

# National Personal Protective Technology Laboratory

## Supplied-Air Respirator (SAR) Conceptual Standard

Policy and Standards Development Branch

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September 17, 2009

# 083A Docket Comments

- **All comments received were reviewed and considered**
  - Comments accepted have been incorporated into the current SAR proposed draft
  - Comments related to issues such as airsource systems, and pneumatic tool takeoff were not adjusted pending additional stakeholder input

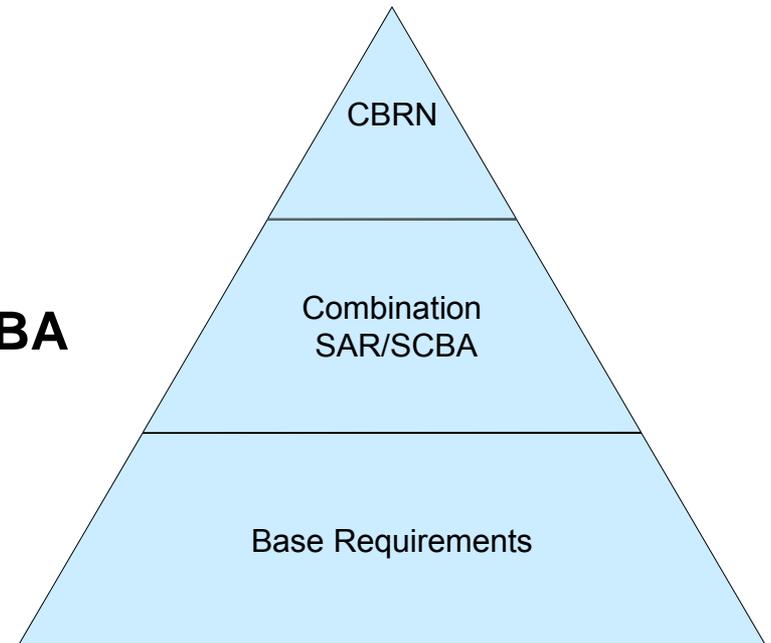
# Organization of SAR Proposed Standard

## SAR Base Requirements

- Respiratory
- Non-Respiratory
- Airsource Blower/Air Compressor / Air Supply Hose

## SAR Enhanced Combination SAR/SCBA Requirements (IDLH)

## SAR Enhanced CBRN Requirements



# SAR Required Technical Actions

- **Revise the Draft Standard**
  - Continue internal technical reviews
  - Post SAR draft standard on NIOSH web for public comment
  - Review additional docket comments and revise draft as required
- **Update Standard Test Procedures (STP)**
  - Eliminate obsolete STP
  - Modify existing STP
  - Develop new STP
- **Evaluate, Acquire, and Secure Test Capabilities**
  - Evaluate current test capabilities with regard to new standard
  - Purchase and install new test equipment
  - Validate test equipment and procedures

## Overview of Technical Aspects Specific to Proposed Subpart J

- SAR will remain subpart J
- Subpart will contain optional requirements for both IDLH and CBRN applications
- SAR will continue to meet the requirements of Subparts A - G of 42 CFR Part 84

# Highlights of Proposed Technical Updates for Subpart J Descriptions

## Airline Type

- Air supply line and respiratory inlet covering with coupling for connection to Grade D or better breathing gas source

## Optional Airsource Type

- Portable blower/air compressor with air supply line and respiratory inlet covering certified as a complete system



# Highlights of Proposed Technical Updates for Subpart J Base Requirements Respiratory

## Airline Type Changes

- Eliminate, Type A – hose mask respirator with large diameter breathing hose that draws inspired air by means of hand or motor-driven blower
- Eliminated, Type AE – Type A with protection from rebounding abrasive materials
- Eliminated, Type B – hose mask respirator with large diameter hose that draws inspired air by means of the users lungs
- Eliminated, Type BE – Type B with protection from rebounding abrasive materials
- Re-designate C and CE as “Airline Type”
- Eliminate demand-type apparatus
- Remain unchanged with CGA G-7.1 updated

## Airline Breathing Air

# Highlights of Proposed Technical Updates for Subpart J Base Requirements Respiratory (Cont.)

## **Exhalation Valve Leakage**

- Modified maximum valve leakage from 30 to 15 ml per minute based on current equipment capabilities

## **Carbon Dioxide Limit**

- Included to insure acceptable CO<sub>2</sub> level (dead space test)

## **Human Subject Testing**

- Included to determine the inhaled carbon dioxide ( $\leq 2.0\%$ ) and oxygen ( $\geq 19.5\%$ ) levels in the breathing zone during tests performed with subjects standing and walking at 3.5 miles per hour

## **Assess Fitting Characteristics**

- Total Inward Leakage (TIL) Test based on benchmark testing to finalize values

# Highlights of Proposed Technical Updates for Subpart J Base Requirements

## Respiratory (Cont.)

### Air Flow Rates

- Manufacturer specified air flow rates at which positive pressure is maintained in the breathing zone based on a sinusoidal breathing profile
- Replaces flow rates of 115 and 170 Lpm for tight and loose fitting respiratory inlet coverings
- Addition of the very high air flow rate based on stakeholder comments



NIOSH Proposed Air Flow Rates		
Air Flow Rate	Minute Volume	Tidal Volume and Respirations
Low	25 L	1.30L @ 19.2 resp/min
Moderate	40 L	1.67L @ 24 resp/min
High	57 L	1.95L @ 29.1 resp/min
Very High	78 L	2.00L @ 39 resp/min

# Highlights of Proposed Technical Updates for Subpart J Base Requirements Non-Respiratory

## **Required Components**

- Airline: Respiratory inlet covering, air supply valve or orifice, air supply hose, detachable couplings, flexible breathing tube, and harness

## **General Construction**

- Shall meet requirements in subpart G of 42 CFR Part 84
- Connections and couplings are required to prevent unintentional disconnection

# Highlights of Proposed Technical Updates for Subpart J Base Requirements Non-Respiratory (Cont.)

## Harness Tests



- Shoulder strap test increased to a 300lb pull for 30 min
- Belts and rings increased to a 500lb pull for 30 min
- Hose attachment to harness remains at 250 lb pull for 30 min
- Life lines or safety harness shall meet ANSI Z359.1 or NFPA 1983
- Total length of hose (heaviest configuration) shall permit dragging over a concrete floor without compromising the harness

# Highlights of Proposed Technical Updates for Subpart J Base Requirements Non-Respiratory (Cont.)

## **Visors/Lenses**

- Must meet the impact and penetration requirements from ANSI Z87.1-2003
- Must achieve a visual field score (VFS) of 90 or greater

## **Noise Level**

- Generated by the respirator during normal operation at maximum airflow shall be less than 80 dBA at both ear canals

## **Failure Mode Effects Analysis**

- Manufacturers shall demonstrate that reliability is assessed and controlled

# Highlights of Proposed Technical Updates for Subpart J Base Requirements Air Supply Hose

## Hose Length

- Air-supply hose length will be manufacturer specified

## Hose Labeling

- All breathing air hoses must be labeled “breathing air only” (not in current SAR draft)

## Hose Permeation

- Addition of permeation tests using kerosene and MEK/toluene.



# Highlights of Proposed Technical Updates for Subpart J Enhanced Requirements for IDLH Combination SAR/SCBA

## Escape Cylinder



- Airline SAR/SCBA will incorporate a 5 or 10 min. duration SCBA escape air cylinder
- A 15 minute or longer duration SCBA air cylinder allows 20% capacity for **entry**
- Automatic switch from supplied air to air cylinder
- Alarm will notify user when the system is on cylinder air
- Requires tight fitting full facepiece

# Highlights of Proposed Technical Updates for Subpart J Enhanced Requirements for IDLH Combination SAR/SCBA (Cont.)

## Visor/Lenses

- Haze, luminous transmittance and abrasion
- Impact and penetration resistance
- Low temperature/fogging

## Communication

- Modified Rhyme Test (MRT)



# Highlights of Proposed Technical Updates for Subpart J Enhanced Requirements Optional CBRN Protections

- Meet base and combination SAR/SCBA requirements
- 15 minute or longer duration escape air cylinder
- Automatic switch from supplied air to air cylinder
- Alarm will notify user when the system is on cylinder air
- Criteria which have been established for CBRN SCBA respirators will be applied to combination SAR/SCBA
  - Requires tight fitting full facepiece
  - Durability conditioning
  - Agent testing

# Highlights of Proposed Technical Updates for Subpart J Requirements for Options

## Hydration

- Drink tube valves and valve seats shall not exceed 30 ml per minute of leakage at 75 mm H<sub>2</sub>O vacuum

## Pneumatic Tool Take-Off

- Requirements for check valve and filter at the take-off point to prevent any back flow or contamination to the respirator
- Maintain positive pressure in the breathing zone at the manufacturers highest specified air flow rate regardless of occurrence with the pneumatic tool line such as blockage or free flow

# Benchmark Live Agent Testing

- Test setup will be similar to the open circuit self-contained breathing apparatus (SCBA) but will include the hose and hose connection
- Draft standard test procedure has been developed
- Test will be conducted at the current open circuit SCBA challenge concentrations for Sarin (GB) and Sulfur Mustard (HD)

# Benchmark (Cont.)

**Breathing Gas, carbon dioxide (CO<sub>2</sub>) machine test**

- Will be conducted on the new CO<sub>2</sub> dead space test system

**Breathing Gas Concentration, human subject generated**

- Required equipment has been purchased and installation started

**Total Inward Leakage**

- Sample respirator equipment has been purchased, pending installation of test equipment

# Benchmark (Cont.)

## Hose Permeation Testing

- Development of new test apparatus, and finalization of test challenge agents

## Positive Pressure Determination

- Existing breathing systems will be tested at all four proposed breathing rates to develop procedures and evaluate general performance

# Highlights of proposed technical updates for Subpart J Standard Test Procedures

## **New Procedures**

- New STP or those derived from existing procedures for other respiratory protective devices

## **Procedures Requiring Revision**

- STP already existing for SAR but requiring modification to test to the new performance standards

## **Obsolete Procedures**

- Eliminated due to changes in the performance requirements and evaluation methods

# Projected Timeline

- August 09:** Post SAR Concept Standard on the NIOSH Web
- September 09:** Hold Public Meeting and Discuss Concept
- November 09:** Revise SAR Concept Standard

# Supplied-Air Respirator (SAR) NIOSH Docket # 083B

## Stakeholder Input can be submitted by

- Mail:  
NIOSH Docket Office  
Robert A. Taft Laboratories, M/S C 34  
Supplied Air Respirators (SAR) – NIOSH Docket # 083B  
4676 Columbia Parkway  
Cincinnati, OH 45226
- Email: [nioshdocket@cdc.gov](mailto:nioshdocket@cdc.gov)
- Fax: (513) 533-8285
- Phone: (513) 533-8303

# Discussion Slide

## Airsource Systems

- **Optional approval**
- **Presently neither NIOSH nor OSHA evaluate portable air supply systems**
- **Inclusion of cylinder carts in Airsource systems**
- **NIOSH approves systems, when SAR are offered as Airsource systems they should be tested in that configuration**

# Discussion Slide

## Total Inward Leakage

<b>Respiratory inlet covering</b>	<b>Maximum TIL value, %</b>
<b>Constant flow half mask</b>	<b>0.2%</b>
<b>Constant flow full facepiece or neck dam</b>	<b>0.01%</b>
<b>Constant flow hood, helmet, or loose fitting facepiece</b>	<b>0.01%</b>
<b>Pressure demand half mask</b>	<b>0.01%</b>
<b>Pressure demand full facepiece</b>	<b>0.01%</b>
<b>Any IDLH or CBRN SAR</b>	<b>0.01%</b>
<b>Any combination with one of the above</b>	<b>The unit must meet or exceed the minimum TIL of each type when tested in that mode.</b>

# Discussion Slide

## Helmet Requirements

- **Should NIOSH require marking helmets that do not meet the mechanical compliance test as “not impact and penetration resistant?”**
- **The current SAR draft standard only requires ANSI Z89.1-2003 Type I or Type II protective cap standards**

# Discussion Slide

## Lens Requirements

- **Should NIOSH require marking lens that do not meet the mechanical compliance test as “not impact resistant?”**
- **The current SAR draft standard only requires ANSI Z87.1-2003 impact and penetration tests**
- **To be marked ANSI Z87.1-2003 the lens would need to pass all of the ANSI 87.1-2003 tests**

# Discussion Slide

## Manufacturer Specified Air Flow Rates

<b>Air Flow Rate</b>	<b>Minute Volume</b>	<b>Tidal Volume and Respirations</b>
<b>Low</b>	<b>25 Lpm</b>	<b>1.30 liters @19.2 respirations per minute</b>
<b>Moderate</b>	<b>40 Lpm</b>	<b>1.67 liters @ 24 respirations per minute</b>
<b>High</b>	<b>57 Lpm</b>	<b>1.95 liters @ 29.1 respirations per minute</b>
<b>Very High</b>	<b>78 Lpm</b>	<b>2.00 liters @ 39 respirations per minute</b>

# Discussion Slide

## Hose Permeation Tests

- **Develop a new sealed test apparatus and test procedure that can be conducted in a laboratory environment under controlled conditions**
- **Proposed permeation tests include gasoline, kerosene, and MEK/toluene**
- **Can all three tests be replaced with one custom blend?**

# Discussion Slide

## Live Agent Testing

- **Should we have two available levels of protection as is being considered with the PAPR standard?**
  - Higher challenge concentration same as the Open Circuit SCBA
  - Lower challenge concentration for perimeter support activities