

# CBRN Canister Requirements

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# CBRN Canister Requirements

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- 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.

# CBRN Canister Requirements

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## Test Representative Agent

- Organic vapor family – cyclohexane
- Acid gas family –  $\text{SO}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{CNCL}$ ,  $\text{COCl}_2$ ,  $\text{HCN}$
- Base gas family – ammonia
- Hydride family – phosphine
- Nitrogen oxide family – nitrogen dioxide
- Formaldehyde family – formaldehyde
- Particulate family – DOP

# CBRN Canister Requirements

TRA	Challenge Concentration (ppm)	Breakthrough Concentration (ppm)
• Cyclohexane	2600	10
• Sulfur dioxide	1500	5
• Hydrogen sulfide	1500	5
• Cyanogen Chloride	300	2
• Phosgene	250	1.25
• Hydrogen Cyanide	940	4.7
• Ammonia	2500	12.5
• Phosphine	300	0.3
• Nitrogen dioxide	500	1 ppm NO2 or 25 ppm NO
• Formaldehyde	500	1

# CBRN Canister Requirements

- Terminology used for capacity of canisters will now be “Capacities 1 thru 6”

Filter Capacity	Test Time (min)	Filter Capacity (ppm-min)
Capacity # 1	15	Test Concentration X 15
Capacity # 2	30	Test Concentration X 30
Capacity # 3	45	Test Concentration X 45
Capacity # 4	60	Test Concentration X 60
Capacity # 5	90	Test Concentration X 90
Capacity # 6	120	Test Concentration X 120

# CBRN Canister Requirements

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## PAPR type

- PAPR concept allows for different operational technologies:
  - Constant flow PAPR
    - Moderate breathing performance
    - High breathing performance
  - Demand response PAPR
    - Moderate breathing performance
    - High breathing performance

# CBRN Canister Requirements

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## Constant Flow PAPR

- **Manufacturer will apply for**
  - Moderate breathing rate performance
  - High breathing rate performance
- **Manufacturer specifies filter capacity**
  - Capacities 1 through 6

# CBRN Canister Requirements

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## Constant flow PAPR

### Airflow for service life testing

- Service life testing of canisters performed at airflow of blower or a minimum flow depending on manufacture specified breathing rate performance
- Intend on looking at ways of measuring actual flow rates through the canister over a specific period of time for a PAPR unit
- Moderate breathing rate performance minimum is 100 Lpm
- High breathing rate performance minimum is 261 Lpm



# CBRN Canister Requirements

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## Constant flow PAPR

- Three tests at 25% RH, 25°C at capacity requested
- Three tests at 80% RH, 25°C at capacity requested
- Three tests for crisis provision capacity
- For multiple canister configuration PAPR units, the airflow for service life testing will be reduced in proportion to the number of canisters
- For PAPRs with a single canister element, the canister shall be tested at a continuous airflow rate of the measured airflow

# CBRN Canister Requirements

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## Demand Responsive PAPR

- Manufacturer will apply for
  - Moderate breathing rate performance
  - High breathing rate performance
- Manufacturer specifies filter capacity
  - Capacities 1 through 6

# CBRN Canister Requirements

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## Demand responsive PAPR

### Airflow for service life testing

- Moderate breathing rate performance PAPR tested at 115 Lpm
- High breathing rate performance PAPR tested at 300 Lpm
- Intend on looking at ways of measuring actual flow rates through the canister over a specific period of time for a demand responsive unit

# CBRN Canister Requirements

## Demand responsive PAPR

- Three tests at 25% RH, 25°C at capacity requested
- Three tests at 80% RH, 25°C at capacity requested
- Three tests for crisis provision capacity
- For multiple canister configuration the airflow will be reduced in proportion to the number of canisters
- For PAPRs with a single canister element, the canister shall be tested at a continuous airflow rate of the measured airflow or the minimum (which ever is greater)

# CBRN Canister Requirements

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## Crisis provision

- Constant flow and demand responsive PAPR
- Three tests at 430 Lpm 50% RH, 25°C for minimum service life of 5 minutes
- Intend on looking at ways of establishing a crisis flow rates through the canister over a specific (short) period of time for a PAPR unit

# CBRN Canister Requirements

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## Protection Stacking

- Additional protection can be added by increasing the category of one or more of the six chemical agent families
- All TRAs for the chemical agent family must pass the higher capacity test
- Example: Manufacture requested a CBRN Cap 1 / Acid Gas Cap 2 / OV Cap 3

# CBRN Canister Requirements

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## Protection of CBRN Cap 1 / Acid Gas Cap 2 / OV Cap 3

### CBRN Cap 1:

- Nitrogen dioxide – 15 minutes
- Formaldehyde – 15 minutes
- Phosphine – 15 minutes
- Ammonia – 15 minutes

### Acid gas Cap 2:

- Cyanogen chloride – 30 minutes
- Hydrogen Cyanide – 30 minutes
- Hydrogen sulfide – 30 minutes
- Sulfur dioxide – 30 minutes
- Phosgene – 30 minutes

### OV Cap 3:

- Cyclohexane – 45 minutes

# CBRN Canister Requirements

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## Additional requirements being considered

- Canister uniformity
  - Canisters must have uniform resistance within the population tested at a prescribed flow rate
  - Average will be determined from initial resistance tests
  - Variance between the population must remain at defined range



# CBRN Canister Requirements

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## Additional performance being considered

- Tests to determine the airflow from individual canister connections on the manifold
- Engineering evaluation of differences in manifold airflows, taken into account in the airflow rate for service life testing

# CBRN Canister Requirements

## Systems vs. Individual Canisters

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### Ongoing Concern during Testing

- Uniformity of canister resistance
- Uniformity of manifold configuration
- Time and cost of service life testing

# **CBRN Canister Requirements Systems vs. Individual Canisters**

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**Three concepts are being investigated to handle these concerns.**

- 1. Individual canister testing; separation of canisters from manifold for testing**
- 2. Systems testing; manifold and canisters as a whole**
- 3. A combination of the individual and systems test**

# **CBRN Canister Requirements Systems vs. Individual Canisters**

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- Individual canister testing
  - 3 canisters 25% RH, 25°C, proportional airflow of blower + percentage increase of flow or time for safety factor
  - 3 canisters 80% RH, 25°C, proportional airflow of blower + percentage of flow or time for safety factor
  - 3 canisters crisis provision
  - Evaluation of equal flow characteristics of the manifold

# **CBRN Canister Requirements**

## **Systems vs. Individual Canisters**

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- **Systems testing**
  - **3 systems (blower fixture and canisters), 25% RH, 25°C, airflow of blower**
  - **3 systems (blower fixture and canisters), 80% RH, 25°C, airflow of blower**
  - **3 systems (blower fixture and canisters), crisis provision**

# CBRN Canister Requirements Systems vs. Individual Canisters

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- Individual canisters and system combination
  - 3 canisters, 25% RH, 25°C, proportional airflow of blower
  - 3 canisters, 80% RH, 25°C, proportional airflow of blower
  - 3 canisters crisis provision
  - Complete manifold with canisters tested at airflow of PAPR against worst chemical or short list of chemicals

# **CBRN Canister Requirements Systems vs. Individual Canisters Pros and Cons**

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- Individual canisters testing
  - Cost; fewer dollars in chemical cost
  - Fewer canisters used for testing
  - Does not account for flow variations in manifold and canisters resistances
  - Deviates from traditional requirements of systems testing described in 42 CFR part 84

# **CBRN Canister Requirements Systems vs. Individual Canisters Pros and Cons**

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- **Systems testing**
  - Much higher cost for chemicals
  - More canisters required for testing
  - Cost in additional test manifolds
  - Will account for flow variations in manifold and canisters resistances
  - Meets traditional requirements of systems testing described in 42 CFR part 84



# **CBRN Canister Requirements Systems vs. Individual Canisters Pros and Cons**

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- **Combination testing**
  - **Lower cost for chemicals**
  - **Fewer canisters required for testing**
  - **Fewer test manifolds**
  - **Will account for flow variations in manifold and canisters resistances**

# CBRN Canister Requirements

## Questions and Comments

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