

Concept for CBRN Full Facepiece Air Purifying Respirator Standard

Goal:

Develop a NIOSH NPPTL full facepiece air purifying respirator standard that addresses CBRN materials identified as inhalation hazards and/or possible terrorist hazards using a minimum number of filters for emergency responders.

Target: Four (4) filters

	Short Duration	Long Duration
TIMs	15 minutes	60 minutes
TIMs plus CO	15 minutes	60 minutes

Hazards:

NIOSH has been evaluating various lists of chemicals that could be deployed as a result of a terrorist incident. In an effort to reduce the number of certification tests necessary as part of a Chemical Biological Radiological Nuclear (CBRN) Air-Purifying Respirator (APR) standard, efforts have been underway to categorize potential respiratory hazards into families with a representative test chemical identified for each family. The following information is a synopsis of this effort to date.

The current carbon technology used in canisters and cartridges were reviewed from existing certification standards. The current standards for gas masks in Europe and the U.S.(NIOSH) were reviewed. The military purchasing specification for ASZM-T carbon for C2A1 military canisters was also reviewed. The most common parameters identified from the review of the military specification and the certification standards were the middle range certification challenges. Some of the test chemicals were considered to be redundant, since other test chemicals would guarantee the carbon effectiveness against the chemicals in question (Chlorine, Hydrogen Chloride, Hydrogen Fluoride, Phosphine, CS & CN Tear Gases). Carbon tetrachloride and Cyclohexane are the representative chemicals for organic vapors. Meeting the organic vapor test for a cartridge will provide protection for all organic vapors having vapor pressures less than those of carbon tetrachloride and cyclohexane. From the CWA /TIC list, approximately 61 organic chemicals are covered by this logic, including GB and HD. The acid gases (32 chemicals) are covered by cyanogen chloride, hydrogen cyanide, hydrogen sulfide, and sulfur dioxide. Ammonia represents the base gases, and covers another 4 chemicals on the list. Ethylene oxide, formaldehyde, phosgene and nitrogen dioxide are considered special case chemicals. Arsine is a hydride and must be removed catalytically (copper⁺² and silver impregnates on carbon). Therefore, 104 of the 151 chemicals can be addressed through testing these 11 chemicals. Nine of the test chemicals are listed in ITF 25.

(DRAFT FOR DISCUSSION)

Chemicals	Organization Using as Test Agent
Ammonia	NIOSH & EN
Arsine	Military
Cyclohexane	Organic Vapor- EN
Carbon Tetrachloride	Organic Vapor- NIOSH
Cyanogen Chloride	Military
Ethylene Oxide	NIOSH
Formaldehyde	NIOSH
Hydrogen Cyanide	NIOSH, EN & Military
Hydrogen Sulfide	NIOSH & EN
Nitrogen Dioxide	NIOSH & EN
Phosgene	Military
Sulfur Dioxide	NIOSH & EN

Hazard mapping: Conduct modeling based on the ‘Most Credible Event’ scenarios developed for the open-circuit SCBA CBRN standard to determine warm zone operational scenarios. Add or delete scenarios depending on TIM being evaluated.

Respirator Use:

A. Warm Use: Less than IDLH concentrations, to REL; sustained warm zone support operations; long term use for decon, traffic control, rehabilitation, rescue and recovery; agent known & quantified.

B. Crisis Provision: Initial assessment to a suspicious occurrence; use as entry & egress device to the point of a recognized hazard & additional protection needed; Short duration, above IDLH concentrations, high physiological (flow) demand.

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Filter	Configuration	Long Duration¹ Less Than IDLH (Panic Demand)	Crisis²	Short³ Duration Less Than IDLH
Filter #1, TIM's less CO	Full Facepiece Back or Chest Mounted	60 Minutes	20 Minutes	
Filter #2, TIM's plus CO	Full Facepiece Back or Chest Mounted	60 Minutes	20 Minutes	
Filter #3, TIM's less CO	Full Facepiece Mask Mounted		5 Minutes	15 Minutes
Filter #4, TIM's plus CO	Full Facepiece Mask Mounted		5 Minutes	15 Minutes

1. Rescue, recovery, rehabilitation
2. Site Assessment, potential threat or escape
3. Escape from low threat situations

Filter Test Requirements:

	Warm Zone	Crisis
	Non IDLH Challenge	High Challenge
64 lpm flow (200 lpm peak)	X	
high flow 100 lpm (300 lpm peak)		X
Rough handling	X	X

Crisis is high use concentration at high flow rate, 300 liters per minute.

Permeation / Penetration Requirements:

Respirator system and component level testing.

Design Requirement:

Interchangeable consumable filter cartridges and canisters.

Rough handling (transportability, temperature range, survivability)

Operation Oriented (donning, field of view/acuity, flow, resistance, storage life, usage life)

Long term field auditing/maintenance procedures/ inspection