National Personal Protective Technology Laboratory

Canister Requirements of CBRN Powered Air-Purifying Respirators with Benchmark Results

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Canister Requirements of CBRN Powered Air-Purifying Respirators

- The requirements for the PAPR canister testing will be based on the same tests as for the air purifying respirator canisters

Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Full Facepiece Air Purifying Respirator (APR), Dated March 7, 2003

- Hazard list derived during earlier CBRN standards development work
### Canister Requirements of CBRN Powered Air-Purifying Respirators

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Challenge Concentration (ppm)</th>
<th>Breakthrough Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclohexane</td>
<td>2600</td>
<td>10</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>1500</td>
<td>5</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>1500</td>
<td>5</td>
</tr>
<tr>
<td>Cyanogen Chloride</td>
<td>300</td>
<td>2</td>
</tr>
<tr>
<td>Phosgene</td>
<td>250</td>
<td>1.25</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>940</td>
<td>4.7</td>
</tr>
<tr>
<td>Ammonia</td>
<td>2500</td>
<td>12.5</td>
</tr>
<tr>
<td>Phosphine</td>
<td>300</td>
<td>0.3</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>500</td>
<td>1 ppm NO₂ or 25 ppm NO</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>500</td>
<td>1</td>
</tr>
</tbody>
</table>
Canister Requirements of CBRN Powered Air-Purifying Respirators

- Manufacturer will apply for
  - Moderate breathing rate performance
  - High breathing rate performance

- Manufacturer specifies filter capacity
  - Cap 1 through 6
Canister Requirements of CBRN
Powered Air-Purifying Respirators

- Service life testing will be performed as a system check at the service life testing.

- An applicant submitted manifold will be used for the service life testing.
  - Three tests at 25% RH, 25°C at capacity requested
  - Three tests at 80% RH, 25°C at capacity requested

Airflow
- Constant flow PAPR
- Breath Response PAPR

- The manifold with canister(s) shall be tested at a continuous airflow rate of the measured airflow
- 115 L/min (moderate) or 300 L/min (high)
Canister Requirements of CBRN

Powered Air-Purifying Respirators

Stacking

Several comments were received at the docket which suggested that stacking did not fit and should be dropped from the concept.
Canister Requirements of CBRN Powered Air-Purifying Respirators

Crisis Provision

The crisis provision requirements for the CBRN PAPR is being investigated. A study is being set up to evaluate whether peak instantaneous panic flows will be covered in certification testing by the higher constant flows.
Canister Requirements of CBRN

Powered Air-Purifying Respirators

CBRN PARTICULATE TESTING

P100 Filter Requirements - Canisters shall meet the requirements for a P-100 filter which is 99.97% particulate filter efficiency against DOP, tested at the measured airflow of the PAPR system.

Constant flow PAPR - Individual canisters tested at the airflow of the PAPR.

Demand responsive PAPR - Individual canisters tested at 115 L/min for moderate breathing rate or 300 L/min for high breathing rate.

For multiple canister configuration the above airflows will be reduced in proportion by the number of canisters.
Canister Requirements of CBRN Powered Air-Purifying Respirators

CBRN PARTICULATE TESTING

- Twenty (20) canisters will be tested against DOP
- Additionally nine canisters from cyclohexane service life tests will be tested against DOP
- The concept of testing using "Equivalent Face Velocity" was removed from the concept. Using docket comments and meetings with stakeholders showed that this was not effective for certification.
Canister Requirements of CBRN

Powered Air-Purifying Respirators

High Flow Testing Equipment

- Equipment has been purchased from two manufacturers of filter testing devices
- Both devices will be able to test at flows up to 450 L/min

Expected delivery date is in February 2005
Canister Requirements of CBRN Powered Air-Purifying Respirators

Benchmark Testing

- P-100 testing was performed for PAPR systems using existing TSI 8130 equipment with a 100 L/min maximum flow
- Three canisters with high efficiency capability showed P-100 efficiency
- Other benchmark testing will be performed at higher flows