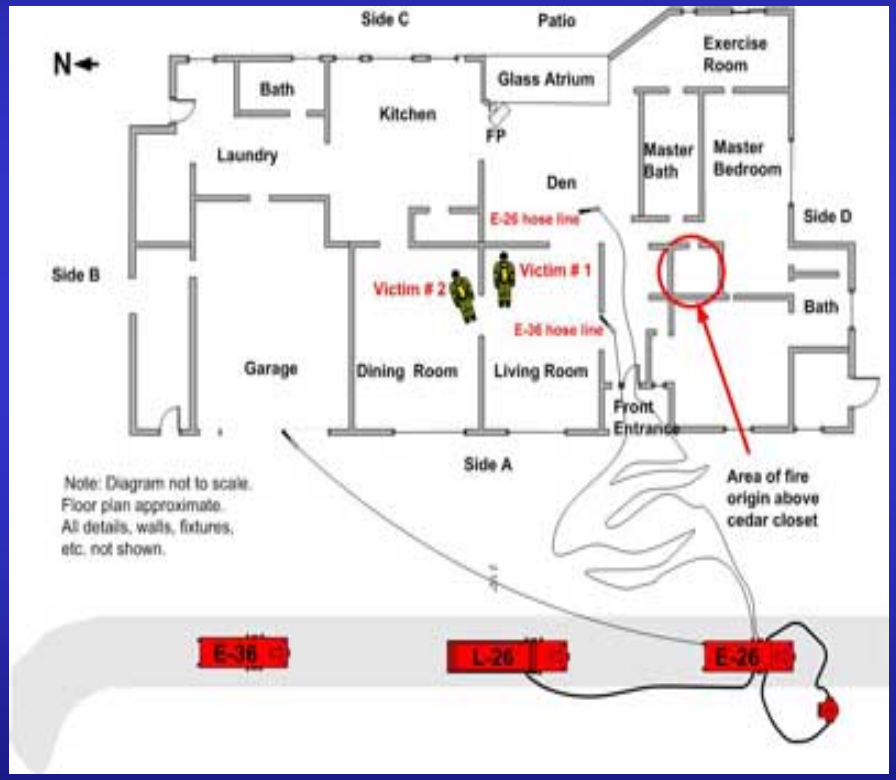
FATALITY INFORMATION

#F-2009-11 TX

- Texas State Fire Marshal's report indicated "a rapid fire growth moved through the narrow hallway with temperatures exceeding ratings of the PPE and SCBA"



FATALITY INFORMATION

Victim 1's location

Victim 2's location

Photos courtesy of fire department

FATALITY INFORMATION

Victim 1's Face Piece

Victim 2's Face Piece

NIOSH Photos

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FATALITY INFORMATION

- Both fire fighters were overcome by rapid fire growth and unable to escape
- Victim 1 died of thermal injuries (including respiratory system)
- Victim 2 died of thermal injuries and smoke inhalation

NIOSH Photo

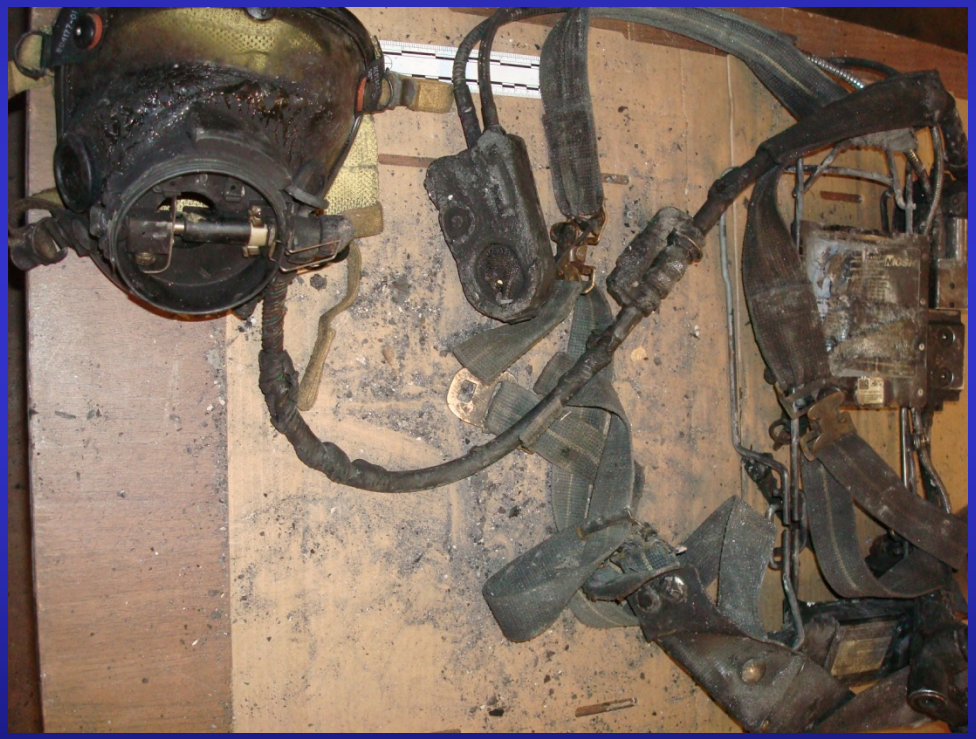
FATALITY INFORMATION

- Victim 1's face piece and hood

NIOSH Photo

FATALITY INFORMATION

- Victim 2's face piece and SCBA assembly



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ADDITIONAL INFORMATION

- Additional information on the incident can be found in NIOSH report F2009-11TX
- Texas State Fire Marshal's Office, Investigative report number FY 09-01, Texas Department of Insurance, Austin Texas, April 12, 2009
- NIOSH NPPTL SCBA Status Investigation Report is still being developed
- NIST Fire Modeling is still being developed

FATALITY INFORMATION

- Current Investigation MD
- FF died after being caught by rapid fire growth on 3rd floor apartment
- Victim radio'd mayday and made it to the balcony door on side C
- Victim was still on air
- Victim died of thermal injuries

NIOSH Photo

FATALITY INFORMATION

- Victim's SCBA face piece thermally degraded

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INJURY INFORMATION

- VA FF suffers severe burns, face piece is severely degraded
- FF bailed out of a 2nd story window after being trapped in pre flashover conditions for approximately 2-3 minutes

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INJURY INFORMATION

- Victim was still on air and did not suffer respiratory injuries, but had to retire due to burn injuries
- Department report states face piece was seconds from failure

NIOSH Photo

ADDITIONAL INFORMATION

- Additional information on this incident can be found at http://www.loudoun.gov/Default.aspx?tabid=2384
- Or http://www.loudoun.gov/Default.aspx?tabid=809

INJURY INFORMATION

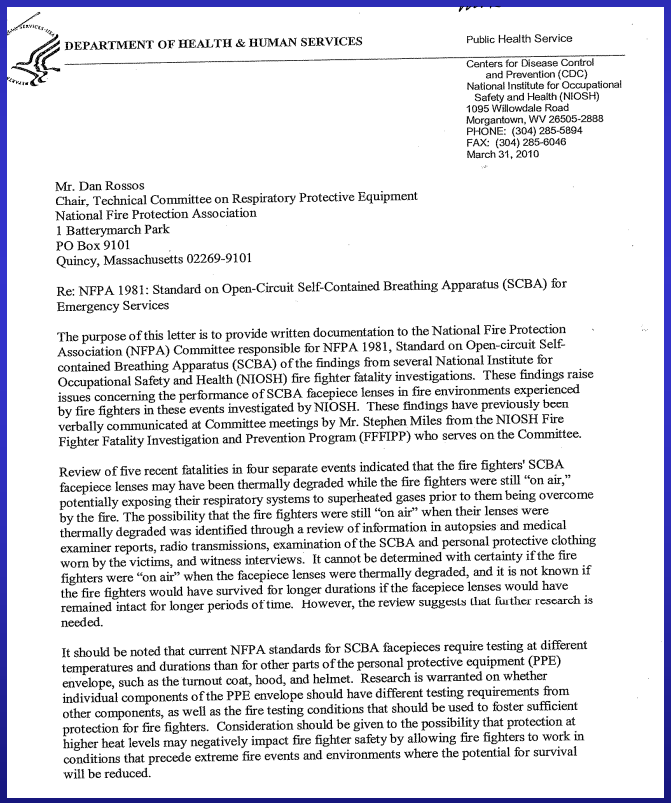
- FF from large metro dept. suffered significant burns while trying to escape residential fire, 2011
- Victim still on air, reported that his mask was moving and used his hand to hold mask in place

INJURY INFORMATION

- FF suffered significant burns, but survived by holding his face piece in place
- Lens separated from face piece skirt after escaping

INFORMATION ON SCBA's INVOLVED IN FATALITIES SHARED

LETTER TO NFPA



DEPARTMENT OF HEALTH & HUMAN SERVICES

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March 31, 2010

Mr. Dan Rossos
Chair, Technical Committee on Respiratory Protective Equipment
National Fire Protection Association
1 Batterymarch Park
PO Box 9101
Quincy, Massachusetts 02269-9101

Re: NFPA 1981: Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services

The purpose of this letter is to provide written documentation to the National Fire Protection Association (NFPA) Committee responsible for NFPA 1981, Standard on Open-circuit Self-contained Breathing Apparatus (SCBA) of the findings from several National Institute for Occupational Safety and Health (NIOSH) fire fighter fatality investigations. These findings raise issues concerning the performance of SCBA facepiece lenses in fire environments experienced by fire fighters in these events investigated by NIOSH. These findings have previously been verbally communicated at Committee meetings by Mr. Stephen Miles from the NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) who serves on the Committee.

Review of five recent fatalities in four separate events indicated that the fire fighters' SCBA facepiece lenses may have been thermally degraded while the fire fighters were still "on air," potentially exposing their respiratory systems to superheated gases prior to them being overcome by the fire. The possibility that the fire fighters were still "on air" when their lenses were thermally degraded was identified through a review of information in autopsies and medical examiner reports, radio transmissions, examination of the SCBA and personal protective clothing worn by the victims, and witness interviews. It cannot be determined with certainty if the fire fighters were "on air" when the facepiece lenses were thermally degraded, and it is not known if the fire fighters would have survived for longer durations if the facepiece lenses would have remained intact for longer periods of time. However, the review suggests that further research is needed.

It should be noted that current NFPA standards for SCBA facepieces require testing at different temperatures and durations than for other parts of the personal protective equipment (PPE) envelope, such as the turnout coat, hood, and helmet. Research is warranted on whether individual components of the PPE envelope should have different testing requirements from other components, as well as the fire testing conditions that should be used to foster sufficient protection for fire fighters. Consideration should be given to the possibility that protection at higher heat levels may negatively impact fire fighter safety by allowing fire fighters to work in conditions that precede extreme fire events and environments where the potential for survival will be reduced.

Communication with NIST

- Notified NFPA 1981 of SCBA face piece performance in recent incidents
- Asked NIST to assist with testing of face pieces in similar situations
- Shared photos and FFFIPP reports with NFPA and NIST

CDC

NIOSH Fire Fighter Fatality Investigation and Prevention Program

NIOSH

NIST Research on Thermal Impact to SCBA face piece

Review of Findings From NIOSH FFFIPP Related to SCBA

- All of the fire fighter fatalities involved in the reviewed incidents were likely still “on air” at the time of the event
- Conditions encountered likely exceeded the performance capabilities of the SCBA face pieces
- Review of data suggest that the fire fighters suffered thermal injuries to the respiratory system
- Many of the fire fighters involved in the incidents were close to an escape point

Review of Findings From NIOSH FFFIPP Related to SCBA

- Findings suggest a need for further research into the thermal resistivity capability of SCBA face piece
- Findings suggest a need to bring the present data forward to provide research bodies and other organizations with information to raise awareness and the protection levels of SCBA and PPE

Review of Findings From NIOSH FFFIPP Related to SCBA

- NIOSH will continue to forward investigation reports from any future fire fighter fatality investigations that suggest performance issues with SCBA face piece or components that impact on NFPA certification
- We welcome suggestions from our stake holders on specific information that NIOSH could collect during fatality investigations

Thank You

www.cdc.gov/niosh/fire

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