CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

- Three Tiers of Requirements
  - 42 CFR, Part 84 Approval
  - Enhanced Performance Requirements
  - CBRN Requirements
CBRN Self-Contained Escape Respirator Concept

- Concept Tier 1: 42 CRF, Part 84 Approval
- Rated Service Life 15, 30, 45, or 60
- Minutes
- Approved For Use at 10.5°C or Lower

CBRN Escape Respirator

Cdc

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CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

- Concept Tier 2: Enhanced Requirement
  - Hood Type Head Covering
  - Donning time 30 Seconds
  - Environmental Conditioning
  - Flammability and Heat Resistance
  - Field of View
  - Fogging
  - Breathing Gas Concentrations
CBRN Escape Respirator

Concept

- Escape Respirator Head Covering
- The escape respirator shall be designed as a hooded device.
- The hood shall include an area for field vision and shall be compatible with wearing of glasses.
CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

- Donning Time Concept Requirement
- 30 Seconds
- From Ready To Use Configuration
- Ready To Use = Operational Package
- Prior To Use
# Durability Test Matrix: Environmental, Transportation and Drop Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Test Method</th>
<th>Test Condition</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Constant</td>
<td>MIL-STD-810F, 501.4</td>
<td>71.0°C (160°F), Constant</td>
<td>5 Weeks</td>
</tr>
<tr>
<td>Cold Constant</td>
<td>MIL-STD-810F, 502.4</td>
<td>Basic Cold, -32°C (-24°F), Constant</td>
<td>3 Days</td>
</tr>
<tr>
<td>Humidity</td>
<td>MIL-STD-810E, 507.3</td>
<td>Realistic, Natural Cycle Humidity Profiles in the U.S.</td>
<td>5 Days “quick look” Mil-Std-810E Table 507.3-11</td>
</tr>
<tr>
<td>Transportation Vibration</td>
<td>MIL-STD-810F, 514.5</td>
<td>U.S. Roadway Vibration, Unrestrained</td>
<td>12 hours/axis, 3 Axes; Total Duration = 36 hours = 12,000 miles</td>
</tr>
<tr>
<td>Drop</td>
<td>Adopted from NIOSH, CBRN APR Standard</td>
<td>Height of 3 Feet</td>
<td>1 Drop on each of the 3 Axes per Unit</td>
</tr>
</tbody>
</table>

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CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

Flammability Concept

- ANSI/ISEA Air-Purifying Respiratory Protective Smoke Escape Device - Draft
- EN 136 Test Equipment
- No After Flame After 5 Seconds
- No Drip, Melt, Hole or Other Damage
CBRN Escape Respirator

- **Field of View (FOV)**
  - Requirement: $\text{VFS} \geq 70 \text{ Points}$
  - Same FOV STP as NIOSH CBRN APR

- **Fogging**
  - Requirement: $\text{PR(\%)} \geq 70 \%$
  - Conditions: Don at $22.2 \degree \text{C} (72 \degree \text{F})$ and enter Low Temp - $10.5 \degree \text{C} (13 \degree \text{F})$ and Hot Humid $32.2 \degree \text{C} (90 \degree \text{F})$; RH @ 60%

- **Communications**
  - Requirement: Optional
  - For Communication Endorsement, Requirement $\geq 70\%$
  - Same Communication STP as NIOSH CBRN APR
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CBRN Self-Contained Escape Respirator Concept

- Breathing Gas Control Concept
  - ABMS @ VO₂ = 1.0, 2.5 & 3.5 l/min
  - CO₂ < 2.5%
  - O₂ > 19.5%
  - For VO₂ = 1.0 & 2.5 l/min
    - Test Time = Service Time (to Oxygen Depletion)
  - For VO₂ = 3.5 l/min
    - Test Time = 5 Minutes
Live Chemical Warfare Agent
Laboratory Respiratory Protection Level

Concept Tier 3: CBRN Requirement

Concept
CBRN Self-Contained Escape Respirator
CBRN Escape Respirator
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CBRN Self-Contained Escape LRPL Concept

- 20 – 40 mg/m$^3$ Corn Oil Aerosol
- 0.4 to 0.6 Micrometer Mass Median Aerodynamic Diameter
- Five Tests From Each Cell
- Each Cell Uniquely Tested
- Measured LRPL 2000
CBRN Escape Respirator

CBRN Self-Contained Escape LRPL Concept

- Hood Type Respirator Required
- Anthropometrics
  - Head Circumference
  - Neck Circumference
  - Face Length
## CBRN Escape Respirator

<table>
<thead>
<tr>
<th></th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Circumference</td>
<td>NA</td>
<td>NA</td>
<td>576 - 600</td>
</tr>
<tr>
<td>Neck Circumference</td>
<td>307 - 350</td>
<td>351 - 375</td>
<td>376 - 409</td>
</tr>
<tr>
<td>Face Length</td>
<td>NA</td>
<td>NA</td>
<td>124 – 133.5</td>
</tr>
</tbody>
</table>

- Five respirators shall be tested with test subjects from each cell of the above table with dimensions identified
- Each cell is uniquely tested
CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

- **CWA Concept Requirement**:
  - Sarin (GB):
    - Vapor Challenge = 2000 mg/m³
    - Breakthrough = 0.087 mg/m³
    - 2.1 mg/min/m³
    - Time Agent Applied = Respirator Tested Service Time
    - Total Test Time = 2 X Respirator Tested Service Time
CBRN Escape Respirator

CBRN Self-Contained Escape Respirator Concept

- Mustard (HD):
  - Vapor Challenge 300 mg/m³
  - Liquid Challenge 0.46 ml
  - Breakthrough – 0.60 mg/m³ Peak
    - 6.0 mg – min/m³ Ct
  - Time Agent Applied = Respirator Tested Service Time
  - Total Test Time = 2 X Respirator Tested Service Time