

**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

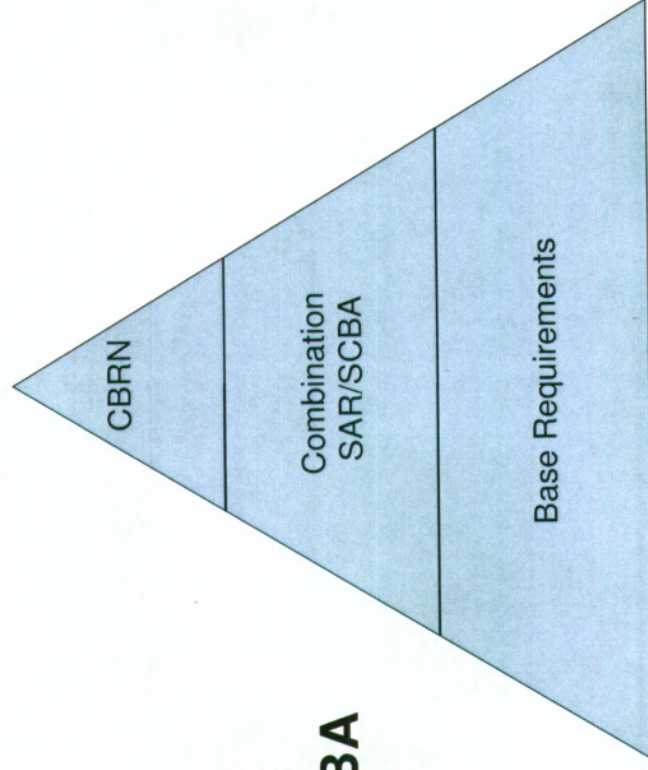
Organization of SAR Proposed Standard

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

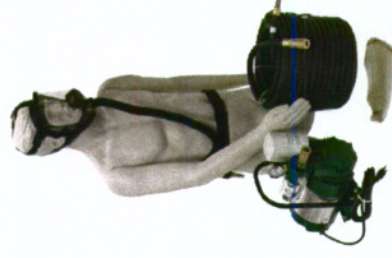
Highlights of Proposed Technical Updates for Subpart J Descriptions

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 CO₂ 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

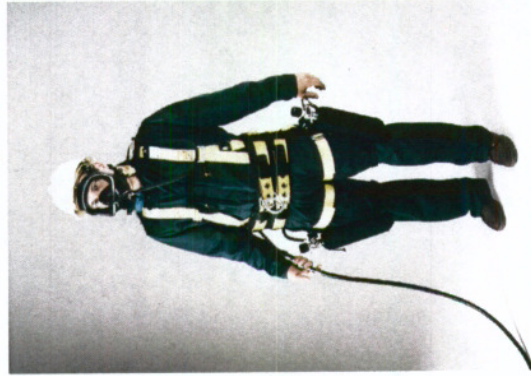
- Shoulder strap test increased to a 300lb pull for 30 min

- 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 H₂O 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 (CO₂) machine test

- Will be conducted on the new CO₂ 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
- 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

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

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

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

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