

A Change For Time

Exit Time and Air Allocation For Fire Service SCBA



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Objective

Allow the Fire Service to specify an Open-Circuit SCBA with:

- ‘Appropriate’ Work Volume
- ‘Appropriate’ Exit Volume
- ‘Appropriate’ Reserve Air Volume
- EOSTI w/ an ‘appropriate’ set point

84.83 (f)

“Each remaining service-life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced within a range of 20 to 25 percent of its rated service time”

Why An Upper Limit?

Pre-1960 Rationale

1. SCBA technology
2. Protective clothing
3. Smaller structures
4. Firefighting strategy and tactics
5. Fuel package

Testing Tolerance

- ‘Range of Success’



Non-Cardiac FF Fatalities Inside Structures

- 1977-2002
 - 53% Decline in Structure Fires
- Traumatic FF Deaths Inside Structures
 - Late 1970's = 1.8/100,000
 - Late 1990's = 3/100,000
 - 63% resulting from smoke inhalation
- FFF Rate By Occupancy Type (93-02)
 - Residential = 1.84/100,000
 - Non-Residential = 4.06/100,000



Source: NFPA




Time In A Bottle

*How we allocate our
breathing air*



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Air Allocation

CYLINDER VOLUME = WORK  + EXIT

- Historically, the alarm was based on a reasonable work period, with some consideration for exit
 - 25% - 50% - 25% Rule
- Today's reality
 - We don't allocate enough air for exit

Time In A Bottle - 25% EOSTI

Rated Service Life	Total Volume	HZ Volume	HZ Time	Exit Volume	Exit Time
30 Min.	45 ft ³ (1274 L)	33.75 ft ³ (955 L)	9.50 Min.	11.25 ft ³ (318 L)	3 Min.
30 Min.	60 ft ³ (1698 L)	45 ft ³ (1274 L)	12.75 Min.	15 ft ³ (425 L)	4.25 Min.
45 Min.	66 ft ³ (1868 L)	49.5 ft ³ (1401 L)	14 Min.	16.5 ft ³ (467 L)	4.67 Min.
60 Min.	88 ft ³ (2490 L)	66 ft ³ (1868 L)	18.7 Min.	22 ft ³ (623 L)	6.25 Min.

The 30-Minute Cylinder & The 25% Low-Air Alarm

- ‘Rated Time’
- 1200L 30-minute Rated SCBA
 - 300L of Air for Exit
 - 3 minutes of Escape Time
- Little Margin of Error
 - What if...
- We Are Packing For One Scenario
 - When else is this acceptable?

Rated Service Time

Based on Respiratory Minute Volume

- NIOSH - 40 liters/minute
 - 30 minute (1200L) cylinder - 31.8375 minutes
- 100 liters/minute
 - 30 minute (1200L) cylinder - 12.735 minutes

12-13 Minutes

- May 9, 2001: Passaic, NJ
 - 13 Minutes after arrival on-scene
 - Last transmission - “Out of Air”
- October 13, 2001: Houston, TX
 - Residential High-Rise (5th Floor)
 - 10-12 Minutes until last transmission
- June 15, 2003: Memphis, TN
 - 12 Minutes after arrival on-scene
 - Mayday - “Low on Air”

Margin of Error...

- What if everything doesn't go just right?
- Time for:
 - Self-Rescue
 - Receiving 'assistance'
 - Rescuing others
- What is our back-up plan?
 - Rapid Intervention Reflex Time

NFPA 1981, 1500 & 1404

NFPA 1981

- 6.2.3 – Shall meet activation requirements of NIOSH 42 CFR 84
- Heads-Up Display @ 50%
- Universal Air Connection (UAC)

NFPA 1500 & 1404

- Situation Awareness (SA)
- Air management

“The Solution Already Exists”

- “Situational Awareness & Air Management are the keys to the prevention of an inadequate air supply”
- “The heads-up display (NFPA 1981 2002 ed.) provides the earlier warning that is needed”
- “An earlier EOSTI will only result in it being ignored by the user”
- “The EOSTI should not be used for exit alarm”

Air Management

1. Working Environment Varies
2. Air Consumption Varies
3. Exit Time Is Part of Size Up

*The Concept Of Air Management Recognizes
That The 25% Remaining Service Life
Indicator (Low-air Alarm) Is Not Adequate*

Situation Awareness

“The degree of accuracy by which one’s perception of his current environment mirrors reality”



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Source: Naval Aviation School Command



Situational Awareness

Affected By:

- Your view of the situation
- Incoming information
- Expectations & biases

Reduced By:

- Insufficient communication
- Fatigue/Stress
- Task overload or underload
- Degraded operating conditions



Source: Naval Aviation School Command



The Reality of Air Management

- Relies on a high degree of situational awareness
- Subject to failure due to human error, unknown factors, catastrophic events
- Human solution for a mechanical deficiency
- Replaces a 'Positive Control System' (the EOSTI) with an error prone human solution

Adding More Reserve Air

Current Regulation

- Increase time in the hazard zone
- Results in additional work stress & other work period issues
- Human monitoring to leave prior to alarm

Proposed Change

- Remove the ceiling from the EOSTI
- Local needs should determine the set point

More Air?

Too much weight/bulk

- Minimal weight/bulk difference between 30 & 45-minute cylinder
- 50% reduction in weight/bulk over past 25 years...

Too much air?

- “Fire fighters will ignore the alarm”
- More air is for Emergency Use only

Work Period Issues

- Work Stress
- Heat Stress
- Depth of Entry
- Fire Progression
 - Fire Development
 - Structural Failure
 - Fireground ‘Rule of Thumb’



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More Air + Earlier EOSTI=

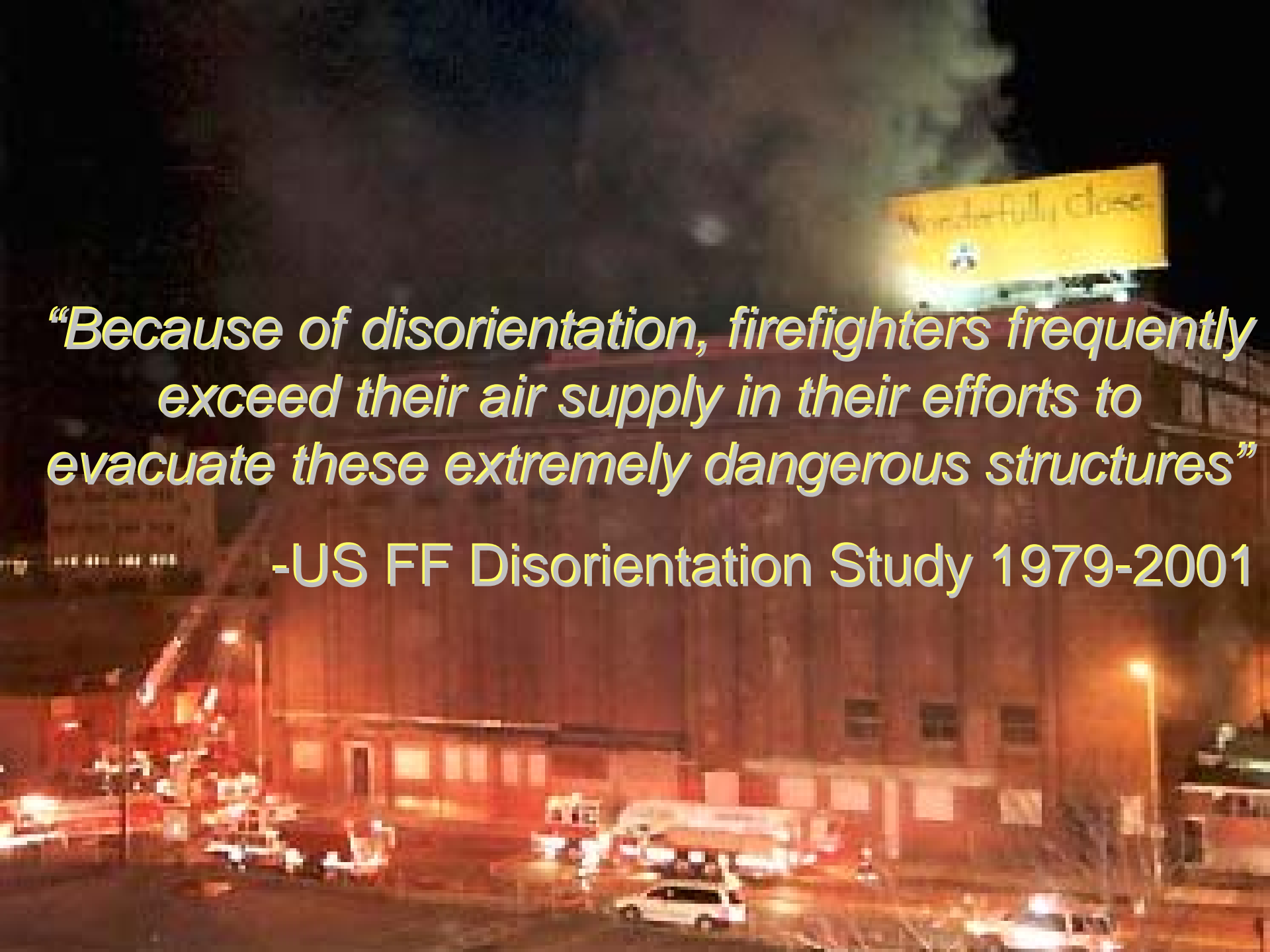
- Opening the Exit Window
- Opening the Self/RIC Rescue Windows
- Work Stress & Depth of Entry Concerns Are Kept in Check
- Local Needs Met

What The Change Should Do:

- Allow the Authority Having Jurisdiction (AHJ; i.e. the Fire Department) to specify an EOSTI >25%
- Allow the fire service to address its exit/escape time needs without increasing the work period
- Give the AHJ the ability to determine an appropriate EOSTI set point based upon local needs

What The Change Should Not Do:

- Require a change from the current EOSTI set point
- Give individual firefighters or departments the ability to adjust the EOSTI set point in the field
- Define an EOSTI set point beyond a minimum level



“Because of disorientation, firefighters frequently exceed their air supply in their efforts to evacuate these extremely dangerous structures”

-US FF Disorientation Study 1979-2001