MEETING OF THE  
TECHNICAL COMMITTEE ON  
RESPIRATORY PROTECTION EQUIPMENT  


March 26-28, 2012  
San Antonio, TX  

AGENDA  

Monday, March 26, 2012  
(9:00 a.m., continuing to the close of business Wednesday, March 28)  

1. Self-introduction of members and guests  
2. NFPA Staff Liaison Report – Dave Trebisacci  
3. Chairman’s Remarks – Chair Dan Rossos  
4. Approval of Minutes - Dec. 13-14, 2011, Fort Lauderdale, FL (attached)  
5. NIOSH Update  
6. UL913 Edition – TC Discussion  
7. Public and Committee Comments – NFPA 1852 (pub. comments to be sent separately)  
8. Public and Committee Comments – NFPA 1989 (pub. comments to be sent separately)  
9. Public and Committee Comments – NFPA 1981 (pub. comments to be sent separately)  
10. Old business  
11. New business – next meeting (Tentative dates July 18-19, 24-25 or 25-26)  
MINUTES OF THE MEETING
TECHNICAL COMMITTEE ON
RESPIRATORY PROTECTION EQUIPMENT
13-14 DECEMBER 2011
FT. LAUDERDALE, FL

AGENDA ITEMS 1-2; SELF-INTRODUCTION OF MEMBERS AND GUESTS, NFPA COMMITTEE PROCEDURAL STATEMENT AND STAFF LIAISON REPORT

Chairman Rossos called the Committee to order at 09:00 on 13 December 2011. Chairman Rossos welcomed Committee members and guests and asked them to introduce themselves. Staff Liaison David Trebisacci read the NFPA Committee Procedural Statement and asked attendees to sign in on the appropriate Member or Guest sign-in sheet. He reviewed the following: status of Committee documents, Fall 2012 cycle dates, the NFPA Research Foundation, legal issues, re-engineering the codes and standards process, and the TC document info pages on the NFPA web site.

Members Present:
Dan Rossos, Chairman Portland (OR) Fire & Rescue
Steven H. Weinstein, Secretary Honeywell Safety Products (rep. ISEA)
David Trebisacci, Staff Liaison NFPA
Chris Anaya California State Firefighters Association
David Bernzweig Columbus (OH) Firefighters
Rodney V. Colbert Fairfax County Fire & Rescue Department
Brian H. Cox Clovis Fire Department
Kenneth Pravetz Virginia Beach Fire Department
William Mundy FDNY
John Kuhn MSA
David Hodson Draeger Safety UK Ltd
Robert Sell Draeger Safety
Jerry Phifer Scott Safety
Beverly Gulledge Scott Safety
Stephen T. Miles NIOSH FFFIPP
Clint Kaller L.A. County Fire Department
Stephen Sanders Safety Equipment Institute
Clint Mayhue ISI
Ira Harkness U.S. Navy
Jason Allen Intertek
Orion Goe Luxfer Gas Cylinders
Robin Gainey International Association of Fire Fighters
John Jarboe Grace Industries, Inc.
AGENDA ITEM 3; CHAIRMAN’S REMARKS

Chairman Rossos reviewed the actions taken at the last TCC meeting, as follows:

1. The TCC directed the TC to consider interoperability of EBSS’s in the current cycle for NFPA 1981.
2. The TCC directed the TC to attempt to include the partitioning of NFPA 1981 in the current cycle.
3. The TCC directed the TC to consider addressing issues associated with alternate cylinder technology in the current cycle for NFPA 1981.

Chairman Rossos read a request for a Formal Interpretation (FI) submitted for NFPA 1989 regarding testing before the filter is changed when a Securus system has shut down the compressor. David Trebisacci will treat this as an informal interpretation and respond to the person who submitted the request for the FI with the TC’s position.

AGENDA ITEM 4; APPROVAL OF THE MEETING MINUTES, MISSOULA, MT; JULY, 2011

Chairman Rossos asked the TC to review the Minutes of the Missoula meeting.
MOTION BY CLINT KALLER, SECOND BY JACK JARBOE
To approve the Minutes of the 19-21 July 2011 meeting in Missoula, MT.

MOTION CARRIED.

AGENDA ITEM 5; NIOSH UPDATE

Jon Szalajda reported that NIOSH met with SEI to determine the process for certifying to NFPA 1984. A Federal Register notice should appear around February announcing the availability of the test procedures. Rulemaking is ongoing on the EOSTI changes. The EBSS policy change is going forward and should have Dr. John Howard’s approval in January. The official letter rescinding the old policy and stating the new policy should happen around February.

AGENDA ITEM 6; DISCUSSION—FACEPIECE LENSES—COMMITTEE PROPOSAL TO NFPA 1981

Facepiece Lens Task Group Chairman Chris Anaya reported that the TG made some minor changes to the Committee Proposal for the two new tests associated with facepiece lenses.

AGENDA ITEM 7; DISCUSSION—COMMUNICATIONS—COMMITTEE PROPOSAL TO NFPA 1981

Task Group Chairman Brian Cox introduced Luke Hollmann from USSI, who explained the STI test validation results that came from Embedded Acoustics (a Netherlands testing laboratory) and USSI.

The TG recommends that the C-weighting that is part of the Committee Proposal be changed to A-weighting, because the A-weighting more closely models how the human ear hears sounds. It also makes the test method consistent with other sound pressure level tests already included in NFPA 1981.

The TG recommends an STI pass/fail criterion of .55 for the Non-Electronic Communications Test.

MOTION BY BRIAN COX, SECOND BY CLINT KALLER
To change the STI pass/fail criterion for the Voice Communications System Test to .60 from the .50 specified in the Committee Proposal.

HAND VOTE
Yes: 13  No: 5  Abstain: 3

MOTION CARRIED.
MOTION BY BRIAN COX, SECOND BY CLINT KALLER
To change the STI pass/fail criterion for the Non-Electronic Communications Test to .55 from the .45 specified in the Committee Proposal and to change to A-weighting from the C-weighting specified in the Committee Proposal.

MOTION CARRIED.

AGENDA ITEM 8; DISCUSSION—BUDDY BREATHERS—COMMITTEE PROPOSAL TO NFPA 1981

Task Group Chairman Clint Kaller reported on the Task Group’s position on responding to the TCC’s note. The TC discussed the issues and reiterated its position taken during discussion at previous meetings, as follows:

- There are significant administrative and testing issues with NIOSH certification of interoperable buddy breathers. Each SCBA manufacturer would have to submit every other SCBA manufacturer’s SCBA with EBSS for certification. Every time a design change occurred with one of those EBSS’s every SCBA manufacturer would have to resubmit for testing.
- There may be significant technical issues to overcome. EBSS’s work off intermediate pressure (the pressure after reduction by the first stage pressure reducer). SCBA manufacturers have different intermediate pressure ranges that are not necessarily compatible with each other. It would be design restrictive to tell manufacturers that all second stage regulators must work off the same intermediate pressure range.
- The TC feels that the value added by having EBSS interoperability does not justify the complications created by the above two bullet points. RIC UAC fittings are standardized and can also be used to assist a firefighter who is out of air in a mutual aid scenario.
- While the TC is not prepared to address these issues at this time, the TC has agreed to continue discussing them for future revisions of the standard.

AGENDA ITEM 9; DISCUSSION—PROPOSED DIVISION OF NFPA 1981 (STRUCTURAL FIRE VS. EMERGENCY SERVICES)

Chairman Rossos led a discussion of how the TC should approach the development of an emergency services SCBA standard. He suggested that the TC submit a formal request to the Standards Council to develop a separate standard, rather than partitioning the current one.

MOTION BY RODNEY COLBERT, SECOND BY DAVID BERNZWEIG
To request the Standards Council to approve the development of a separate standard for SCBAs for non-firefighting emergency services.

MOTION CARRIED.
AGENDA ITEM 10; DISCUSSION—FLAT PACK—COMMITTEE PROPOSAL TO NFPA 1981

Chairman Rossos reviewed the TCC’s note to the TC to consider the 16 issues associated with the “flat pack” identified by the TC, as described in the Minutes of the Missoula TC meeting.

MOTION BY CLINT KALLER, SECOND BY DAVID BERNZWEIG
To amend 8.22.5.1 to include language that is not design-restrictive.

MOTION CARRIED.

MOTION BY DAVID HODSON, SECOND BY JERRY PHIFER
To create a Committee comment to change 8.22.5.1 to the following:
“The specimen, fitted with the SCBA manufacturer's breathing air cylinder and valve assembly, shall be fixed to the carrying assembly in accordance with the manufacturer’s end user instructions provided with the SCBA.”

MOTION CARRIED.

The TC felt that many of the other “flat pack” issues described in the Minutes of the Missoula TC meeting required new tests to be developed and validated which could not be completed within the time frame of the current cycle. The TC agreed that NFPA 1981 should not preclude new SCBA technology from being tested for certification to the standard and that the TC will continue to modify appropriate sections of the standard that could prevent such new technology from being tested and certified.

AGENDA ITEM 11; OTHER ISSUES/PROPOSALS

David Bernzweig read proposed language to revise NFPA 1989 to address the issue that led to the request for a Formal Interpretation. The TC will consider this language for a Committee Comment at the March TC meeting.

AGENDA ITEM 12; OLD BUSINESS

Steve Weinstein asked the TC to summarize the changes that need to be made to Section 6.1.10, as discussed at the Missoula TC meeting. Steve Weinstein will send the changes to Dave Trebisacci for inclusion in the Travel File to generate a Committee Comment at the March TC meeting.
AGENDA ITEM 13; NEW BUSINESS

The next TC meeting will be March 26-28, 2012 in San Antonio, TX.

Possible dates were discussed as follows for a July TC meeting: July 18-19, July 24-25 and July 25-26.

AGENDA ITEM 14; ADJOURNMENT

MOTION BY CLINT KALLER; SECOND BY RODNEY COLBERT
To adjourn.

MOTION CARRIED.

Chairman Rossos adjourned the meeting at 12.45 on 14 December 2011.

Respectfully submitted,

Steven H. Weinstein, Secretary
Technical Committee on Respiratory Protection Equipment
Report on Comments – November 2012

Final Action:

Submitter: Steven H. Weinstein, Honeywell Safety Products
Comment on Proposal No: N/A
Recommendation: Revise text to read as follows:

4.4 SCBA Compliance—Upgrades and Retirement.
4.4.1 SCBA that are currently in service shall be certified as compliant with at least one of the following standards:

4.4.2* Where currently-in-service SCBA do not meet the requirements of 4.4.1 and are covered by any of the following four categories, such SCBA shall be upgraded as specified in 4.4.3 or shall be retired as specified in 4.4.5:
(1) Currently-in-service SCBA that were not certified as compliant with the 1992 1997 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service, when the SCBA was manufactured.
(2) Currently-in-service SCBA that were not certified as compliant with the 1997 2002 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire and Emergency Services, when the SCBA was manufactured.
(3) Currently-in-service SCBA that were not certified as compliant with the 2002 2007 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Fire and Emergency Services, when the SCBA was manufactured.
(4) Currently-in-service SCBA that were not certified as compliant with the 2007 2013 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, when the SCBA was manufactured.

4.4.2.1 The provisions of 4.4.4 shall apply to SCBA that are not covered by any of the four categories specified in 4.4.2.

4.4.3* SCBA shall be permitted to be upgraded to be compliant with the 2007 2013 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, in accordance with the SCBA manufacturer’s and certification organization’s instructions.

4.4.4* Where currently-in-service SCBA do not meet the requirements of 4.4.1 and are covered by any of the following categories, such SCBA shall be retired as specified in 4.4.5:
(1) Currently-in-service SCBA that only met the requirements of NFPA 19B, Standard on Respiratory Protective Equipment for Firefighters, when the SCBA was manufactured.
(2) Currently-in-service SCBA that only met the requirements of the 1981 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters, when the SCBA was manufactured.
(3) Currently-in-service SCBA that only met the requirements of the 1987 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters, when the SCBA was manufactured.
(4) Currently-in-service SCBA that only met the requirements of the 1992 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters, when the SCBA was manufactured.
(5) Currently-in-service SCBA that were purchased prior to 29 July 1981 that did not meet the requirements of the 1971 edition of NFPA 19B, Standard on Respiratory Protective Equipment for Firefighters, when the SCBA was manufactured.
(6) Currently-in-service SCBA that were purchased after 29 July 1981 and prior to 30 June 1987 that did not meet the requirements of the 1981 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters, when the SCBA was manufactured.
(7) Currently-in-service SCBA that were purchased after 30 June 1987 and prior to 14 August 1992 that did not meet the requirements of the 1987 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters, when the SCBA was manufactured.
(8) Currently-in-service SCBA that were purchased after 14 August 1992 and prior to 15 August 1997 that did not meet the requirements of the 1992 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for
4.4.5 Retired SCBA shall be disposed of as specified in 4.7.1.

Substantiation: These revisions (1) contemporize the 4-revision service life requirements of the SCBA in 4.4.1 and 4.4.2 by replacing the 1992 edition of NFPA 1981 with the 1997 edition and adding the 2013 edition, (2) update the permissible upgrade requirements in 4.4.3 by replacing the 2007 edition of NFPA 1981 with the 2013 edition, and (3) update the retirement requirements in 4.4.4 to be in synchronization with the 4-revision service life requirements of 4.4.1 by adding SCBAS certified to the 1992 edition of NFPA 1981 and non-NFPA-compliant SCBAS purchased during the effectivity period of NFPA 1992 to the list of SCBAs that shall be retired.
8.25.3.3 Signal processing options that uses specific features of natural speech (for example: pitch, formant analysis, voice unvoiced) to enhance the speech intelligibility or the usability of VA systems should be disabled during the STI test.

Although The STI method takes speech features into account that are directly related to speech intelligibility, the STI test signal does not possess all features found in natural speech. Therefore, the STI test signal is not speech by nature but mainly based on modulated noise signals.

Advanced signal processing algorithms such as noise reduction, VOX, VAD, pitch manipulation etc. that make use of these specific speech features with the ultimate goal to improve the speech intelligibility or the usability of VA systems may become underestimated or even suppress the modulated noise signal yielding no STI output at all.

Any advanced signal processing option that uses specific features of natural speech should be disabled during STI tests.

An extensive list for situations in which STI should be used with care and possible workarounds can be found in IEC 60286-16 4th edition.

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2.3.6 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


Substantiation: The 7th edition of UL 913 is intended to align the standard with existing European and IEC intrinsic safety standards. The ultimate goal is to have a common set of rules in the future. The 7th edition was not released to address any safety issues with the 5th or 6th edition. It was released to bring global alignment of standards. Further, UL has pushed back the 7th edition compliance date to July 2016 due partly to concerns from industry in general and partly due to a concern over a lack of capacity of complete all reassessments on time.

The deleted dates actually (in error) reference the 7th edition.

Most importantly, however, a change to the 7th edition will require the complete replacement of the electronics on the SCBA, making upgrades from the 2007 to the 2012 edition impractical. Fire companies wishing to purchase cost effective upgrade kits will not be able to do so and will be required to purchase completely new SCBA which may not be compatible with their 2007 edition equipment.
Where the voice communications system is automatically activated, the operation of the on/off control shall override the auto activation of the voice communications system without affecting the performance of the SCBA. Other audio enhancements which impair the correct operation of the voice communication system during STI testing shall be disabled.

Operational benefits such as noise cancellation and similar advanced audio enhancements may not respond correctly during STI testing and shall be disabled if these features produce an incorrect STI score.

Modern mask communication systems take the advantage of Digital Signal Processing in means of voice enhancement and sophisticated VOX functions. These processing functions offer better sound quality, less transmitted noise, ease of use and of course: a higher speech intelligibility.

The upcoming standard NPFA 1981:2013 will require the Speech Transmission Index (STI) as an objective measuring tool to rank full face masks and VA systems with respect to the speech transmission quality, a number between 0 and 1. Although the STI method has been designed to mimic the spectral and temporal characteristics as found in natural speech, the STI test signal is in fact only a modulated noise carrier. The true nature of the STI method enables to measure how well modulations in the speech signal (due to phonemes, vowels, words) are preserved. These modulations are recognized as the most important carriers of the speech information. Preservation of the modulations is what is STI is all about.

Although the STI method acts as a good and objective predictor of the speech intelligibility, the STI signal itself isn’t speech at all but, as already mentioned, modulated noise. The fact that speech and the STI signal are different by nature will inherently give rise to problems for the more sophisticated VA systems that uses certain parameters derived from the speech signal itself to detect speech or to be able to improve the speech intelligibility. These systems will not ‘see’ the modulated noise signal as a speech signal and moreover will probably fully ignore it. One can compare this situation with a speech recognizer which will produce no reasonable output when it is ‘listening’ to noise.

Below are two major cases for VA systems described for which the STI method will either underestimate the speech intelligibility or even produce no output at all.

Voice and noise discrimination algorithms

Voice activation systems (VOX) were designed for freedom of operation, helping the user to initiate transmission etc. without button operation. The most advanced algorithms for mask applications do not transmit inhalation noise, only the speech signal itself. This transmission triggering is used to operate radio (PTT keying), but also to save power and enhance usability by not amplifying breathing noise. The STI test signal, which is a noise signal by nature, is not categorized as speech and will therefore not be amplified through a more sophisticated VA system.

Noise Reduction algorithms are generally looking for background noise, a steady state continuous signal that differs radically from speech. The noise reduction filters are designed to dynamically attenuate any signal that is also not similar to natural speech. Again, since the STI test signal matches the noise figure by design, it is being filtered and attenuated radically. Similar issues are found in communication systems using mobile phone (GSM) or speech coding technology.

Enhancement of the speech signal

Mask users can produce a large variation in their vocal effort. They may be either whispering or shouting as a result, level differences up to 30 dB will be encountered. Still the VA-systems must be capable of handling these level variations without overloading or clipping. Compressors, expanders and limiters are used to normalize the speech levels, prevent clipping of output signals and to maximize sound output of VA system for best speech intelligibility in noisy environments.

Also, howling control or feedback attenuation tries to find out the spectrum band that is being repeated, which in this case may be - unfortunately - the STI test signal. Pitch shifting (used in the older days to reduce howling) will have no effect on the speech intelligibility but a huge effect on the STI.

All of these algorithms are non-linear processing of sound, and can have a profound effect on the STI output. Some effect will be underestimated but some may unfairly result in an STI-value close to 0. A more extensive list of signal processing features for which STI should not be used can be found in section 4.5 Limitations of the STI method, IEC 60286-16 Ed. 4 (2011).
**Suggestion and conclusion**

Although STI is a powerful and reliable tool to measure the speech transmission index and predict the speech intelligibility, the method should be applied with care and with certain restrictions. Since the STI signal is not a speech signal but modulated noise, there is a potential danger that signal processing techniques are optimized towards the STI and that more sophisticated signal processing algorithms will remain unnoticed or may eventually fail in an STI test.

The easiest way of conducting STI measurements with mask equipped with signal processing features is to allow a measurement mode where the algorithms interfering with STI signals are switched off during measurements. This mode can be in a way standardized, both set of allowed algorithms being turned off but also entering the measurement mode.

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**Submitter:** David Hodson, Draeger Safety UK Ltd.  
**Comment on Proposal No:** 1981-25  
**Recommendation:** Revise text to read as follows:

8.1.4.8.1 During breathing tests conducted at temperature below freezing A air exhaled thru the headform shall be conditioned to an average temperature of 80 ±10 degrees F (27±6 degrees C) when measured at the breathing passage outlet at the mouth of the test headform.

**Substantiation:** The use of hot air to simulate a more life like internal mask condition is most relevant at low temperatures. Performing exhalation heating only during low temperature is most beneficial to simulate operational use.

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**Submitter:** David Hodson, Draeger Safety UK Ltd.  
**Comment on Proposal No:** N/A  
**Recommendation:** Revise text to read as follows:

8.1.4.9 The breathing machine shown in Figure 8.1.4.9 or equivalent shall be used.

**Substantiation:** Current wording is specific to a breathing machine from a single supplier and is design restrictive. Performance is defined as part of the breathing cycle parameters and alternate technical methods of producing the correct breathing cycle are now available e.g. stepping motor and ball lead screw devices with flexible bellows. Equivalent allows for alternate designs which can fulfill the desired performance. Section 8.1.4.1 uses the same words for the test head form.

This is not original material; its reference/source is as follows: Current standard.
This test method shall apply to each electronic device of the SCBA required to meet the mandatory design requirements of Chapter 6.

8.24 Heat and Immersion Leakage Tests.

8.24.1 Application. This test method shall apply to each electronic device of the SCBA required to meet the mandatory design requirements of Chapter 6.

8.24.2 Samples.

8.24.2.1 Each. The sample to be tested shall be as specified in Section 4.3.9.

8.24.2.2 Samples for conditioning shall be complete SCBA, percent.

8.24.3.2 The two specimens shall be tested after conditioning within an oven specified in Section 8.24.4 at 177°C, +5°C/-0°C (350°F, +10°F/-0°F) for 15 minutes.

8.24.5.6 The on one of the two specimens, all electronic components shall be operated in accordance with the manufacturer's instructions for normal use to determine the proper functioning.

8.24.5.7 The specimen shall then be re-immersed in the test water container for an additional 5 minutes. The power source compartment(s) shall be open, and the power source shall not be installed.

Substantiation: This performance test now follows the same test conditions as NFPA 1982 PASS. It allows for all testing and performance requirements are completed on a single unit as per 1982 ensuring the product must pass all tests.

This is not original material; its reference/source is as follows:
Current standard.

8.29.4.5.3

The protective hood shall not cover or protect any part of the facepiece or the facepiece retention system that holds the facepiece to the headform.

The protective hood shall cover the facepiece retention system that holds the facepiece to the headform, but not cover or protect any part of the facepiece lens.

Substantiation: Fire fighters wear hoods (as required during radiant testing) and this would simulate more closely actual wearing.

It may even be more relevant to suggest a helmet but there are many types in the market so which one? Also a helmet could be dislodged unlike a hood.
1981- Log #9 FAE-RPE

Final Action:

Submitter: John Gardell, City of Pittsburgh Bureau of Fire
Comment on Proposal No: 1981-11

Recommendation: Revise text to read as follows:

2.3.6 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


Substantiation: In 2010 the City of Pittsburgh Bureau of Fire received a grant that enabled us to replace our 15 year old SCBA. As with many cities, Pittsburgh has severe financial problems and without the grant of about $950K we would not have been able to buy SCBA and comply with NFPA 1981, 2007 Edition. Now that we have current SCBA it is our intention to stay current to the NFPA 1981 standard. However, after talking to our SCBA manufacturer I understand the cost to upgrade to the next edition of the standard will potentially be so high we will not be able to do that.

From what I understand adopting UL 913 7th Edition Section 2.3.6 from Log #9 will require all current FireHawk M7 users to replace most, if not all electronics on the SCBA to upgrade to the NFPA 1981, 2013 Edition if this is adopted into the standard. This will most likely raise the price of upgrading to nearly the same price as new SCBA and will prohibit us from staying current to the latest NFPA standard.

I also understand that UL 913 7th Edition Section 2.3.6 will not bring any significant enhancement to firefighter safety. I know of many urban fire departments that will be in the same situation and if they knew about this proposed change they would also vigorously oppose this addition to the NFPA 1981 standard.

Our issue is that this change will have minimal enhancements to the safety of firefighters, and the cost association will prevent future upgrades that may greatly increase firefighter safety. Please do not allow this change. It will do harm to many fire departments around the country that are already struggling to provide equipment to keep firefighters safe.

Thank you.
John Gardell, City of Pittsburgh Bureau of Fire

As a firefighter with the City of Pittsburgh Bureau of Fire, an officer in the IAFF Local 1, fire instructor, and member of the Health and Safety Committee, I opposed the proposed change in the NFPA 1981, 2013 Edition SCBA standard to change the low air alarm back to 25% from the 33% proposed. Generations of firefighters have been trained that the low pressure alarm sounds at 25% of the air supply. This is a long standing and well known fact and all current training materials and courses reinforce this.

Changing to 33% on new SCBA will cause a tremendous amount of confusion in departments with SCBA complying with different versions of the SCBA standard. Many fire departments buy a few new SCBA every year. In this case departments will have to buy non-compliant SCBA to keep their low alarm activation points standardized or risk having different alarm activation points in their fleet of SCBA.

In addition this would cause confusion in mutual aid situation where different responding departments could have varying alarm activation points depending on what NFPA 1981 edition SCBA they have.

And while we train against this and certainly don't condone it, the fact remains that some firefighters will stay in IDLH conditions after the low pressure alarm sounds knowing from experience they have a certain amount of escape time. By changing to a 33% low air alarm more people will ignore the low air alarm and stay in longer knowing they have even more escape time. Again, we do not condone or practice this but this change will most certainly provide incentive to ignore the low air alarm and put firefighters at risk.

There is an old saying, "If it ain't broke, don't fix it". There is also the Law of Unintended Consequences that could apply here. While the motivation behind this change is probably to increase firefighter safety, I believe the unintended consequence will have the opposite effect.

Additionally, I would question as to what analysis either quantitative or qualitative has been accomplished to validate the increase to 33%. What evidence is there to say that 8% will increase firefighter safety? What data has been collected that substantiates that the three to four more minutes will ensure a firefighter will be out of the IDLH. I believe this change does not address the root causes behind poor air management. I feel that this committee should share their concerns with a more appropriate committee. The safety measures should be addressed in standards reflecting incident management, incident safety, and education.

Please do not adopt this change. Thank you.
**Revise text to read as follows:**

When Performing Section 8.2.5.5.2 of Environmental Temperature Test, Air exhaled thru the headform shall be conditioned to an average temperature of 80±10 degrees F / 27±6 Degrees C when measured at the breathing passage outlet at the mouth of the test headform.

******Insert Figure 8.1.4.8.1 Here******

**Substantiation:** By making the breathing simulator better replicate human respiration the test will better reflect the performance of the respirator in actual use. The mechanical breathing simulator significantly differs from actual measured respiration temperatures due to natural heat exchange in the human respiratory tract. This addition will allow the breathing simulator to better replicate actual human use.

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**Revise text to read as follows:**

When Performing Section 8.2.5.5.2 of Environmental Temperature Test and Section 8.27.5.5 of Emergency Breathing Safety System Cold Temperature Performance Test, Air exhaled thru the headform shall be conditioned to an average temperature of 80±10 degrees F / 27±6 Degrees C when measured at the breathing passage outlet at the mouth of the test headform.

******Insert Figure 8.1.4.8.1 Here******

**Substantiation:** By making the breathing simulator better replicate human respiration the test will better reflect the performance of the respirator in actual use. The mechanical breathing simulator significantly differs from actual measured respiration temperatures due to natural heat exchange in the human respiratory tract. This addition will allow the breathing simulator to better replicate actual human use.

See Page 2 for Figure 8.1.4.8.1.
**Report on Comments – November 2012**

1981- Log #13 FAE-RPE
(8.28.4.4) Final Action:

**Submitter:** Jason L. Allen, Intertek Testing Services

**Comment on Proposal No:** 1981-23

**Recommendation:** Revise text to read as follows:

8.28.4.4 The radiant heat test apparatus panel shall be as specified in ASTM E162 Standard Test method for Surface Flammability of Materials Using a Radiant Heat Energy Source, Section 6.1.1 and Figure 1, without the inclusion of the Sheet Steel Stack.

**Substantiation:** Specifying the Apparatus could imply more of the ASTM E162 set-up than intended.

1981- Log #14 FAE-RPE
(8.3.4.2.3) Final Action:

**Submitter:** Jason L. Allen, Intertek Testing Services

**Comment on Proposal No:** 1981-26

**Recommendation:** Revise text to read as follows:

8.3.4.2.3 If a different geometry of pressure vessels are used compared to the standard industry cylinder construction, the compartments shall be designed to accommodate the size and shape of the different pressure vessel, allowing a clearance of 150 mm±25/-0 mm (6 in. ±1/-0 in) between the top to bottom length and width of the pressure vessel and all sides of the compartment.

**Substantiation:** Previous text needed clarification on which dimension the clearance was need on. Additionally a tolerance to this clearance was added.

1981- Log #15 FAE-RPE
(8.11.5.7) Final Action:

**Submitter:** Jason L. Allen, Intertek Testing Services

**Comment on Proposal No:** N/A

**Recommendation:** Revise text to read as follows:

8.11.5.7 The ventilation rate shall be set at 40L/min, +/-2L/min with a respiratory frequency of 12 to 24 breaths/min, +/- 1 breath/min at ambient conditions as specified in Section 8.1.3.2.

**Substantiation:** The above respiratory rate was an error that contradicts Table 8.1.4.10(b). This change will align the two.
1981- Log #16  FAE-RPE

Final Action:

**Submitter:** Steven H. Weinstein, Honeywell Safety Products

**Comment on Proposal No:** 1981-13

**Recommendation:** Revise text to read as follows:

2.3.6 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


**Substantiation:** After the TC on RPE accepted in principle Proposal #1981-13 in the ROP, some events have occurred which call into question the merit of the proposal. UL has decided not to implement the 7th edition of ANSI/UL 913 until 2016 for intrinsic safety certifications it performs for its own customers. They are still using the 5th edition. There has been some talk that UL implementation of the 7th edition of ANSI/UL 913 for its own certifications could be delayed further, or that the 7th edition could even be withdrawn at some point. They have received pushback from their customers who do not feel certification to the 7th edition is in everyone's best interests. The goal is eventually to have harmonization of European and U.S. intrinsic safety standards, and the 7th edition of ANSI/UL 913 will not accomplish that. My proposal is to revert back to the 6th edition of ANSI/UL 913 for NFPA 1981, since it has been used for many years; has proven to be reliable standard; and does not introduce new, possibly controversial variables whose repercussions are not yet fully understood. If UL itself is not using the 7th edition of ANSI/UL 913, I do not think NFPA 1981 should be specifying it.

1981- Log #17  FAE-RPE

Final Action:

**Submitter:** Henry A. Fonzi, III, Mine Safety Appliance Company

**Comment on Proposal No:** 1981-25

**Recommendation:** Delete the following text:

8.1.4.8.1 Air exhaled thru the headform shall be conditioned to an average temperature of 80+/-10 degrees F / 27+/-12 Degrees C when measured at the breathing passage outlet at the mouth of the test headform.

**Substantiation:** In 1987, the NFPA 1981 committee developed conditioned testing for self-contained breathing apparatus (SCBA). This included room, elevated and cold temperature tests. These tests have remained unchanged for over 24 years. The public comment was accepted in principle without further plans to verify the feasibility of the test. MSA attempted to duplicate the new requirement and was unable to raise the temperature to 80+/-10 degrees F without interfering with the breathing trace and performance of the test equipment. Intertek was contacted to understand their test setup. They indicated they were also unable to adequately heat the air without causing issues conducting the test. To date, it is unclear whether this test is feasible as specified.

Furthermore, there is no benefit to the firefighter to change the test parameters. If anything, this change will make it less stringent therefore easier for some manufacturers to pass the requirements.

Based on these facts, it is strongly recommended that we remove any changes to the cold temperature testing.
8.28.5.9  The airflow performance test shall begin no longer than 30 s before the SCBA facepiece is exposed to the radiant heat apparatus and shall continue for a total duration of 15 min no less than 80% of the NIOSH-rated duration of the cylinder used.

Substantiation: The 15 min. time duration in 8.28.5.9 conflicts with the duration requirement set forth in 7.21.2.

8.29.5.6  The airflow performance test shall begin no longer than 60 s before the SCBA and mannequin are placed into the oven with the door closed and shall continue for a total duration of 24 min no less than 80% of the NIOSH-rated duration of the cylinder used.

Substantiation: The 24 min. time duration in 8.29.5.6 conflicts with the duration requirement set forth in 7.22.2.
7.20.1 The donor and receiving each SCBA shall be tested independently for airflow performance as specified in Section 8.1, Airflow Performance Test.

8.27 Emergency Breathing Safety System Cold Temperature Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 mm (0.0 in.) water column and shall not be greater than 89 mm (3½ in.) water column above ambient pressure from the time the test begins until the time the test is concluded.

8.27.5.1 The variation in pressure extremes caused by the cold temperature performance test configuration shall be determined as specified in 8.27.5.1.X in the following manner. The airflow performance test as specified in Section 8.1, Airflow Performance Test, shall be carried out using the configuration specified in 8.2.4 at the 103 L/min, ±3 L/min ventilation rate. The difference in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.4 from the values obtained using the configuration specified in Section 8.1, Airflow Performance Test.

8.27.5.1.X For the receiving SCBA, the airflow performance test as specified in Section 8.1, Airflow Performance Test, shall be carried out using the configuration specified in 8.2.4 with a ventilation rate set at 103 L/min, ±3 L/min. The difference in pressure in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.4 from the values obtained using the configuration specified in Section 8.1, Airflow Performance Test.

8.27.5.1.X For the donor SCBA, the airflow performance test as specified in Section 8.1, Airflow Performance Test, shall be carried out using the configuration specified in 8.2.4 with a ventilation rate set at 40 L/min, ±1 L/min. The difference in pressure in pressure between the two tests shall be calculated by subtracting the values obtained using the configuration defined in 8.2.4 from the values obtained using the configuration specified in Section 8.1, Airflow Performance Test.

8.27.5.1.1 The breathing machine for the donor SCBA and for the receiving SCBA shall be such that they initially operate out of phase of each other. At least twice during the test duration the breathing machines must operate in phase with each other.

8.27.5.2 For the receiving SCBA, the facepiece pressure during each entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.25.1.X to determine pass or fail as specified in 7.2.1.1.

8.27.5.X For the donor SCBA, the facepiece pressure during each entire test shall be read from the strip chart recorder and corrected by adding the value of the difference in pressure calculated in 8.27.5.1.X to determine pass or fail as specified in 7.2.1.1.

8.27.5.3 The dwell period between cold temperature tests shall be used for refilling the breathing air cylinder and visually inspecting the SCBA for any gross damage that could cause unsafe test conditions.

8.27.5.4 The receiving and donor SCBA shall be cold soaked at -32°C, ±1°C (−25°F, ±2°F) for a minimum of 12 hours.

8.27.5.5 The receiving SCBA shall then be tested for airflow performance as specified in Section 8.1, Airflow Performance Test, with a ventilation rate set at 103 L/min, ±3 L/min, at a chamber air temperature of -32°C, ±5°C (-25°F, ±10°F).

8.27.5.5.1 For the EBSS cold temperature performance test the airflow performance test shall begin after five cycles of the breathing machine and shall continue to operate through at least 36 bar (520 psi) of the donor SCBA cylinder inlet pressure.

8.27.5.X The donor SCBA shall then be tested for airflow performance as specified in Section 8.1, Airflow Performance Test, with a ventilation rate set at 40 L/min, ±1 L/min, at a chamber air temperature of -32°C, ±5°C (-25°F, ±10°F).

8.27.5.X.X For the EBSS cold temperature performance test the airflow performance test shall begin after five cycles of the breathing machine and shall continue to operate through at least 36 bar (520 psi) of the donor SCBA cylinder inlet pressure.

Substantiation: The proposed standard specifies that the donor SCBA and receiving SCBA are breathing at equivalent breathing rates of 103 L/min +/- 3 L/min. The proposed standard specifies that the breathing machines initially operate out of phase of each other and that they operate in phase with each other at least twice during the test duration. As it is currently written, the test method does not provide a repeatable test method. The breathing machine breathing...
frequency tolerances are such that it is not possible to predictably control in phase and out of phase respirations. The two breathing machines may operate out of phase with each other during the entire test. Alternately, the two breathing machines may operate in phase with each other for a significant portion of the test.

It is recommended that the breathing machines operate at different frequencies. Specifically, it is recommended that the donor SCBA operate at a 24 breaths per minute frequency and that the receiving SCBA operate at 30 breaths per minute frequency. These frequencies are consistent with the current NFPA 40 liters per minute and 103 liters per minute breathing rates. It is recommended that the receiving SCBA operate at the higher breathing rate to correlate to an emergency situation when the receiving SCBA user is low on air and under stress.

When the donor and receiving SCBA breathing machines operate at different frequencies, the breathing machine test will produce a more consistent test with respect to the frequency of when the breathing machines operate in phase and out of phase with each other.

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**Submitter:** Robert Sell, Draeger Safety, Inc.

**Recommendation:** Add Appendix information for 1.3.1.1: Prior to the NFPA 1981-2013 Edition, NIOSH/NPPTL policy did not permit the use of an emergency escape support breathing system or “Buddy Breathing” but investigations by the Task Group assigned by the Respiratory Protection Equipment (RPE) Technical Committee found that these type of devices are being used and trained on by the Fire Service and have been successfully used. The Technical Committee approached NIOSH/NPPTL on this topic and NIOSH/NPPTL opened Docket #147 to obtain input and comments from all interested parties and based upon the input received NIOSH/NPPTL has changed their policy based upon the current technology that exists to prevent two users from being contaminated by the Immediately Dangerous to Life and Health atmospheres encountered. The RPE Technical Committee created performance requirements Emergency Breathing Support Systems (EBSS) to ensure continued compliance with the standard when the EBSS is being used.

It must be understood that the duration of the SCBA air supply is dependent on the volume of air in the cylinder and that the use of the EBSS will reduce the duration of the air supply from the cylinder. In addition, the Organization Having Jurisdiction needs to develop the Standard Operating Procedures and training requirements to ensure that the EBSS is properly used.

**Substantiation:** In the “Origin and Development of NFPA 1981” section at the beginning of the current edition of the NFPA 1981 standard discusses the use of “buddy breathing” as being prohibited by NIOSH and with the implementation of the EBSS this now needs to be addressed.

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**Submitter:** Robert Sell, Draeger Safety, Inc.

**Recommendation:** Revise text to read as follows:

7.22.2 The duration of the test as specified in 8.29 shall be no less than 80% of the NIOSH-rated duration 30 minutes regardless of the cylinder used.

**Substantiation:** During the development of the convection lens heat and flame resistance test it was always discussed that this test method was to determine the survivability of the user in the event of a lens failure due to high convective heat and heat and flame exposure. Based upon development tests performed, once the primary test conditions have been completed (high convective heat and heat and flame exposure has been removed and the SCBA has been dropped freely) and if the SCBA has not experienced a catastrophic failure or major lens defects then the duration, regardless of rated cylinder duration, will meet the 80% requirement. Since the user needs to be exiting the area because of a SCBA issue 24 minutes should be sufficient time for an egress. In addition, just utilizing a 30 minute test period testing time can be reduced.
**Revise text as follows:**

### 8.29.5.14

The SCBA shall be observed for any afterflame, and the afterflame shall be extinguished with multiple spray-type devices using room temperature water.

**Substantiation:** During development tests performed by Draeger it was found that this can be a very busy time once the flames have been removed. The use of multiple devices/personnel would be able to extinguish the flames in a timely manner.

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**Revise text to read as follows:**

Add Section 8.28.4.3.2.1: The protective hood, once placed on the test headform, shall be wetted with water.

**Substantiation:** During development tests performed by Draeger it was found that the protective hood would begin to char and then burn at locations closer to the panel as compared to the specified distance for the lens before the conclusion of the 5 minute radiant panel exposure and this affects the performance of the facepiece during the test. Allowing water to be added to the hood does begin to help eliminate this issue.

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**Revise text to read as follows:**

Add Section 8.28.5.4.4: During the conduct of the test, water from a spray type device shall be applied when charring or burning of the protective hood begins to occur.

**Substantiation:** During development tests performed by Draeger it was found that the protective hood would begin to char and then burn at locations closer to the panel as compared to the specified distance for the lens before the conclusion of the 5 minute radiant panel exposure and this affects the performance of the facepiece during the test. Allowing water to be added to the hood does begin to help eliminate this issue.
7.21.2 The duration of the test as specified in 8.28 will be no less than 80% of the NIOSH-rated duration regardless of the cylinder used.

During the development of the radiant heat test it was always discussed that this test method was to determine the survivability of the user in the event of a lens failure due to high radiant heat. Based upon development tests performed, once the primary test conditions have been completed (radiant heat has been removed and the SCBA has been dropped freely) and if the SCBA has not experienced a catastrophic failure or major lens defects then the duration, regardless of rated cylinder duration, will meet the 80% requirement. Since the user needs to be exiting the area because of a SCBA issue 24 minutes should be sufficient time for an egress. In addition, just utilizing a 30 minute test period testing time can be reduced.
1981-     Log #27  FAE-RPE  Final Action:
(2.3.9, Chapter 3 Various Definitions, 4.3.9, 6.1, 7.10, 7.17, Chapter 8, and Annex A)

Submitter: Judge Morgan, SCOTT Safety
Comment on Proposal No:  1981-10
Recommendation:  Revise text to read as follows:

Chapter 2  Referenced Publications

2.3.9 IEC Publications. International Electrotechnical Commission, 3, rue de Varembé P.O. Box 131, 1211 Geneva 20, Switzerland

Chapter 3  Definitions

3.3.1 (HATS) Head and Torso Simulator = A mannequin with built-in ear and mouth simulators that provides a realistic reproduction of the acoustic properties of an average adult human head and torso.
3.3.2 (STI) Speech Transmission Index = A measure of intelligibility of speech quality on a scale of intelligibility whose values varies from 0 = completely unintelligible to 1 = perfect intelligibility.
3.3.3 (SPL) Sound Pressure Level = The local pressure deviation from the ambient (average, or equilibrium) atmospheric pressure caused by a sound wave.
3.3.4 (MRP) Mouth Reference Point = A point 50 mm in front of and on the axis of the lip position of a typical human mouth (or artificial mouth)
3.3.5 (MMP) Microphone Measurement Point = A point 1.5 m in front of and on the axis of the lip position of typical human mouth (or artificial mouth) and 1.5 m above the floor

Chapter 4  Certification

4.3.9 SCBA and SCBA components shall be subjected to the tests specified in Table 4.3.9 for each series.

Chapter 6.1  General Design Requirements

6.1.10 All SCBA shall have a voice communications system that, at a minimum, shall consist of a mechanical speaking diaphragm.
6.1.10.1 The voice communications system shall be designed to project sound without other persons needing a receiver to hear the voice communications.
6.1.10.2 Where the voice communications system uses electronics, the design shall incorporate an indicator that the system is “on”. This indicator shall be permitted to be positioned outside the user's field of vision with the SCBA facepiece properly donned.
6.1.10.3 Where the voice communications system uses electronics, the power source shall display a visual alert signal indicating low power capacity.
6.1.10.4 Where the voice communications system uses electronics, the voice communications system shall be designed to be switched off and on manually without the performance of the SCBA being affected.
6.1.10.5 Where the voice communications system is automatically activated, the operation of the on/off control shall override the auto activation of the voice communications system without affecting the performance of the SCBA.
6.1.10.6 Where the voice communications system uses electronics, the voice communications system shall be permitted to be equipped with an adjustable volume (gain) control.

Chapter 7 Performance Requirements

7.10 Non-Electronic Communications Performance Requirements, The SCBA voice communications system shall be tested for communications performance as specified in Section 8.10, Non-Electronic Communications Performance, and shall have a Speech Transmission Index (STI) value of not less than 0.55.
7.17 Supplementary Voice Communications System Performance Requirements. The SCBA voice communications system, as identified by the SCBA manufacturer, shall be tested for communication performance as specified in Section 8.25, Supplementary Voice Communications System Performance, and shall have a Speech Transmission Index (STI) value of not less than 0.60.

8.10 Non-Electronic Communications Performance Test.
8.10.1 Application. This test method shall apply to complete SCBA facepiece(s) and second stage regulator(s).
8.10.2 Samples. Each sample to be tested shall be as specified in Section 4.3.9 with all voice communications systems installed, including supplementary voice communications systems, and in the “off” mode per manufacturer instructions.

8.10.3 Specimen Preparation.

8.10.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.10.3.2 Specimens for conditioning shall be complete medium size SCBA facepiece(s) and inner mask(s) with the second stage regulator(s) installed in the as worn position as specified by the manufacturer.

8.10.4 Apparatus.

8.10.4.1 Testing shall be conducted in a chamber having the following minimum characteristics:

1) Room dimensions: 3.6 m long × 3.0 m wide × 3.0 m high (12 ft long × 10 ft wide × 10 ft high) with a minimum volume of 32.4 m³ (1200 ft³).
2) Construction: Hemi-anechoic
3) Ambient noise level inside chamber: <40 dBA/<55 dBC
4) Walls and ceiling: = ≥90% absorptive for 100 Hz<f<1000 Hz

8.10.4.1.1 All surfaces above the floor acoustically treated for internal acoustic absorption, as well as for external noise mitigation.

8.10.4.2 A (G.R.A.S. K.E.M.A.R. Head and Torso Simulator (HATS) model 45BM) shall be used for testing.

8.10.4.2.1 The mouth simulator shall be capable of producing 112 dB/1 kHz sine tone at 25 mm (1 inch) with the mouth reference point un-equalized and the total harmonic distortion (THD) shall be ≤3%.

8.10.4.2.2 The mouth simulator frequency response shall be able to be equalized flat ± 1 dB between 100 Hz and 10 kHz and the response shall be -15 dB or less at 100 Hz and -20 dB or less at 15 kHz.

8.10.4.3 The sound pressure level (SPL) meter having the following characteristics shall be used:

1) The SPL meter shall be capable of applying an equivalent continuous sound pressure level (Leq) of using an A weighting filter.
2) The SPL meter shall have a dynamic range from 30 dB (or less) to 130 dB (or more).
3) The SPL meter shall display the measurement to at least one decimal place.

8.10.4.4 The signal/pink noise analog audio signal generators having the following characteristics shall be used:

8.10.4.4.1 One generator shall be capable of playing wave files in the following format:

1) 48 kHz, 16-bit mono at the output level of 0 dB, FS=18 dBu since according to EBU R68

8.10.4.4.2 The second generator shall be capable of generating pink noise and sine waves from -80 dBu to -2 dBu in one digit steps with a THD+N of -90 dB (0.0032%) at 8 dBu noise floor typ 25uv.

1) The frequency range shall be 10 Hz to 20 Hz in 1 digit steps ±0.01%.
2) The amplitude accuracy shall be within ±0.5 dB or less.

8.10.4.5 The digital equalizer having the following characteristics shall be used:

1) The digital equalizer shall be capable of at least two concurrently selectable equalizer sections:
   a. One-31 band graphic with an adjustment range of at least ±18 dB.
   b. A Ten band parametric with an adjustment range of at least ±18 dB.
2) The digital equalizer shall have a dynamic range of >112 dB.
3) The digital equalizer shall be capable of equalizing the frequency response of the HATS mannequin of:
   a. ±1 dB flat between 100 Hz and 10 kHz,
   b. applying a 180 Hz high pass filter with a slope of -24 dB octave,
   c. and a 10 Hz low pass filter with a slope of -24 dB octave (-15 dB at 100 Hz – 20 dB at 15 kHz).

8.10.4.6 A powered speaker having the following characteristics shall be used:

1) A sensitivity of ≥84 dB at one watt at 1 meter.
2) The frequency response shall be rated at ≤80 Hz to ≥13 kHz.
3) The amplifier shall deliver ≥10 watts with a total harmonic distortion <1%.

8.10.4.7 A microphone having the following characteristics shall be used:

1) The microphone shall be a condenser type.
2) The microphone polar pattern shall be omni-directional.
3) The frequency response shall be flat ±0.5 dB from 100 Hz to 15 kHz.
4) The residual noise shall be ≤-30 dB.
5) The microphone shall accept signals of at least 130 dBA.

8.10.4.8 A Speech Transmission Index (STI) analyzer having the following characteristics shall be used:

1) The STI PA analyzer shall be capable of measuring and displaying a single value STI PA result to two decimal places with a 7 octave band modulated noise test signal using the Netherlands Organization for Applied Scientific Research (TNO) verified algorithm.

8.10.4.9 All of the apparatus identified in Sections 8.4.10.4.2, 8.10.4.3, 8.10.4.4, 8.10.4.5, and 8.10.4.6 shall be located in the hemi-anechoic chamber and arranged as shown in Figure 8.10.4.9(a) and 8.10.4.9(b).

*****Insert Figure 8.10.4.9(a) Here*****

*****Insert Figure 8.10.4.9(b) Here*****

8.10.4.10 The HATS test mannequin shall be positioned in the chamber in the following manner: Refer to Figure 8.10.4.9(a) and 8.10.4.9(b).

8.10.4.10.1 The distance between the HATS test mannequin and the microphone shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in), and they shall be facing each other.

8.10.4.10.2 The distance between the HATS test mannequin MRP and the floor shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in).

8.10.4.10.3 The distance between the microphone and the floor shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in).

8.10.4.11 The test chamber shall be filled with broadband “pink” noise with a tolerance of +/- 1(db) per octave band from 100 Hz to 10 kHz.

8.10.4.12 The pink noise speaker shall be placed directly beneath the microphone and oriented such that the central axis of the speaker cone is directly facing the microphone.

8.10.4.12.1 The speaker shall be situated on top of a block of isolating acoustic foam such that no part of speaker box is contacting the floor or microphone stand to prevent conduction of sound to the microphone.

8.10.4.12.2 The height of the speaker off the floor shall be at least 0.125 m (5 in), as measured from the bottom of the speaker box, and the distance between the speaker and microphone shall be no less than 1 m (40 in) , as measured from the top of the speaker grille/enclosure.

Note: Any changes made to the pink noise speaker configuration require re-calibration of the pink noise spectrum per Section 8.10.4.13.

8.10.4.12.3 Refer to Figure 8.10.4.12 for reference in placing the pink noise speaker.

*****Insert Figure 8.10.4.12 Here*****

8.10.4.13 The pink noise speaker shall be fully equalized flat, from 100 Hz to 10 kHz, to within +/- 1 db on a relative scale in 1/3 octave bands as measured at the microphone position.

8.10.4.14 The STI test signal from the mannequin shall be adjusted to achieve an A weighted sound level of 97 dB, +/- 0.5 dB at the mouth reference point (MRP), 50 mm ± 3 mm (2 in ± 1/8 in) from the test mannequin’s mouth.

8.10.4.14.1 The microphone used for calibrating STI signal shall be omni-directional and oriented in a horizontal front facing manner.

8.10.4.14.2 The STI signal shall be equalized flat to within +/- 1 db on a relative scale in 1/3 octave bands as measured at the mouth reference point of the HATS.

8.10.4.14.3 HATS Calibration
1) Equalize flat with pink noise @ 97 dBA from 100 Hz – 10kHz to +/- 1 db on a 1/3 octave scale
2) Reduce the levels for the 125 Hz octave band (the 100, 125, 160 1/3 octave bands) by 10 dB
3) Reduce the levels for the 250 Hz octave band (the 200, 250, 315 1/3 octave bands) by 2 dB
4) Apply STIPA signal and adjust Sound Pressure Level (SPL) to 97 ± 0.5 dBA

8.10.4.15 The gain of the powered speaker amplifier used to generate the pink noise shall be adjusted to achieve an A-weighted sound level of 15 dBA ± 0.5 dB below the signal level generated as identified in Section 8.10.4.14 measured at the microphone placed as identified in Sections 8.10.4.10.1 and 8.10.4.10.3.

8.10.5 Procedure.
8.10.5.1 The method for measuring speech transmission index shall be as specified in IEC 60268-16:2003, Sound System Equipment – Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index, with the modified apparatus specified in Section 8.10.4.
The medium size facepiece with inner mask and second stage regulator in the normal use mode shall be fitted to the HATS test mannequin in the following manner:

1) Place the chin of the mannequin in the “chin cup” of the facepiece.
2) Place the facepiece to seal against the face of the HATS test mannequin.
3) The head harness of the facepiece shall be passed over the HATS test mannequin and tightened in a manner that maintains the symmetry of the facepiece on the HATS test mannequin with talc to minimize friction between the HATS test mannequin and strap.
4) The straps shall be tightened to a tension of 50 N (11.2 lbf).

Three medium size facepieces shall be tested in the chamber having an ambient noise field as specified in Sections 8.10.4.11 through 8.10.4.15. Each facepiece shall be mounted as specified in Section 8.10.5.2 and the tested as follows

1) Three separate measurements shall be recorded for each donning of the facepiece.
2) Five separate donnings shall be performed.
3) Total of 45 measurements
   i. 3 (facepieces) × 3 (measurements) × 5 (donnings) = 45 measurements

8.10.6 Report.

8.10.6.1 Record and report the STIPA signal Sound Pressure Level per octave band, the Modulation Transfer Index per octave band, and overall STI score at the Mouth Reference Point described in Section 3.3.x.

8.10.6.1.1 A minimum of one STIPA signal recorded per Section 8.10.6.1 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental STIPA recording at MRP shall be collected.

8.10.6.2 Record and report the STIPA signal Sound Pressure Level per octave band, the Modulation Transfer Index per octave band, and overall STI score at the Microphone Measurement Point described in Section 3.3.5.

8.10.6.2.1 A minimum of one STIPA signal recorded per Section 8.10.6.2 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental STIPA recording at Microphone Measurement Point shall be collected.

8.10.6.3 Record and report the Pink Noise Sound Pressure Level per octave band at the Microphone Measurement Point described in Section 3.3.5.

8.10.6.3.1 A minimum of one Pink Noise measurement recorded per Section 8.10.6.3 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental Pink Noise measurement recording at Microphone Measurement Point shall be collected.

8.10.6.4 Record and Report the STI score for each facepiece measurement sampled as described in Section 8.10.5.3 (total of 45 scores shall be recorded). Record the starting time of each facepiece donning.

8.10.6.5 Calculate the average for each donning. There will be a total of 15 averages of 3 measurements; 5 average’s for each of the 3 facepiece samples.

8.10.6.6 See Appendix A for sample report recording sheet

8.10.7 Interpretation.

8.10.7.1 The averages calculated in Section 8.10.6.5 to shall be used to determine a pass or fail per Section 7.10.

8.10.7.2 If any of the 15 averages score less than the minimum threshold specified in Section 7.10 the facepiece shall be considered to have failed and reported as such.

8.10.7.3 If all of the 15 averages score equal to or greater than the minimum threshold specified in Section 7.10 the facepiece shall be considered to have passed and reported as such.

8.25 Supplementary Voice Communications System Performance Test.

8.25.1 Application. This test method shall apply to complete SCBA facepiece(s) and second stage regulator(s).

8.25.2 Samples. Each sample to be tested shall be as specified in Section 4.3.9 with voice communications systems installed and in the “on” mode per manufacturer instructions.

8.25.3 Specimen Preparation.

8.25.3.1 Prior to testing, specimens shall be conditioned for a minimum of 4 hours and tested at an ambient temperature of 22°C, ±3°C (72°F, ±5°F) and RH of 50 percent, ±25 percent.

8.25.3.2 Specimens for conditioning shall be complete medium size SCBA facepiece(s) and inner mask(s) with the second stage regulator(s) installed in the as worn position as specified by the manufacturer.

8.25.4 Apparatus.

8.25.4.1 Testing shall be conducted in a chamber having the following minimum characteristics:

1) Room dimensions: 3.6 m long × 3.0 m wide × 3.0 m high (12 ft long × 10 ft wide × 10 ft high) with a minimum volume of 32.4 m³ (1200 ft³).
2) Construction: Hemi-anechoic
3) Ambient noise level inside chamber: <40 dBA/<55 dBC
4) Walls and ceiling: ≥90% absorptive for 100 Hz< f<10000 Hz

8.25.4.1.1 All surfaces above the floor acoustically treated for internal acoustic absorption, as well as for external noise mitigation.

8.25.4.2 A (G.R.A.S. K.E.M.A.R. Head and Torso Simulator (HATS) model 45BM) shall be used for testing.

8.25.4.2.1 The mouth simulator shall be capable of producing 112 dB/1 kHz sine tone at 25 mm (1 inch) with the mouth reference point un-equalized and the total harmonic distortion (THD) shall be ≤3%.

8.25.4.2.2 The mouth simulator frequency response shall be able to be equalized flat ± 1 dB between 100 Hz and 10 kHz and the response shall be -15 dB or less at 100 Hz and -20 dB or less at 15 kHz.

8.25.4.3 The sound pressure level (SPL) meter having the following characteristics shall be used:

1) The SPL meter shall be capable of applying an equivalent continuous sound pressure level (Leq) of using an A weighting filter.
2) The SPL meter shall have a dynamic range from 30 dB (or less) to 130 dB (or more).
3) The SPL meter shall display the measurement to at least one decimal place.

8.25.4.4 The signal/pink noise analog audio signal generators having the following characteristics shall be used:

1) The frequency range shall be 10 Hz to 20 Hz in 1 digit steps ±0.01%.
2) The amplitude accuracy shall be within ±0.5 dB or less.

8.25.4.5 The digital equalizer having the following characteristics shall be used:

1) The digital equalizer shall be capable of at least two concurrently selectable equalizer sections:
   a. One-31 band graphic with an adjustment range of at least ±18 dB.
   b. A Ten band parametric with an adjustment range of at least ±18 dB.
2) The digital equalizer shall have a dynamic range of ≥112 dB.
3) The digital equalizer shall be capable of equalizing the frequency response of the HATS mannequin of:
   a. ±1 dB flat between 100 Hz and 10 kHz,
   b. applying a 180 Hz high pass filter with a slope of -24 dB octave,
   c. and a 10 Hz low pass filter with a slope of -24 dB octave (-15 dB at 100 Hz – 20 dB at 15 kHz).

8.25.4.6 A powered speaker having the following characteristics shall be used:

1) A sensitivity of ≥84 dB at one watt at 1 meter.
2) The frequency response shall be rated at ≤80 Hz to ≥13 kHz.
3) The amplifier shall deliver ≥10 watts with a total harmonic distortion <1%.

8.25.4.7 A microphone having the following characteristics shall be used:

1) The microphone shall be a condenser type.
2) The microphone polar pattern shall be omni-directional.
3) The frequency response shall be flat ±0.5 dB from 100 Hz to 15 kHz.
4) The residual noise shall be ≤-30 dB.
5) The microphone shall accept signals of at least 130 dBA.

8.25.4.8 A Speech Transmission Index (STI) analyzer having the following characteristics shall be used:

1) The STI PA analyzer shall be capable of measuring and displaying a single value STI PA result to two decimal places with a 7 octave band modulated noise test signal using the Netherlands Organization for Applied Scientific Research (TNO) verified algorithm.

8.25.4.9 All of the apparatus identified in Sections 8.4.25.4.2, 8.25.4.3, 8.25.4.4, 8.25.4.5, and shall be located in the hemi-anechoic chamber and arranged as shown in Figure 8.25.4.9a and 8.25.4.9b.

******Insert Figure 8.25.4.9(a) Here******

******Insert Figure 8.25.4.9(b) Here******

8.25.4.10 The HATS test mannequin shall be positioned in the chamber in the following manner: Refer to Figure
8.25.4.9(a) and (b).
8.25.4.10.1 The distance between the HATS test mannequin and the microphone shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in), and they shall be facing each other.
8.25.4.10.2 The distance between the HATS test mannequin MRP and the floor shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in).
8.25.4.10.3 The distance between the microphone and the floor shall be 1.5 m, +25 mm/-0 mm (5 ft, +1 in/-0 in).
8.25.4.11 The test chamber shall be filled with broadband “pink” noise with a tolerance of +/- 1(one) dB per octave band from 100 Hz to 10 kHz.
8.25.4.12 The pink noise speaker shall be placed directly beneath the microphone and oriented such that the central axis of the speaker cone is directly facing the microphone.
8.25.4.12.1 The speaker shall be situated on top of a block of isolating acoustic foam such that no part of speaker box is contacting the floor or microphone stand to prevent conduction of sound to the microphone.
8.25.4.12.2 The height of the speaker off the floor shall be at least 0.125 m (5 in), as measured from the bottom of the speaker box, and the distance between the speaker and microphone shall be no less than 1 m (40 in), as measured from the top of the speaker grille/enclosure.
Note: Any changes made to the pink noise speaker configuration require re-calibration of the pink noise spectrum per Section 8.25.4.13.
8.25.4.12.3 Refer to Figure 8.25.4.12 for reference in placing the pink noise speaker.

*****Insert Figure 8.25.4.12 Here*****

8.25.4.13 The pink noise speaker shall be fully equalized flat, from 100 Hz to 10 kHz, to within +/- 1 db on a relative scale in 1/3 octave bands as measured at the microphone position.
8.25.4.14 The STI test signal from the mannequin shall be adjusted to achieve an “A” weighted sound level of 97 dB, +/- 0.5 dB at the mouth reference point (MRP), 50 mm ±3 mm (2 in ± 1/8 in) from the test mannequin’s mouth.
8.25.4.14.1 The microphone used for calibrating STI signal shall be omni-directional and oriented in a horizontal front facing manner.
8.25.4.14.2 The STI signal shall be equalized flat to within +/- 1 dB on a relative scale in 1/3 octave bands as measured at the mouth reference point of the HATS.
8.25.4.14.3 HATS Calibration
1) Equalize flat with pink noise @ 97 dBA from 100 Hz – 10kHz to +/- 1 dB on a 1/3 octave scale
2) Reduce the levels for the 125 Hz octave band (the 100, 125, 160 1/3 octave bands) by 10 dB
3) Reduce the levels for the 250 Hz octave band (the 200, 250, 315 1/3 octave bands) by 2 dB
4) Apply STIPA signal and adjust Sound Pressure Level (SPL) to 97 ± 0.5 dBA
8.25.4.15 The gain of the powered speaker amplifier used to generate the pink noise shall be adjusted to achieve an A-weighted sound level of 9 dBA ± 0.5 dB below the signal level generated as identified in Section 8.25.4.14 measured at the microphone placed as identified in Sections 8.25.4.10.1 and 8.25.4.10.3.
8.25.5 Procedure.
8.25.5.1 The method for measuring speech transmission index shall be as specified in IEC 60268-16:2003, Sound System Equipment – Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index, with the modified apparatus specified in Section 8.25.4.
8.25.5.2 The medium size facepiece with inner mask and second stage regulator in the normal use mode shall be fitted to the HATS test mannequin in the following manner:
1) Place the chin of the mannequin in the “chin cup” of the facepiece.
2) Place the facepiece to seal against the face of the HATS test mannequin.
3) The head harness of the facepiece shall be passed over the HATS test mannequin and tightened in a manner that maintains the symmetry of the facepiece on the HATS test mannequin with talc to minimize friction between the HATS test mannequin and strap.
4) The straps shall be tightened to a tension of 50 N (11.2 lbf).
8.25.5.3 Three medium size facepieces shall be tested in the chamber having an ambient noise field as specified in Sections 8.25.4.11 through 8.25.4.15. Each facepiece shall be mounted as specified in Section 8.25.5.2 and the tested as follows:
4) Three separate measurements shall be recorded for each donning of the facepiece.
5) Five separate donnings shall be performed.
6) Total of 45 measurements
   i. 3 (facepieces) \times 3 (measurements) \times 5 (donnings) = 45 measurements

8.25.6 Report.
8.25.6.1 Record and report the STIPA signal Sound Pressure Level per octave band, the Modulation Transfer Index per octave band, and overall STI score at the Mouth Reference Point described in Section 3.3.x.
8.25.6.1.1 A minimum of one STIPA signal recorded per Section 8.25.6.1 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental STIPA recording at MRP shall be collected.
8.25.6.2 Record and report the STIPA signal Sound Pressure Level per octave band, the Modulation Transfer Index per octave band, and overall STI score at the Microphone Measurement Point described in Section 3.3.5.
8.25.6.2.1 A minimum of one STIPA signal recorded per Section 8.25.6.2 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental STIPA recording at Microphone Measurement Point shall be collected.
8.25.6.3 Record and report the Pink Noise Sound Pressure Level per octave band at the Microphone Measurement Point described in Section 3.3.5.
8.25.6.3.1 A minimum of one Pink Noise measurement recorded per Section 8.25.6.3 shall be collected prior to the start of facepiece testing and at the conclusion of facepiece testing; where breaks in testing of more than 1 hour have occurred another supplemental Pink Noise measurement recording at Microphone Measurement Point shall be collected.
8.25.6.4 Record and Report the STI score for each facepiece measurement sampled as described in Section 8.10.5.3 (total of 45 scores shall be recorded). Record the starting time of each facepiece donning.
8.25.6.5 Calculate the average for each donning. There will be a total of 15 averages of 3 measurements; 5 average’s for each of the 3 facepiece samples.
8.25.6.6 See Appendix A for sample report recording sheet.
8.25.7 Interpretation.
8.25.7.1 The averages calculated in Section 8.25.6.5 to shall be used to determine a pass or fail per Section 7.25.
8.25.7.2 If any of the 15 averages score less than the minimum threshold specified in Section 7.25 the facepiece shall be considered to have failed and reported as such.
8.25.7.3 If all of the 15 averages score equal to or greater than the minimum threshold specified in Section 7.25 the facepiece shall be considered to have passed and reported as such.

*******Insert Appendix A Figure Here******

Substantiation: The NFPA 1981 TC was tasked with coming up with a better standard for communications, a TG was formed and with the proposed standard was changed for non electronic and electronic communications from the MRT (Modified Rhyme Test) to STI (Speech Transmission Index). The STI method has been subjected to constant refinements since it was introduced in the 1970’s and has been proven to be a very robust test method. It has been agreed amongst the members of the task group that the STI test has certainly removed much of the subjectivity introduced by the MRT protocol. However, several further improvements are suggested to increase the repeatability and reproducibility of the STI standard further.

The first point is the use of C-weighting as opposed to the standard A-weighting scale. This recommendation to use “C-weighting” is not in line with the IEC standard for STI, and contradictory to the STI protocol’s design. Attenuation of the lower octaves is supposed to happen, the STI test was designed and validated using A-weighting [1]; changing the weighting without confirmation testing invalidates the results. A-weighting is commonplace in all variants of STI testing and all human factor acoustics testing as this is how our ears work. The A-weighting was chosen for STI testing signal in order to overcome spectral differences between signals and to have the signal levels closely match perceived levels as validated in subject based intelligibility experiments using CVC (Dutch) word scores [1]. Furthermore, C-weighting puts an emphasis on low frequencies that are of little importance to speech intelligibility and therefore the STI test; this emphasis on low frequencies can be amplified by the HATS torso in an unnatural manner [2]. For STI testing this generally means we cannot be assured that testing done using C-weighting will be perceived the same by a human ear as testing done with A-weighting. It also means that we have unnecessarily introduced a factor that could potentially reduce repeatability between test setups since the emphasized lower frequencies of the C-weighting may reflect off of the torso of the Head and Torso Simulator (HATS) causing unknown variations. Thus it is proposed to change the weighting factor applied when setting the level of the STIPA signal and Pink noise signals to us an A weighting filter.
The contention point is the 105.5 dB requirement at the Mouth Reference Point (MRP) 50 mm (2 in) from the test mannequins’ mouth. This sound pressure level is very difficult for most commercially available mouth simulators to produce. In fact, it should be noted that this requirement may be over and above the published capabilities of GRAS KEMAR 45BM mannequin specified in draft standard. Per GRAS’s publication the minimum continuous output for the mouth simulator on the 45BM model is 110 dB between 200 Hz and 6 kHz and 100 dB between 100 Hz and 10 kHz [3]; note that 125 Hz and 8000 Hz are used in the octave band for STI testing. Also note that the MRP used in the GRAS publication is 25 mm (1 in) as opposed to the 50 mm (2 in) as written in point 8.10.4.15 of the draft standard. What this means for the test setup is that the specified KEMAR mannequin may be incapable of producing the specified test signal level if the max SPL occurs at frequencies less than 200 Hz or above 6 kHz. It might even be incapable all together due to the discrepancy in the MRP between the GRAS publication and draft standard. If it is capable, it may be distorting the STI test signal causing generally lower than perceived STI numbers. It may also mean faster deterioration of the speaker driver within the mouth simulator leading to diminished STI factors over time. All of these situations also lend to potential issues with repeatability and reproducibility. Thus is proposed to reduce the SPL by a minimum of 3 dB’s; this along with the change in the weighting filter discussed in the previous argument equate to an SPL of 97 dBA for the signal level.

The third point is the tolerance of 6 dB per octave band allowable in the pink noise spectrum is very wide and unnecessary if the sound field is properly setup. The tolerance of 6 dB allows for large variations in the signal to noise ratio which can have significant effect on the STI score. This affects the inherent repeatability and reproducibility of the level if the max SPL occurs at frequencies less than 200 Hz or above 6 kHz. It might even be incapable all together due to the discrepancy in the MRP between the GRAS publication and draft standard. If it is capable, it may be distorting the STI test signal causing generally lower than perceived STI numbers. It may also mean faster deterioration of the speaker driver within the mouth simulator leading to diminished STI factors over time. All of these situations also lend to potential issues with repeatability and reproducibility. Thus is proposed to change the tolerance allowable in the pink noise spectra to +/1 dB per 1/3 octave band.

The fourth point is the direction of the pink noise speaker, if the forward axis of the speaker is oriented away from the microphone as required the sound will be immediately absorbed by the dampening foam of the anechoic chamber. This will make it very difficult to achieve the desired sound field. The speaker should be placed on the floor below the microphone with its central axis pointed directly upward at the microphone. Thus new arrangements and schematics were provided to better described this arrangement.

The fifth point was the sampling arrangement. Since the STI is repeatable measurement to measurement to within 3 dB [1], and most of the variation lies within the donning of the facepiece to the manikin it is suggested that more donnings be accomplished with each test. Thus it proposed that 3 facepiece samples be provided, each of the samples shall be donned 5 times, 3 measurements shall be recorded for each donning.

The sixth point deals with the use of an absolute minimum for the pass/fail criteria that is applied to each individual measurement. Due to the inherent error of 3 dB of the STIPA test, there needs to some averaging to ensure that the measurements are approaching the true mean for the donning. Consider the following; during a single donning the measurements 0.54, 0.54 and 0.57 are taken. Two of measurements are considered to have failed while one is considered to have passed, but according to the sampling method nothing should have changed in between these measurements; the difference in measurements comes solely from the allowable error within the STI test. By taking the average of these 3 measurements for the donning we approach the true mean value for the donning by the central limit theorem. Thus it is proposed that the pass/fail threshold be applied not to each individual measurement but the averages for each donning.

The seventh point deals with reporting of the test data. In an effort to ensure that data remains comparable and that the test signals and pink noise spectra remain substantially similar the STIPA spectra Sound Pressure Levels and Modulation Transfer Indices shall be reported per 1/3 octave band along with the test data and pass/fail analysis.

These recommendations for change are based on independent testing and limited round robin testing. The current NFPA voice draft standard incorporates several discrepancies that undermine STI’s inherent repeatability and reproducibility. Changes made to the STI test protocol did not align with the IEC standard 60268-16 that is referenced at the beginning of the standard. These changes were not validated and thus we cannot assess their effectiveness on perceived intelligibility. However By making the proposed changes and improvements found herein, it is ensured that a more robust, repeatable, and reproducible test standard will have been created.

Citations
Upon request at the time of purchase, the manufacturer shall provide to the purchaser an information sheet with each SCBA that documents at least the following:

(a) Manufacturing performance tests conducted at time of manufacture, and the results
(b) Date of manufacture
(c) Model number
(d) Serial number
(e) Lot number, if applicable
(f) Hydrostatic test dates and results, if applicable
(g) Using Warning Label of SCBA (new inserted statement)

Substantiation: Adding my suggested Warning Label to above mentioned section of standard code; result in increasing of SCBA safe margin as described in enclosure file.

MY PROPOSAL FOR NFPA 1981 along with enclosure #4
If you would like to understand the positive effect of my proposal named a warning label for SCBA, you have to consider this matter, in view of users of SCBA who work in an industrial process unit, like a gas refinery.

Please let me tell you a case as below:

1) An industrial case
Please image you as a operator work in a Gas Refinery that its main task is the removal of Hydrogen Sulfide (H₂S) from gas stream, because it is a corrosive and poisonous gas.
Also your refinery has at least 15 vital zones (like Gas Treating Unit, Sulfur Recovery Unit, etc.) and all of them need to have a SCBA device.
This means that your fire brigade is installed one SCBA device in each zone (or location) for emergency conditions (like H₂S leakage).
But all SCBA devices are not same, i.e. your fire brigade supplied SCBA devices from 8 different the U.S companies (like MSA, etc), because of some limitations, so you expect your employees have several SCBA with different Charge Pressure values (5400, etc.).

WHEN A PROBLEM APPEAR?
Now you are working as a operator in an Gas Treating unit and this process unit has a MSA SCBA with pressure charge of 5400 psi, but your friend works in a different place (for example a Sulfur Recovery Unit) and has another SCBA with pressure charge of 4050 psi in his working area.
You go to meet your friend in his work place and your work place is far away your friend.
When you arrived there, your friend has exposed with a lot of a poison gas like H₂S, nobody is there for help except you who are familiar with SCBA.
You see him and understand his dangerous conditions, because you know that his brain cells will damage permanently, if you do not give him oxygen immediately (3-6 minutes), remember that you have a very short time for this action.
Therefore you decide to chose and wear a SCBA device (i.e. a MSA SCBA that is installed in your friend’s work place), if it is safe, but you do not know its Charge Pressure, because this kind of SCBA is different from what is installed in your work place.
Also you know that before you attempt to save your friend’s life you need to ensure that your SCBA is safe to use, so
you require to know its Pressure Charge then you open valve of cylinder and look at your pressure gauge and use it, if your gauge show an amount more than 90% of SCBA Pressure Charge, so it is safe.

But you do not have time to look for its pressure charge and calculate its safe pressure under emergency condition, because you have a lot of stress and want to save your friend’s life in a short time.

REMEMBER: your golden time to rescue your friend’s life is very short time (3-6 Min. only), after this time your friend’s nervous cells of brain begin to die.

QUESTION #1: Do you think that 3 seconds is enough time to do all above actions (i.e. looking for charge pressure and calculate its safe amount, when you have stress)?
I do not think so, as a safety man who knows H₂S correctly.

QUESTION #2
How could we choice a safe SCBA device and wear in a short time, without need to calculation of safe charge pressure?

By using of a warning label of SCBA (enclosure file #4), because manufacture of SCBA is written “SAFE GAUGE PRESSURE” (90% of charge pressure) on the warning label, so you do not need any calculation, it is enough you look at its warning label only, you do not loss golden seconds for calculation and you use them for saving of life.

QUESTION #2: If the related number of charge pressure of SCBA is unreadable or is defected or the light is not enough to read it (its number is small on company label), how you find correct Charge Pressure of MSA SCBA and save your friend life?

By using of a warning label of SCBA (enclosure file #4), because it has a big 3 digits number in center of warning label, so you can find and read it easily.

Also it is readable at night easily, because its number is black and its background is yellow.

Based on above mentioned description, you no have time to save your friend’s life surly, but you can decrease your required time to 3 seconds, if you have a warning label like what I send you as attached file.

Meanwhile as a customer when we used a SCBA and fill it again but its charge pressure is less than the amount of Pressure Charge that manufacture is mentioned on cylinder label, of course in an acceptable range, we need to advise the others from this change, because charge pressure on company label is not reliable now, how we could do it?

By using a new warning label of SCBA (enclosure file #4).

The U.S. SCBA manufactures would be able to increase their SCBA safety factor, because of the following reasons, if they use a SCBA Warning Label (enclosure file #4) like what I sent you:

1) Users no need to know Charge Pressure of Cylinders (or keep it in his mind), because manufacture calculated the amount of 90% of Pressure Charge before and mentioned as a big 3 digits number on the center of a warning label, it is useful when we must use several SCBA devices with different charge pressures.

2) You save the required time to rescue, because no need to loss your time because of calculation, it is enough you look at your gauge and compare it with a 3 digits number on the center of Warning Label.

3) Because it is a big number, so it always is readable and user will find it immediately, without any mistake.

4) This label will stick on two sides of cylinder, one on back board (user will see this side first, when you hang a SCBA on wall) and another on cylinder, because it is possible you separate a cylinder from its back board.

5) When we have to use several cylinders with different values for Pressure Charge, the selection of a safe cylinder is difficult in a short time.