

## National Personal Protective Technology Laboratory

### Benchmark Testing for CBRN, Full-Facepiece, Closed-Circuit, Self-Contained Breathing Apparatus (SCBA)

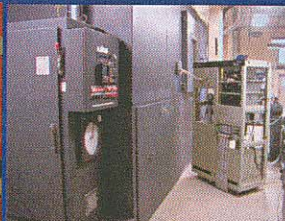
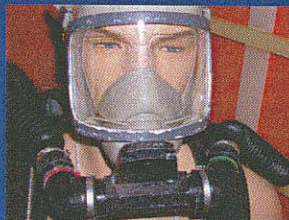
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July 19, 2005



## Benchmark Tests Conducted

- Laboratory Respiratory Protection Level (LRPL)
- Heat and Flame
- Accelerated Corrosion Resistance
- Particulate Resistance

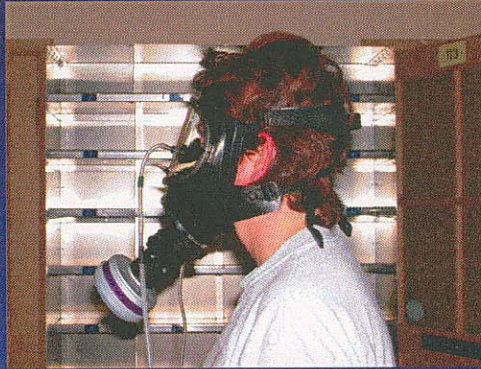




## Laboratory Respiratory Protection Level (LRPL)

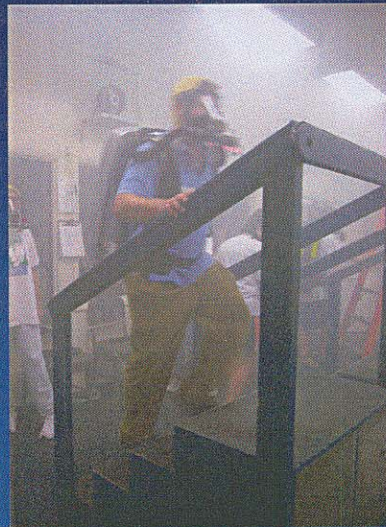
- **Procedures**

- Existing NIOSH CBRN LRPL Tests (RB-CET-STP-CBRN-0352)
- Tests conducted by US Army Research, Development and Engineering Command
- Used equipment from 2 manufacturers
- 8-Subjects / 2-Trials
  - 2 each - Manufacturer A's apparatus
  - 2 each - Manufacturer A's face piece w/ filter adapter
  - 2 each - Manufacturer B's apparatus
  - 2 each- Manufacturer B's face piece w/ filter adapter



## LRPL

- **Pass/Fail Criteria**
  - Full System  $\geq 10,000$
  - w/ Filter adapter  $\geq 500$
- **Exercises (1-minute each)**
  - Normal breathing
  - Deep breathing
  - Turn head side to side
  - Move head up and down
  - Recite the rainbow passage or equivalent
  - Sight a mock rifle
  - Reach for floor and ceiling
  - On hands and knees, look side to side
  - Facial grimace
  - Climb stairs at regular pace
  - Normal breathing





## LRPL

- **Results**

- One subject with the filter adapter did not pass the LRPL of 500 because their hairline was in the periphery. It was a one size fits all mask so no resizing could be done.



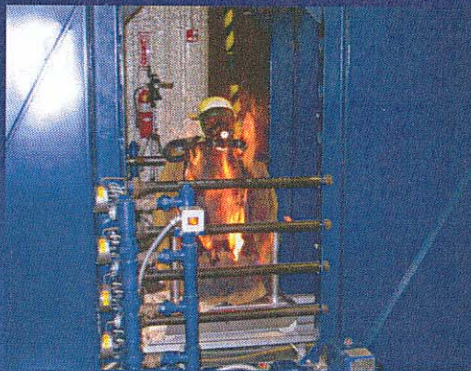
- **Conclusions**

- Current CC-SCBAs pass existing LRPL tests.

## Heat and Flame Resistance

- **Treatment**

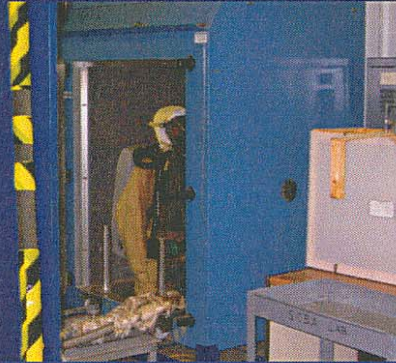
- Section 8.11.5 of NFPA 1981, 2002 Edition
  - Exposed to 95°C for 15-minutes
  - Exposed to direct flame contact for 10-seconds
  - Raised 150 mm and dropped freely
  - Note: Tests conducted without live oxygen cylinder
- Tests conducted at Intertek Testing Services
- Used equipment from 2 manufacturers
- 2 CC-SCBAs were tested





## Heat and Flame Resistance

- **Problems noted**
  - After flame beyond 2.2 seconds at:
    - Hose
    - Harness
    - Facepiece hose connector
  - Hole burnt through the hose
  - Hole burnt through the facepiece hose connector
  - Backpack fell off the mannequin
  - Bypass valve was fused shut
  - Oxygen bottle strap was burnt through
- **Note: Existing CC-SCBAs were used but were not hardened for heat or flame test. We anticipated problems and that is why live oxygen cylinders were not used.**



## Heat and Flame Resistance

- **ABMS Testing Results after retrofitting CC-SCBAs:**
  - Unit #1
    - No difference from untreated units.
    - Test terminated at 240 minutes, empty.
  - Unit #2
    - No difference from untreated units.
    - Test terminated at 167 minutes, empty.
  - **Conclusions: Heat and flame treatment did not adversely affect the performance.**





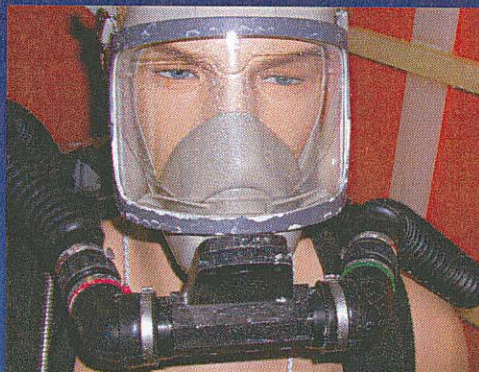
## Accelerated Corrosion Resistance

- **Treatment**
  - MIL-STD 810F, Environmental Test Methods, Method 509.4, Salt Fog
- **Test Conditions**
  - 24-hours at 5%  $\pm$  1% salt fog
  - 24-hours in drying chamber set at 35°C  $\pm$  2°C
  - Run 2-cycles
  - 2 CC-SCBAs (from different manufacturers) were tested



## Accelerated Corrosion Resistance

- **Results**
  - No damage to the control and operating features.
  - ABMS Test Protocol – no difference from untreated units.





## Particulate Resistance

- Treatment

- MIL-STD-810F, Method 510.4, Procedure 1 – Blowing Dust with modified NPFA 1981 Test Procedures:

- CC-SCBA was not rotated during the test because it was attached to a headform in lieu of the torso or mannequin. This was done to minimize the trachea tube length between ABMS and CC-SCBA.

- Test Conditions

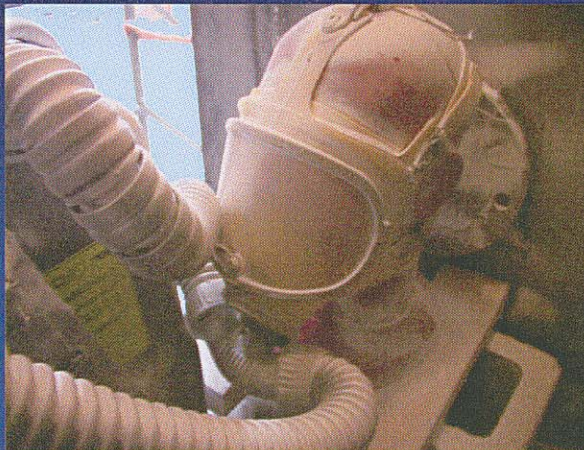
- Air velocity:  $533.4 \text{ m/min} \pm 76.2 \text{ m/min}$
  - Temperature:  $23^\circ\text{C} \pm 3^\circ\text{C}$
  - Operated ABMS at Workload B – 40 liters/minute (Table 2.a in Concept Paper)
  - 2 CC-SCBAs (from different manufacturers) were tested



## Particulate Resistance

- Results

- No difference from untreated units.





## Remaining Benchmark Testing

- Chemical Agent Permeation and Penetration Resistance Against HD and GB
- Environmental Temperature Operational Performance
- Vibration Endurance
- Communications Performance
- Facepiece Lens Haze, Luminous Transmittance and Abrasion Resistance
- Fabric Flame Resistance
- Fabric Heat Resistance
- Thread Heat Resistance



## Questions

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