CBRN Canister Requirements

Mr. Terry Thornton, NIOSH

CBRN Canister Requirements

The requirements for the PAPR canister testing will be the 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

Hazard Analysis and Selection

- **Initial vulnerability assessment list of chemical agent hazards identified potential respiratory hazards**
- **Classification of hazards into Agent Families**
- **Test Representative Agent (TRA) required for each family of agents.**
- **Back up data with other agents within family being generated.**
- **Biological and Radiological agents are addressed as particulates requiring P-100 media**

CBRN Canister Requirements

- Category Grouping Addresses 139 Respiratory Hazards
- Eleven (11) test representatives identified for certification testing

CBRN Canister Requirements

61 Organic Vapor Family

with vapor pressures less than that of Cyclohexane

32 Acid Gas Family

4 Base Gas Family

4 Hydride Family

5 Nitrogen Oxide Family

1 Formaldehyde Family (only member of family)

32 Particulate Family

Organic Vapor Family		
acetone cyanohydrin	ethyl chloroformate	phenyl mercapatan
acrylonitrile	ethyl chlorothioformate	phenylcarbylamine chloride
allyl alcohol	ethyl phosphorodichloridate	phenyldichloroarsine
allyl chlorocarbonate	ethylene dibromide	phosgene oximedichloroforoxime
bromoacetone	hexachlorocyclopentadiene	sarin
bromobenzylcyanide	hexaethyl tetraphosphate	sec-butyl chloroformate
chloroacetone	iso-butyl chloroformate	soman
chloroacetonitrile	iso-propyl chloroformate	tabun
chloroacetophenone	lewistite	tert-octyl mercapatan
chloroacetyl chloride	methanesulfonyl chloride	tetraethyl dithiopyrophosphate
Chloropicrin	methyl orthosilicate	tetraethyl lead
chloropivaloyl chloride	methyl parathion	tetramethyl lead
crotonaldehyde	mustard, lewisite mixture	tetranitromethane
cyclohexyl methyphosphonate	nitrogen mustard HN-1	trimethoxysilane
dibenz-(b,f)-1,4-oxazepine	nitrogen mustard HN-2	trimethylacetyl chloride
Diketene	nitrogen mustard HN-3	V-Sub X
dimethyl sulfate	n-propyl chloroformate	diphosgene
diphenylchloroarsine	o-chlorobenzylidene malononitrile	o-ethyl-s-(2isopropyaminoethyl)methyl phosphonthiolate
diphenylcyanoarsine	parathion	ethyl phosphonothioicdichloride
distilled mustard	perchloromethyl mercaptan	methyl phosphonic dichloride
		phosphorus oxychloride

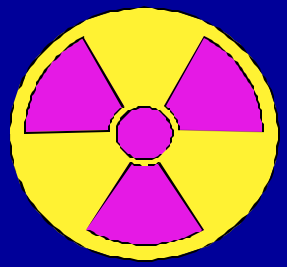
Acid Gas Family		
boron tribromide	cyanogen chloride	phosgene
boron trichloride	dichlorosilane	phosphorus trichloride
boron trifluoride	ethyl phosphonous dichloride	silicon tetrafluoride
bromine	fluorine	sulfur dioxide
bromine chloride	hydrogen bromide	sulfur trioxide
bromine trifluoride	hydrogen chloride	sulfuric acid
carbonyl fluoride	hydrogen cyanide	sulfuryl chloride
chlorine	hydrogen fluoride	titanium tetrachloride
chlorine pentafluoride	hydrogen iodide	tungsten hexafluoride
chlorine trifluoride	hydrogen sulfide	bromine pentafluoride*
chlorosulfonic acid		hydrogen selenide*

CBRN Canister Requirements

Nitrogen Oxide Family	Base Gas Family	Hydride Family	Particulate Family	Formaldehyde Family
nitric acid	allyl amine	arsine	adamsite	formaldehyde
nitric acid, fuming	ammonia	germane	sodium azide	
nitrogen dioxide	dimethyl hydrazine, 1,2	phosphine	Sodium fluoroacetate	
nitrogen tetraoxide	methyl hydrazine	stibine	13 Biological agents	
nitrogen trioxide			16 Radiological / Nuclear agents	

Particulate Biological Agents
(USAMRIID and/or CDC Lists)

- **Anthrax**
- **Brucellosis**
- **Glanders**
- **Pneumonic Plague**
- **Tularemia**
- **Q Fever**
- **Smallpox**
- **Venezuelan Equine Encephalitis**
- **Viral Hemorrhagic Fevers**
- **T-2 Mycotoxins**
- **Botulism**
- **Ricin**
- **Staphylococcus Enterotoxin B**



Particulate Radiological\Nuclear Agents

(USAMRIID and/or DOE Lists)

- **Hydrogen 3**
- **Carbon 14**
- **Phosphorous 32**
- **Cobalt 60**
- **Nickel 63**
- **Strontium 90**
- **Technetium 99m**
- **Iodine 131**
- **Cesium 137**
- **Promethium 147**
- **Thallium 204**
- **Radium 226**
- **Thorium 232**
- **Uranium 235 & 238**
- **Plutonium 239**
- **Americium 241**

CBRN Canister Requirements

Test Representative Agent

- **Organic Vapor Family** Cyclohexane
- **Acid Gas Family** SO_2, H_2S, CNCL, $COCl_2$, 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

- Minimum Service Life specified by manufacture

  15, 30, 45, 60, 90 or 120 minutes

- Three canisters tested at 64 Lpm, 25 % Rh, 25^{O} C.
- Three canisters tested at 64 Lpm, 80 % Rh, 25^{O} C.

- Three canisters tested at 100 Lpm, 50 % Rh, 25^{O} C for minimum service life of 5 minutes.

CBRN Canister Requirements

Dimensions and Weight of Canisters

- Maximum weight of 500 grams.
- Canister must be able to pass through a 5 inch opening with threads perpendicular to opening.

CBRN Canister Requirements

Breathing Resistances

Inhalation and Exhalation Resistances. PAPR unit mounted on a test fixture with air flowing at a continues rate of 85 Lpm both before and after each service life bench test.

INHALATION Initial Final	 70 mm H_2O 85 mm H_2O
Exhalation	20 mm H_2O

CBRN Canister Requirements

Breathing Resistances

Inhalation Resistances Canister Only. Canister resistance to inhalation airflow will be measured at a continues rate of 85 Lpm both before and after each service life bench test.

INHALATION	
Initial	50 mm H_2O
Final	65 mm H_2O

CBRN Canister Requirements

Breathing Resistances

Canister Uniformity. Canisters must have uniform resistance within the population tested. Average will be determined from initial resistance tests. Variance between the population must remain at ± 2.5 mm of H_2O