



What's special about Chemical, Biological, Radiological, and Nuclear (CBRN) powered air-purifying respirators (PAPR)?

NIOSH Fact Sheet

This guidance will help respiratory protection program administrators, managers, and powered air-purifying respirator (PAPR) wearers understand the special features of a NIOSH-approved chemical, biological, radiological, and nuclear (CBRN) PAPR. These respirators have unique performance, use limitations, and storage requirements compared to NIOSH-approved industrial PAPR. The respiratory protection program administrator should assure that PAPR manufacturer recommendations are addressed. This information may also be used by managers and PAPR wearers to optimize personal protection.

NIOSH issues certificates of approval to CBRN PAPR as tight-fitting full facepiece gas mask respirators with canisters, referred to as “14G approval” and to PAPR’s with loose-fitting hoods and cartridges as “23C approval.”

When using, purchasing, or storing a CBRN PAPR, the requirements set by National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the manufacturer of the specific unit should all be taken into consideration. Remember, a 14G CBRN PAPR may be used for escape from an atmosphere that has become immediately dangerous to life or health, but a 23C CBRN PAPR may not be used in that situation. Additionally, approved CBRN PAPR must not be used in oxygen-deficient atmospheres or to enter an

atmosphere immediately dangerous to life or health.

OSHA defines an atmosphere immediately dangerous to life or health as follows: An atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere (29 CFR 1910.120(a)(3)).

What is the significance of the CBRN standards?

In October 2006, NIOSH implemented a voluntary approval program for CBRN PAPR. NIOSH CBRN PAPR standards and tests provide scientifically-based, industry-accepted evaluation criteria that establish levels of protection for approved respirators. These respirators are tested to ensure they meet these levels of protection against specified levels of CBRN agents. CBRN standards and tests significantly affect selection, use, and maintenance requirements of CBRN PAPR as compared to other NIOSH-approved industrial PAPR.

The complete CBRN PAPR standards and tests are posted on the NIOSH National Personal Protective Technology Laboratory (NPPTL) website at: <http://www.cdc.gov/niosh/npptl/respstds.html#approved> and



http://www.cdc.gov/niosh/npptl/stps/respirator_testing.htm#STP_APR_CBRN.

To ensure the proper care, effective use, and derive optimal protective benefits of a CBRN PAPR, a respiratory protection program administrator must be aware of the PAPR's unique performance capabilities, limitations of use and special storage requirements specified by the manufacturer. PAPR wearers should also be trained to fully understand and appreciate the unique characteristics of the CBRN PAPR in order to obtain optimal protection during use.

A NIOSH-approved 14G PAPR or 23C PAPR that is not approved with CBRN protection must not be used for protection against chemical warfare agents.

In addition, always refer to and understand the instructions provided with the PAPR. For complete instructions on PAPR batteries, it may be necessary to consult the instructions provided with the PAPR, battery, and battery charger.

How can one determine if a PAPR is NIOSH-approved for CBRN protection level?

Each NIOSH certificate of approval includes labels to be used by the applicant. To determine if a PAPR has been approved by NIOSH for CBRN protection, the full NIOSH approval label for the facepiece, canister, or cartridge should be consulted. A full approval label contains important information to assist users in understanding the respirator, its protections, cautions and limitations of

use, and approved assembly of components. This is a paper label provided with the PAPR blower, facepiece, canister, and cartridge.

The full approval label contains the following:

- Department of Health and Human Services (DHHS) and NIOSH Logos.
- NIOSH TC approval number—The NIOSH approval number (TC-23C-XXXX for loose-fit CBRN PAPR; TC-14G-XXXX for tight-fit CBRN PAPR) shown with row of components. “CBRN” is not contained in the approval number.
- Type and level of protection—The CBRN protection is listed with “CBRN” and a capacity level (e.g., CBRN Cap1, CBRN Cap2).
- Exact part numbers of the CBRN approved assembly of components listed in a row beginning with the NIOSH TC approval number.
- Caution and limitation statements.

Care must be taken to identify the components of the PAPR with CBRN protection because the full NIOSH approval label may contain approved component assemblies for CBRN PAPR or non-CBRN PAPR protections. The respiratory protection program administrator should assure the PAPR is assembled with the correct components for the required protection.

Labels attached directly to the CBRN canister or cartridge are most often adhesive labels and the printed labels appearing on their containers provide condensed information. The canister/cartridge label includes the NIOSH emblem, the applicant's name and

address, an approval number, protections (e.g. CBRN Cap1, CBRN Cap2), and cautions or limitations of use. It does not contain the listing of components required for the NIOSH-approved assembly.

Labels placed on canisters and cartridges are also color coded. The color of a CBRN PAPR canister or cartridge is olive. The color marking can be achieved by either the color of the label or the body of the component. Where the color marking is achieved by label color, the body of the component may be any color.

Other components such as the blower or facepiece of the CBRN PAPR assembly are not required to contain the NIOSH emblem or CBRN marking. Components are not required by NIOSH to be individually labeled/marked “CBRN”. Some manufacturers may label the actual components with CBRN logo but most do not. NIOSH requires that each respirator, respirator component, and container be labeled distinctly to show the lot number, serial number, or approximate date of manufacture of the component.

For more details on how to read a NIOSH approval label, refer to the NIOSH Fast Fact sheet on *NIOSH Approval Labels—Key Information to Protect Yourself*, posted on the NIOSH National Personal Protective Technology Laboratory (NPPTL) website at: <http://www.cdc.gov/niosh/docs/2011-179/>

How do CBRN PAPR testing procedures apply to real-world use?

Chemical Agent Permeation and Penetration Tests

These tests assure that under specified laboratory conditions the PAPR assembly of components, including the materials used in the respirator construction (facepiece, hood, valves, lens, hoses, gaskets, etc.) will resist chemical warfare agent migration through the completely assembled PAPR. The components of other NIOSH-approved PAPR and CBRN PAPR are not interchangeable even if they appear to be similar. NIOSH-approved industrial 14G and 23C PAPR are not tested against chemical warfare agent permeation and penetration.

Some NIOSH-approved CBRN PAPR require special components (e.g., eyepiece or lens outserts [protective coverings], mask skins/covers, breathing tube covers) that must be in place for the respirator to provide the CBRN protection level. These components are constructed of materials that resist permeation of chemical warfare agents.

Failure to use the approved eyepiece or lens outserts and/or the required protective covers as approved by NIOSH can result in permeation or penetration of warfare agents through the CBRN PAPR.

Both the 14G CBRN PAPR and 23C CBRN PAPR are tested by NIOSH to ensure they provide effective user protection for a minimum time period of at least eight hours. The 14G CBRN PAPR is also tested to ensure it would provide effective user protection for a minimum time period of at least 2 hours against liquid droplets. Therefore, neither type of PAPR should be utilized for more than eight hours and the 14G CBRN PAPR must not be utilized for

more than two hours if liquid drop exposure occurs. The 23C CBRN PAPR must not be used if liquid droplet exposure occurs.

A CBRN PAPR is considered to be contaminated and must be discarded after initial contact with any liquid or vapor phase chemical warfare agent, regardless of the duration or frequency of such contact. The entire CBRN PAPR must be decontaminated and disposed of in accordance with manufacturer's instructions and applicable regulations.

Canister Gas/Vapor Challenge and Breakthrough Concentration Service Life Tests

These tests evaluate whether gas or vapor will breakthrough (pass through the canister/cartridge) the CBRN PAPR under specific laboratory conditions.

NIOSH tests the canister or cartridge to the maximum laboratory service life specified by the manufacturer. For a service life of less than 60 minutes, the canister/cartridge capacity level is specified in 15-minute intervals. A designation of Cap1 refers to a laboratory-rated service life of 15 minutes, Cap2—30 minutes, and Cap3—45 minutes. The canisters and cartridges must meet or exceed the manufacturer's specified service life time during the laboratory test without exceeding the identified breakthrough concentration level.

Workplace conditions are rarely identical to laboratory-controlled tests. Therefore, the actual in-use service life of a CBRN PAPR may differ from the NIOSH laboratory-rated performance. A

change schedule should be established prior to using a CBRN PAPR.

Laboratory Respirator Protection Level (LRPL) Tests

The respirator's ability to fit a wide range of facial sizes and shapes and the clarity of facepiece size selection and donning instructions are assessed by this test.

These NIOSH laboratory tests do not preclude the need to conduct an individual fit test of the CBRN 14G PAPR facepiece as required by OSHA. Manufacturers may specify a quantitative fit factor higher than that required by OSHA. For example, where OSHA requires a fit factor of 500 for a tight-fitting full facepiece the PAPR manufacturer may recommend a quantitative fit factor as high as 2,500. Care must be taken by the respiratory protection program administrator in assuring a proper fit for each wearer as specified in the manufacturer's user instructions.

Always refer to the manufacturer's use instructions included with each CBRN PAPR facepiece for the recommended minimum quantitative fit factor.

What are the minimum packaging requirements?

The 14G CBRN PAPR and its required components are subjected by NIOSH to environmental and durability conditioning tests conducted in the manufacturer-specified minimum packaging configuration (MPC).

The MPC is the protective packaging in which the end user must store or maintain the CBRN PAPR and the

required components. Failure to store the CBRN PAPR in the manufacturer's recommended MPC may allow damage to occur that could render the PAPR unable to provide the expected level of protection. Damage may not be detectable by the wearer prior to use.

Examples of common MPC's include hard plastic carriers, clamshell containers, canvas carry bags, drawstring plastic bags, or vacuum sealed bags. Each manufacturer is likely to have unique packaging requirements. The manufacturers' use instructions and the full NIOSH approval label will identify the MPC.

In addition, both the CBRN canister and cartridge packaging and vacuum or airtight-sealed wrapping is commonly marked with a shelf life date. The canister/cartridge can be used up to this expiration date if it has been maintained as specified by the manufacturer. The canister/cartridge should not be used if this date has been exceeded. Always store the canister or cartridge as described by the manufacturer (packaging, environmental temperatures and humidity, etc.). For 14G CBRN canisters stored in an MPC, and do not use the canister or cartridge if the vacuum or airtight sealed wrapping is damaged.

Can an industrial PAPR be retrofitted or upgraded to the CBRN protection level?

NIOSH-approved industrial PAPR can be retrofitted with the proper components to provide CBRN PAPR protection level provided:

- The retrofit is performed according to the manufacturer's instructions using the manufacturer's retrofit kit specific for upgrading that PAPR model to CBRN protection.
- Respirators to be retrofitted must be in "fully operational and protective condition" (less than five years of prior service as an industrial respirator as part of an OSHA-compliant respiratory protection program).
- The retrofit kit must contain the following: CBRN PAPR retrofit kit instructions; replacement packaging, components, parts, materials; CBRN canisters or cartridges.
- The PAPR must be assembled to the identical assembly of the NIOSH-approved components, including the minimum packaging configuration for tight fitting CBRN PAPR.

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DHHS (NIOSH) Publication No. 2013-156

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September 2013

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4676 Columbia Parkway
Cincinnati, OH 45226-1998

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Penalty for Private Use \$300

