

**National Personal Protective
Technology Laboratory**

**Concept Standard for
CBRN, Full Facepiece, Closed Circuit,
Self-Contained Breathing Apparatus
(SCBA)**

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NPPTL *Research to Practice
through Partnerships*

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Purpose

- To discuss following requirements
 - Fabric flame resistance requirement
 - Fabric heat resistance requirement
 - Thread heat resistance requirement
 - Facepiece lens haze, luminous transmittance and abrasion resistance requirement
 - Communications performance requirement
 - Chemical warfare agent permeation and penetration resistance requirement
 - Laboratory respiratory protection level (LRPL) test requirement

Requirements from Relative Sections of NFPA 1984 Draft Version #94

- Environmental temperature operational performance
- Heat and flame operational performance
- Vibration endurance
- Fabric heat and flame resistance
- Thread heat resistance
- Accelerated corrosion resistance
- Particulate resistance
- Facepiece lens, haze, luminous transmittance & abrasion
- Communication performance

Fabric Flame Resistance Requirement

- Fabric average char length \leq 4 inches
- Fabric average after flame \leq 2 seconds
- Test Method:
 - Five specimens conditioned, 5 wash cycles, IAW American Association of Textile Chemists (AATC) 135
 - Federal Test Method Standard 191A, Method 5903.1; Flame Resistance of Cloth

Fabric Heat Resistance Requirement

- Fabric shall not melt or ignite
- Test method:
 - Federal Test Method Standard 191A, Method 1534; 5 specimens conditioned, 5 wash cycles, IAW American Association of Textile Chemists (AATC) 135
 - Forced circulating oven at air stream temperature of 260°C to 265°C (500°F to 510°F)

Thread Heat Resistance Requirement

- Thread shall not melt or ignite
- Test method:
 - Federal Test Method Standard 191A, Method 1534; melting point of synthetic fibers at air temperature of 260°C to 265°C (500°F to 510°F)

Facepiece Lens Haze, Luminous Transmittance and Abrasion Resistance

- Requirement: Change in haze \leq 14%
- Test method:
 - NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Emergency Services, 2002 Edition; Section 8.9

Communications Performance

- **Requirement:**
 - Average calculated value $\geq 72\%$
- **Test Method:**
 - NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Emergency Services, 2002 Edition; Section 8.10

Chemical Warfare Agent (CWA) Penetration and Permeation Resistance

CWA Test Parameters

- Sarin (GB) and sulfur mustard (HD) challenge vapor concentrations are equivalent to the NIOSH CBRN SCBA Open Circuit Standard
- SMARTMAN upper-torso manikin connected to a NIOSH automated breathing and metabolic simulator (ABMS)

CWA Test Parameters

- Sarin (GB):
 - Vapor challenge – 2,000 mg/m³
 - Breakthrough
 - 0.087 mg/m³ (fails at 3 consecutive peak readings)
 - 2.1 mg•min/m³ Ct
 - Time agent generated = 30 minutes
 - Total test time = 6 hours (current requirement)
 - Breathing rates: 100 L/min and 40 L/min

CWA Test Parameters

- Mustard (HD):
 - Vapor challenge 300 mg/m³
 - Liquid challenge 0.86 ml
 - Breakthrough
 - 0.60 mg/m³ (fails at 3 consecutive peak readings)
 - 6.0 mg•min/m³ Ct
 - Vapor challenge = First 30 minutes
 - Liquid challenge = 6 hours
 - Total test time = 6 hours (current requirement)
 - Breathing rates: 100 L/min and 40 L/min

Laboratory Respirator Protection Level (LRPL)

- Description – Fit-factor corn oil aerosol test
- Purpose – Establishes a benchmark level of protection under laboratory conditions
- Not intended as an indication of protection in an actual response scenario

Laboratory Respirator Protection Level (LRPL) *Challenge Aerosol Criteria*

- 20–40 mg/m³ Corn Oil aerosol
- 0.4–0.6 μm mass median aerodynamic diameter

Laboratory Respirator Protection Level (LRPL) Pass / Fail Level

- LRPL \geq 10,000 for each human subject
- Evaluated over 11 test exercises
- Tested with CC-SCBA operating

Laboratory Respirator Protection Level (LRPL) Subject Exercises

- 1) Normal breathing + 6) Sight a mock rifle
- 2) Deep breathing 7) Reach for the floor and ceiling
- 3) Turn head side to side + 8) On hands and knees, look side to side
- 4) Move head up and down 9) Facial grimace
- 5) Recite the rainbow reading passage or equivalent + 10) Climb stairs at a regular pace
- + Emergency response exercises 11) Normal breathing

Questions

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