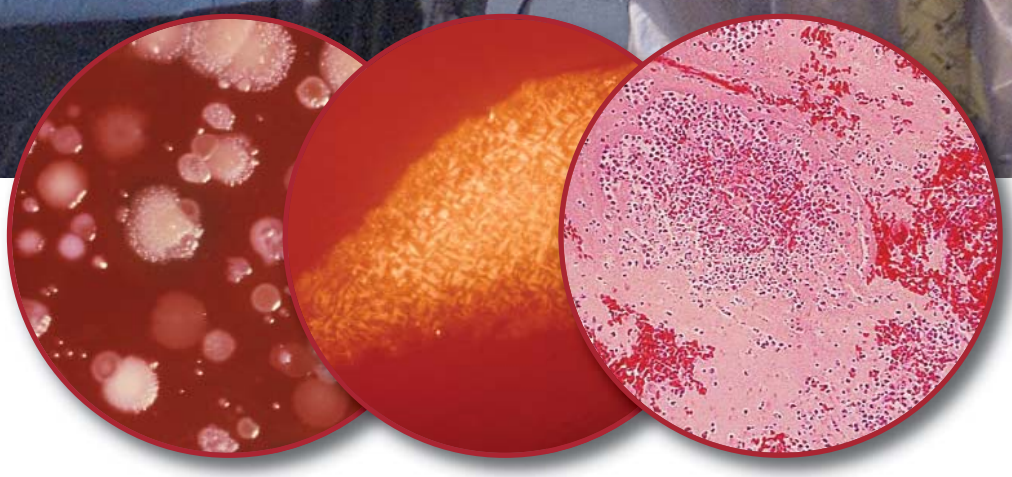
Primer for CBRN Respiratory Protection



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Bioterrorism: *the intentional use of microorganisms, or toxins, derived from living organisms, to produce death or disease in humans, animals, or plants.*

Bioterrorism

Did you know that the first bioterrorism incident against a U.S. community occurred in 1984?

Oregon's local health authorities closed down restaurants with salad bars after nearly 400 people became infected with Salmonella Typhimurium. A total of 751 people were victims of a bizarre scheme to hold down voter turnout. A religious cult called the Rajneeshees grew their own bacteria and intentionally contaminated salad bars.

Smallpox

In June 2001, Oklahoma City suffered a fictional smallpox attack during a program called "Dark Winter." Because it's highly contagious, within 13 days the disease "spread" to 25 states and 15 countries.

Anthrax

In October 2001, the testing lab at Fort Detrick, Maryland, found that anthrax spores sent to Senator Tom Daschle were extremely potent. It took months to clear all traces of the weapons-grade anthrax from the Hart Senate Office Building.

Two postal workers in a mail facility that handled the anthrax-tainted letters also died.

Note: *This document covers various elements of the NIOSH CBRN Standards. However, it is not intended to serve as a substitute for the NIOSH documents themselves, which are available online at www.cdc.gov/niosh/npptl/*

References

- *Federal Register: September 27, 2002 (Volume 67, Number 188, Notices, page 61108)*
- *"Protecting Emergency Responders–Lessons Learned from Terrorist Attacks" (The Rand Report, a report of the December 2001 conference sponsored by NIOSH)*
- *Centers for Disease Control and Prevention www.cdc.gov*
- *"Publication of the Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Full-Facepiece Air-Purifying Respirator (APR)" www.cdc.gov/niosh/npptl/aprstdsite.html*
- *"Approval of Self-Contained Breathing Respirators for Emergency Workers in Terrorist Attacks" www.cdc.gov/niosh/npptl/scbasite.html*
- *Images of Smallpox and Anthrax courtesy of CDC.*
- *CNN online www.cnn.com*

Mustard Gas

In 1996, the Pentagon reportedly confirmed a single case of exposure to Mustard Gas in an Iraqi bunker. But eight years earlier, on what's now known as Bloody Friday, a deadly cloud enveloped Halabja in Northern Iraq, killing 5,000 that day. And 65,000 more victims suffer from lingering skin and respiratory diseases, elevated rates of cancer, and birth defects.

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CBRN Respirator Standards Development

Introduction

The National Institute for Occupational Safety and Health (NIOSH), along with the U.S. Army Soldier Biological and Chemical Command (SBCCOM), and the National Institute for Standards and Technology (NIST) are continuing their efforts to develop appropriate standards and test procedures for all classes of respirators that will provide respiratory protection from Chemical, Biological, Radiological, and Nuclear (CBRN) agent inhalation hazards.

The Federal InterAgency Board for Equipment Standardization and Interoperability (IAB) has worked to identify personal protective equipment that is already available on the market for responders' use. The IAB has identified the development of standards or guidelines for respiratory protection equipment as a top priority. NIOSH, NIST, the National Fire Protection Association (NFPA), and the Occupational Safety and Health Administration (OSHA) have entered into a Memorandum of Understanding defining each agency or organization's role in developing, establishing, and enforcing standards or guidelines for responders' respiratory protective devices. NIST has initiated Interagency Agreements with NIOSH and SBCCOM to aid in the development of appropriate protection standards or guidelines. NIOSH has taken the lead in developing standards or guidelines to test, evaluate, and approve respirators.

Background

In May 1994, a group of government and military specialists formed the Chemical Agent Safety and Health Policy Action Committee (CASHPAC) to address the need for standards for appropriate respiratory protection and clothing, and to recommend new or revised chemical agent safety and health policy to the Defense Agency.

These specialists (chartered safety & health professionals from Army Materiel Command and the US Army Technical Center for Explosives Safety) gathered to develop criteria for performance of chemical protective clothing and respiratory protection for use under HAZWOPPER for the Chemical Stockpile Emergency Preparedness Program (CSEPP). Specifically, CASHPAC Protocol covered testing of Sarin (GB), DMMP (Sarin simulant), Hydrogen Cyanide (AC), and Cyanogen Chloride (CK).

MSA worked with CASHPAC to identify test protocol for APRs. Also, MSA conducted independent live-agent testing of MSA masks and canisters in accordance with CASHPAC Protocol and the current thinking for protection of responders. Testing of MSA's Advantage® 1000 & Millennium® gas masks used with CBA/RCA Canisters was performed at the US Army's Edgewood SBCCom facility in Maryland and TNO Laboratories (Netherlands).

MSA then used available NIOSH testing and certification standards to receive NIOSH approvals for use against Riot-Control Agents (O-Chlorobenzylidene Malononitrile [OCBM]and Chloroacetophenone [CN]) and P100 high-efficiency particulates.

MSA respirators were identified as being effective against OC (Oleoresin Capsicum, the "active" ingredient of OC tear gas).

Canisters for the Advantage 1000 and Millennium respirators contain the same type of fill as C2A1 military canisters, which are used with the MCU2P and M40 military gas masks, in smaller amounts. The reduced fill satisfies the smaller size requirements of law enforcement for riot control and low levels of toxic gases.

These compact military-style masks became the preferred mask for law enforcement, with their right or left cartridge mount on the facepiece, third-party-documented exceptional face fits, and ability to maintain quality and effectiveness.

These masks quickly became the market leaders, due to quality, size, comfort, fit, and excellent visibility. Tens of thousands of masks were sold into law enforcement and other first responder communities between 1996 and the present.

Even before September 11, 2001, a growing awareness of increasing threats of terrorism included the threat of chemical or biological weapons. No government standard for equipment to protect responders from these threats existed.

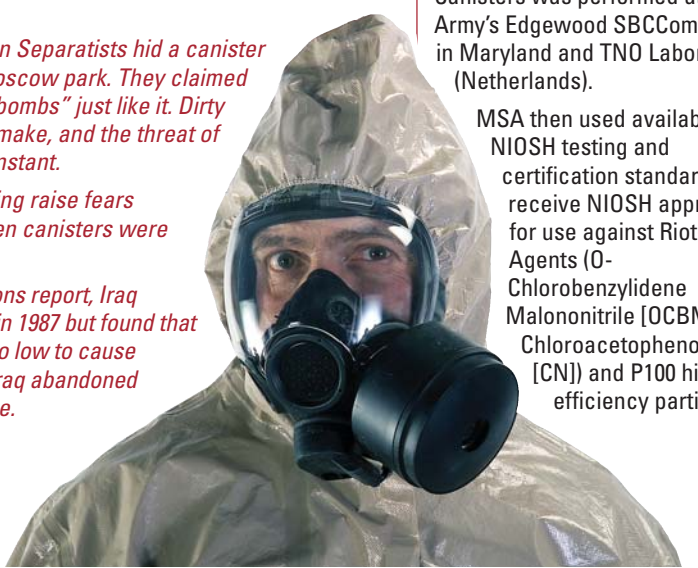
In March 1999, government and industry representatives met at NIOSH in Morgantown, West Virginia, to review the status of respiratory protection for Domestic Preparedness, user requirements, and governmental roadblocks. After collecting information from interested groups and agencies, they determined how government approvals to certify equipment could be structured to meet responders' needs while establishing stronger cooperation between agencies (CDC, DOJ, OSHA, DOD).

Dirty Bombs

In November 1995, Chechen Separatists hid a canister of Cesium-137 in a busy Moscow park. They claimed to have seven more "dirty bombs" just like it. Dirty bombs are cheap, easy to make, and the threat of them spreads panic in an instant.

Reports of nuclear smuggling raise fears higher. The Chechen's seven canisters were never found.

According to a United Nations report, Iraq tested a dirty bomb device in 1987 but found that the radiation levels were too low to cause significant damage. Thus, Iraq abandoned any further use of the device.



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NIOSH CBRN Standard for Full-Facepiece APRs (aka Gas Masks)

Theorizing that terrorists were as likely to use toxic industrial materials (TIMs) as well as chemical, biological, and radiological agents, they discussed how a protocol for testing and certification of respiratory protection devices could be developed for industrial chemicals as well as chemical/ biological/ radiological exposures.

New NIOSH Standards

As a result of the 1999 conference, the CDC and NPPTL (National Personal Protective Technology Laboratory) determined to establish new standards for CBRN respiratory protection. After 9/11, the process was accelerated, and a new agency evolved to coordinate equipment approvals. The NPPTL was set up in Pittsburgh, Pa., to take on that certification role, working with the Edgewood Arsenal to jointly "approve" respiratory protection and clothing.

The respiratory protection approval process was developed to evolve standards about every 6 to 9 months, each based on the earlier findings. The standards are being developed through a series of "concept" papers instead of in the traditional standards-setting process.

Each step in the respirator standards development is covered in minute detail on the NIOSH-NPPTL website. http://www.cdc.gov/niosh/npptl/standardsdev/cbrn/ We shall describe the first, to help you better understand the processes.

The new NIOSH CBRN Standard for full-facepiece APRs (gas masks) was issued on March 7, 2003.

Testing

This new standard raises the bar on performance. It tests and approves devices as a system as "CBRN-compliant." It establishes very stringent testing and certification protocols for:

* Chemical, Biological, Radiological, Nuclear agents
* Mask permeation & penetration
* Carry & transportation
* Use performance
* Quality assurance

How Long?

Systems may be approved for different durations, the shortest being 15 minutes. This designation specifies that the testing will be performed at the elevated levels of test agent for 15 minutes. The device cannot reach the breakthrough target during that time.

Short-duration devices are approved in 15-minute intervals (of 15, 30, and 45 minutes). Long-duration devices are approved in 30-minute intervals, starting with 60 minutes, then 90 and 120 minutes. Devices for this longer duration would likely be mounted on the back or chest, rather than facepiece, due to the need for large amounts of carbon fill, so the standard allows both mask- and back- or chest-mounted canisters.

Where?

The CBRN Standard defines environments and identifies applications where the masks are to be used, including "warm-zone applications" and "the crisis provision."

Warm-zone applications are activities which would be done at a distance from the highest concentration, where monitoring has taken place and it has been determined that the exposure levels are stabilized. Those operations would include support, decontamination, and control (possibly long-term use), as well as rescue and recovery.

The Crisis provision is included because of concern that terrorists could employ a secondary device which would be actuated as the responders arrive at the scene. Also, this provision considers mask performance during potential exposure from pockets of contaminants during recovery, during extreme physical demands, or above IDLH (escape) conditions.

What Challenge Agents?

The designers of the testing protocol developed their logic from the concept of the "most credible event." One basis for this concept is the number and type of chemicals, particularly industrial chemicals, which would most likely be encountered. They identified 151 Toxic Industrial Materials (TIMs), put them into categories or families, then reduced them to a list of "10 Test Representative Gases." The sense is that if you pick the most difficult gas within a family, you can protect against all of the others.

Thirteen biological and 16 radiological contaminants were identified. These contaminants are considered "particles" under this standard, so there is a requirement for a P100 filter.

Test matrix

The test matrix defines testing for each critical dimension of respiratory protection and the human interface, including:

1. Both traditional flow (64 Lpm) and high flow (100 Lpm) that could be experienced during escape.
2. Particulate testing, done under normal conditions and with hot, cold, and hydrocarbon-laden air to ensure consistency of performance efficiency.
3. Permeation and penetration protocols.
4. Fit testing—Laboratory Respiratory Protection Level (LRPL) "Fit Factor"
   1) with the device as designed, using the standard Los Alamos panel; and
   2) to simulate the device being used with a different canister, with a panel of 8 individuals with a weighted canister—to meet the maximum requirements of the standard.
5. A lens-abrasion test (optical haze) to ensure that the user's ability to see is not impaired because of wear and tear during storage or carry.
6. A communications test (modified Rhyme test) to ensure adequate communication between the wearer and others around him/her.
7. A field of view test to determine to what extent vision is reduced by wearing the device.
8. A fogging test for cold-temperature operations.
9. A carbon dioxide test to ensure proper air exchange within the facepiece.
10. A specific test for a hydration device, if applicable.

CBRN Standard for Gas Masks (cont.)

Mustard (HD), which easily permeates materials, and Sarin (GB), which can find even the smallest opening, were picked to be representative of the other Chemical Warfare Agents.

Service Life Testing

Service life testing (at both traditional- and high-flow levels for a minimum of 15 minutes) is performed under various conditions to simulate many possibilities of exposure, such as hot and cold conditions, different levels of humidity, vibration during transportation, and dropping. Also crucial is a maximum breathing resistance requirement to ensure that users are not over-stressed by their respirator.

The 10 representative test chemical agents are listed in a table below, with concentrations and breakthrough levels. The levels remain the same for any duration of canister. The duration is increased to gain the longer length of approval.

No strict logic governs how the levels were chosen. They have changed a number of times through the concept development. These test levels and breakthrough concentrations are stipulated in the final standard.

Particulate Testing

The particulate efficiency testing conditions include: hot and cold, humidity, vibration during transportation, dropping, and maximum breathing resistance, plus DOP penetration. (Initially, a mechanical P100 filter was required, and the use of electrostatic filters was excluded. Because of improved electrostatic performance, they are now included in this standard, with additional performance requirements for the filters, including an exposure to organic vapors and a follow-up efficiency test.)

Canister Test Challenge and Test Breakthrough Concentrations*

	Concentration (ppm)	
	Test	***Breakthrough***
Ammonia	2500	12.5
Cyanogen chloride	300	2
Cyclohexane	2600	10
Formaldehyde	500	1
Hydrogen cyanide	940	4.7 [1]
Hydrogen sulfide	1000	5
Nitrogen dioxide	200	1 ppm NO^2 or 25 ppm NO^2
Phosgene	250	1.25
Phosphine	300	0.3
Sulfur dioxide	1500	5

1 Sum of HCN and C2N2.
2 Nitrogen Dioxide breakthrough is monitored for both NO2 and NO. The breakthrough is determined by which quantity, NO2 or NO, reaches breakthrough first.

** Table 3 from "Statement of Standard for Chemical, Biological, Radiological, and Nuclear (CBRN) Full Facepiece Air Purifying Respirator (APR)," revision 1; March 17, 2003.*

Permeation & Penetration

The first test calls for the respirator system to be mounted on a "Smartman" tester and then be exposed to the challenges. The system is first tested with DOP to insure a good fit to prevent contamination of the equipment by live agents. The chamber is then filled to a concentration of 50 mg/m^3 of Mustard. The test proceeds for 6 hours; at the 7th hour, .43 to .86 ml droplets of liquid Mustard are placed on various surfaces of the mask to simulate a splash. The monitoring continues for 2 more hours. As a very invasive chemical, Mustard is used to test for material permeation. The second test exposes the system to 210 mg of Sarin for 8 hours. Sarin is a very penetrating chemical that will find even the smallest opening.

These are very aggressive tests. It is clear that a gas mask will need to be made of either Hycar rubber, butyl, or possibly EPDM, or have a butyl hood "second skin" to cover the elastomer. It is very doubtful that all gas masks will pass this test.

MSA has tested our Millennium® Gas Mask to these requirements, and found that the Millennium system exceeds the 8-hour performance requirements for both Mustard and Sarin.

Fit Testing—LRPL

What has traditionally been called "fit factor" is now described as Laboratory Respiratory Protection Level (LRPL).

A full facepiece is traditionally assigned a fit factor of 50 if quantitative fit testing has been performed. Most agencies look for a minimum of 500 as they perform the tests. The CBRN standard's requirement for a LRPL of 2000 may prevent some existing masks from being approved. Another requirement involves performing a modified LRPL with a smaller panel of 8 individuals using the manufacturer's canister, but weighted to 500 grams. The facepiece must achieve a fit factor of 2000.

A minimum of 22 test subjects is required for the LRPL, and 36 to 53 trials are required. The exercises are the same as used in traditional fit testing, plus sighting a rifle, reaching for the floor and ceiling, getting on hands and knees, turning head from side to side, and "facial expressions."

Field of View

The new NIOSH CBRN gas mask standard requires an effective field of vision of not less than 90%. Using an American Medical Association test method for determining vision impairment, the panel must achieve a score of 90. Typically a binocular facepiece will barely exceed 90, whereas a full-vision facepiece will have a score near 100 on a scale of 110. This is so with MSA's Millennium Gas Mask, which has an effective field of view of 99%, thus fulfilling both the standard's requirements and users' pleas for optimum vision.

Another important measure of visibility (part of the AMA test) is the overlapped field of view, the area that can be seen with both eyes. The higher the number is, the better. For example, MSA's Millennium overlap is 81.6%, compared to only 46.1% for another binocular-style mask.

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Did you know?
Over 7 million MSA Gas Masks, including the M17, M23, and M40 Series, have protected US military forces throughout the past century.

Interoperability

Among issues that First Responders to the Oklahoma City, World Trade Center, and Pentagon disasters have identified as crucial to address is Readiness, including caches of standardized equipment available for immediate use, training and proper fitting of protective equipment, and compatibility of equipment among neighboring groups of responders.

Another issue is interoperability. Because the CBRN Gas Mask standard has established common specifications for canister and facepiece threads, gaskets, and resistance, the "interchange-ability" of manufacturers' NIOSH-approved CBRN gas mask canisters with other facepieces is possible. It's important to note that this concept does NOT promote mixing manufacturers' components during regular use, and NIOSH testing is done with ONLY the manufacturer's own system components. The cautions and warnings specifically indicate that users should never interchange components among manufacturers.

Implementation

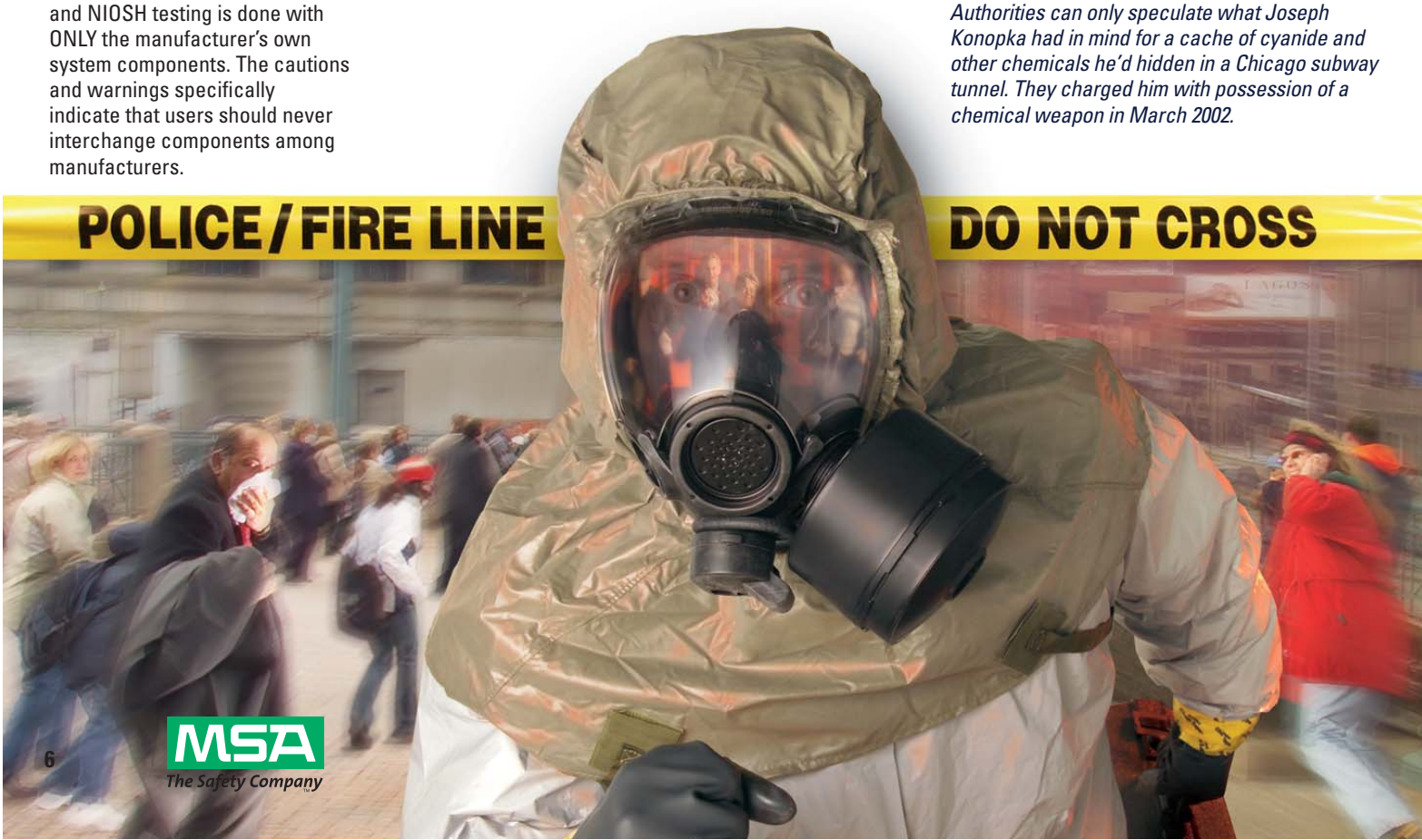
After public meetings and comments on the concept draft in late 2002, the final NIOSH CBRN Full-Facepiece APR Standard was published on March 7, 2003, released to manufacturers on March 11, and made effective immediately.

MSA received NIOSH approval for our Millennium® CBRN Gas Mask in March 2004. ✪

The new CBRN Standard promotes the objective of "interoperability," using these specifications.

- The mask connector and canister thread must be 40 mm or EN 148.1. Military threads such as those on MSA's Millennium and M40 gas masks are accepted.
- The canister can be mounted to the facepiece on the middle or either side. The gasket material is specified as EPDM (known for good permeation resistance), but a manufacturer can use another material with performance documentation. The diameter (both ID and OD), thickness, and hardness (of 65 +/- 10 Shore A) are specified.
- Bayonet or other proprietary connectors, adapters, or twin cartridges are not permitted.
- The system resistance including facepiece and canister cannot exceed 65 mm of water. The maximum canister resistance is 50 mm.
- Maximum canister weight cannot exceed 500 grams, and the widest part of the canister cannot exceed 5" to enable interchangeability of manufacturers' canisters and to ensure visibility.

Cyanide
Authorities can only speculate what Joseph Konopka had in mind for a cache of cyanide and other chemicals he'd hidden in a Chicago subway tunnel. They charged him with possession of a chemical weapon in March 2002.



Frequently Asked Questions

Q: What does "CBRN" mean?

A: CBRN is an acronym for "Chemical, Biological, Radiological, and Nuclear" usually followed by a word like "agents," "weapons," or "warfare." The CBRN Standard includes a full spectrum of potential and non-traditional threats from terrorism.

Q: What is the difference between "radiological" and "nuclear" agents?

A: A number of radiological agents are described within the standard. Classical nuclear hazards are associated with the aftermath of nuclear devices. Radiological hazards can occur from nuclear devices as well as a "dirty bomb" which disburses radiological hazards by means of a non-nuclear device.

Q: What's the difference between "chemical" and "biological" agents?

A: "Chemical" agents are typically man-made compounds. These gaseous or vapor hazards include Toxic Industrial Materials (TIMs) and military chemical weapons.

Examples: Some chemical agents, like Sarin and VX, attack the nervous system, disabling the body's "off switch," causing muscles and organs to work themselves to death. Mustard Gas is a blistering agent that attacks the skin and mucous membranes on contact.

"Biological" agents are bacteria or viruses that are dangerous to the life and/or health of biological organisms, specifically human beings.

Examples: Anthrax is an infectious disease that kills by multiplying inside the body and releasing toxins into the blood. Botulism is a muscle-paralyzing disease caused by a toxin made outside the body. Smallpox is a viral infection that can be spread by human-to-human contact.

Note: See the list of selected chemical and biological agents on page 8.

Q: What is a NIOSH approval?

A: NIOSH is the National Institute for Safety and Health, a part of the Centers for Disease Control (CDC). NIOSH has been the product-certification agency of Respiratory Protective Devices for use in accordance with the requirements of the Occupational Safety and Health Act (OSHAct). Certified products must meet stringent government standards developed and established by NIOSH scientists along with industry experts. A product which bears a NIOSH certification label assures the user that the product has been tested by an independent agency and is consistently manufactured in accordance with a consistent and audited quality plan.

Q: Why do we need NIOSH standards for CBRN respirators?

A: NIOSH has traditionally established performance requirements for industrial respirators. The Military has traditionally established performance requirements for respiratory devices for the Military. The CBRN standards bridge these two jurisdictions to establish performance criteria for devices for people who respond to potential chemical, biological, or radiological incidents.

Q: Why do we have to buy NIOSH-approved CBRN respiratory protection?

A: The OSHA standards state that NIOSH-certified devices must be used when specified and where available. Until now, there has not been a specific approval for devices to be used in this sort of environment. Some government agencies are not required to comply with OSHA. Some states have local OSHA plans which supersede the Federal requirements. It is important to read and understand the local requirements as well as to assess the potential hazards. A CBRN-certified device will provide a broader range of chemical protection than even the standard military canister and the reassurance of third-party certification. Even if you do not require CBRN compliance, you must still use a NIOSH-approved device where one exists.

Q: Is there a shelf life for CBRN canisters?

A: Canisters are typically sealed in a bag or container that protects them from the environment. This is important since environmental exposure to ambient chemicals and moisture will affect the performance of the filter element. Provided that the integrity of the canister has not been violated, CBRN canisters can sit on a shelf, unused, for 5 years. Complete details are included in the instructions with each canister and gas mask.

Q: What other protection is needed from CBRN agents?

A: Besides respiratory protection, you will need complete body protection, such as total-encapsulating suits, gloves, boots, hoods, etc. Check with your MSA distributor for protective clothing information. ✪

Cyanide

A London plot to release cyanide gas on the Underground tube network was foiled with the arrest of three reported to have links to Al Quaeda.

Ricin

Evidence indicates that the international terrorists behind the Millennium Bomb Plot were planning simultaneous ricin attacks in Europe and the U.S. Though a deadly poison, ricin is a lightweight compared to anthrax. To match the killing power of one kilogram of anthrax, a terrorist would need four metric tons of ricin. But there is no treatment for ricin poisoning.

In 1978, Bulgarian author Georgi Markov died after getting hit with a ricin-filled dart while walking in London.

Sarin

On a Monday morning in March 1995, Aum Shinrikyo cultists released a cloud of impure Sarin gas in a crowded Tokyo subway. Even in dilute form, the chemical killed 12 and sickened thousands. Though they posed no threat in the U.S., the cult had an office in New York City, just a few blocks from the Times Square subway station.

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Examples of Chemical, Biological, Radiological, and Nuclear (CBRN) Hazards

Selected Agents & Threats

Agents	Indications	Characteristics, Comments
Chemical agents		
Cyanide	Rapid breathing, restlessness, dizziness, weakness, headache, nausea and vomiting, rapid heart rate. Exposure to a large amount of cyanide by any route may also cause these other health effects: convulsions, low blood pressure, slow heart rate, loss of consciousness, lung injury, respiratory failure leading to death.	Sometimes described as having a "bitter almond" smell, but it does not always give off an odor, and not everyone can detect this odor.
Mustard (HD)	Blistering of the skin and mucous membranes on contact. These symptoms may not occur for 2 to 24 hours: Red and itching skin; irritation, pain, swelling, and tearing in eyes; runny nose, sneezing, hoarseness, bloody nose, sinus pain; abdominal pain, diarrhea, fever, nausea, and vomiting.	Not found naturally in the environment, but can be carried long distances by wind. Smells like garlic, onions, or mustard. Color is clear to yellow or brown.
Ricin	Inhalation: coughing, tightness in the chest, difficulty breathing, nausea, and aching muscles. Within a few hours, the body's airways (such as lungs) become severely inflamed (swollen and hot), excess fluid builds up in the lungs, breathing becomes even more difficult, and the skin might turn blue. Ingestion: internal bleeding of the stomach and intestines that leads to vomiting and bloody diarrhea.	Easy to make. It takes a deliberate act to make ricin and use it to poison people. As few as 500 micrograms can kill an adult. Death comes within 36 to 48 hours
Sarin (GB)	Exposure through skin contact or eye contact. Runny nose, watery eyes small, pinpoint pupils, eye pain, blurred vision, drooling and excessive sweating, cough, chest tightness, rapid breathing, diarrhea, increased urination, confusion, drowsiness, weakness, headache, nausea, vomiting, and/or abdominal pain, slow or fast heart rate, abnormally low or high blood pressure.	Not found naturally in the environment, but clothing that has come in contact with sarin vapor can release sarin for about 30 minutes afterward, which can lead to exposure of other people.
VX	Exposure through skin contact, eye contact, or inhalation. Runny nose, watery eyes small, pinpoint pupils, eye pain, blurred vision, drooling and excessive sweating, cough, chest tightness, rapid breathing, diarrhea, increased urination, confusion, drowsiness, weakness, headache, nausea, vomiting, and/or abdominal pain, slow or fast heart rate, abnormally low or high blood pressure.	Most potent of all nerve agents. Odorless and tasteless. It's an oily liquid that is amber in color and very slow to evaporate. It evaporates about as slowly as motor oil.
Biological agents		
Anthrax	Inhalational anthrax (most lethal form): sore throat, mild fever, muscle aches and malaise Cutaneous anthrax: raised bump resembling spider bite within 1-2 days	Not contagious. Prophylactic inoculation available. Spores do not have a characteristic appearance (e.g., color), smell, or taste.
Botulism	Symptoms begin within 6 hours to 2 weeks (most commonly 12 to 36 hours) after eating food that contains the toxins. Double vision, blurred vision, drooping eyelids, slurred speech, difficulty swallowing, dry mouth, muscle weakness that descends from the shoulders down through the upper arms, lower arms, thighs, calves, etc.	Not contagious. Caused by a nerve toxin that is produced by the bacterium Clostridium botulinum. About 110 cases of botulism are reported yearly in the US.
Smallpox	Fever, malaise, head and body aches, and sometimes vomiting. The fever is usually high, in the range of 101 to 104 degrees F.	Contagious. Prophylactic inoculation available. Direct and fairly prolonged face-to-face contact is required to spread smallpox from one person to another. Also can be spread through direct contact with infected bodily fluids or contaminated objects (bedding, clothing, etc.). Can be carried by air in enclosed settings such as buildings, buses, and trains.
Plague	Fever, weakness, rapid onset of pneumonia, cough, shortness of breath, chest pain, watery or bloody sputum. Nausea and vomiting	Contagious through close contact. Incubation period one to six days. Five to 15 cases are reported in the United States each year.
Radiological /nuclear threat		
Dirty bomb	Radiological Dispersal Devices or "dirty bombs" combine conventional explosives, such as dynamite, with radioactive materials in the form of powder or pellets.	Radiation cannot be seen, smelled, felt, or tasted by humans. Washing reduces the amount of radioactive contamination on the body and thus effectively reduces total exposure. Taking potassium iodide (KI) tablets after an incident involving radioactive materials may limit the risk of ionizing radiation damage to a person's thyroid gland.

Source: Centers for Disease Control and Prevention. www.cdc.gov

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