National Personal Protective Technology Laboratory

NIOSH O_2 Prohibition for Entry in High Radiant Heat and Open Flame Environments while Wearing Oxygen Devices

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Current Prohibition – (Federal Register, Vol. 50, No. 222, pages 47456 – 47457 dated Monday, November 18, 1985)

Available information does not demonstrate to the satisfaction of NIOSH that positive-pressure closed-circuit self-contained breathing apparatus which use a breathing gas of pure oxygen can be used during direct exposure to open flames and/or high radiant heat and assure the wearer's safety. Therefore, NIOSH has determined that until it has been demonstrated to the satisfaction of NIOSH that those devices can be worn under such conditions, it is prudent to presently limit the use of positive-pressure closed-circuit self-contained breathing apparatus which use pure oxygen breathing gas to mines and mining atmospheres which do not involve exposure to open flames or high radiant heat.

Heat and Flame Testing Conducted

- Intertek – June 8, 2005
- Dekra EXAM – July 25, 2007
- Intertek – March 19, 2008

Intertek Testing 2005

- **Treatment**
  - Section 8.11.5 of NFPA 1981, 2002 Edition:
    - Exposed to 95°C for 15-minutes.
    - Exposed to direct flame contact for 10-seconds.
    - Raised 150 mm and dropped freely.
    - Note: Tests conducted without live oxygen cylinder.
  - Used equipment from 2 manufacturers.

Intertek 2005 - Results

- **Problems noted:**
  - After flame beyond 2.2 seconds:
    - Hose
    - Harness
    - Facepiece hose connector
  - Hole burnt through the hose.
  - Hole burnt through the facepiece hose connector.
  - Backpack fell off the mannequin.
  - Bypass valve was fused shut.
  - Oxygen bottle strap was burnt through.

Note: Tested CC-SCBAs were not hardened for heat or flame test.

ABMS Testing Results after Retrofitting

- Unit #1
  - No difference from untreated units.
  - Test terminated at 240 minutes, empty.
- Unit #2
  - No difference from untreated units.
  - Test terminated at 167 minutes, empty.
- Conclusions: Heat and flame treatment did not adversely affect the performance.

Dekra EXAM Testing - 2007

- **Treatment**
  - Department 8 of the Association for the Promotion of German Fire Safety, Guideline 0802
    - Exposed to 95°C for 15-minutes.
    - Exposed to direct flame contact for 10-seconds.
    - Raised 150 mm and dropped freely.
    - Simulate a leakage of 2.5mm.
    - Note: Tests conducted with live oxygen cylinder.
  - Used equipment from one manufacturer.

Dekra EXAM 2007 - Results

- **Problems noted:**
  - None – met requirements of EN137, Section 6.11.2.2, Flame Engulfment.

Note: CC-SCBA tested was hardened for the heat or flame test.

Intertek Testing 2008

- **Treatment**
  - Section 8.11.5 of NFPA 1981, 2002 Edition:
    - Exposed to 95°C for 15-minutes.
    - Exposed to direct flame contact for 10-seconds.
    - Raised 150 mm and dropped freely.
    - Note: Tests conducted with live oxygen cylinder.
  - Used equipment from 2 manufacturers.

Intertek 2008 - Results

- **Problems noted:**
  - Both units had an after flame greater than 2.2 seconds.
  - One unit did not function per the manufacturer's requirements after flame exposure. The sample had a small flame on the lower left side of the face piece. This caused a leak into the mask, which engulfed the unit into flames during the post test airflow.

Note: CC-SCBAs tested were hardened for the heat or flame test.

NIST Research

- **Background**
  - Objectives
    - To develop a computational fluid dynamics (CFD) simulation of the outward leakage of oxygen around the facepiece of a closed circuit breathing device .
    - To experimentally validate the simulation
  - Partner
    - NIST Buildings and Fire Research Laboratory

NIST Conclusions

- **Oxygen expelled through leak in respirator is propelled away from head region through advection and dissipates through diffusion.**
- **Risk of flammable mixture near head is observed in 10 % propane environment.**
  - This is an extreme environment (fuel-rich, near flammable mixture).
- **In case of flammable environment, oxygen leak results in small fuel-lean region near head.**
- **In fuel-lean environment, oxygen further decreases fuel concentration.**
- **NIST Technical Note 1484, "A Computational Model of Dissipation of Oxygen from an Outward Leak of a Closed-Circuit Breathing Device" available at this link, http://fire.nist.gov/bfrlpubs/fire07/PDF/f07024.pdf chronicles the research work completed by NIST.**

Input Sought on Prohibition

- Opinion on the current prohibition.
- Supporting data to maintain, modify, or rescind the current prohibition.
- What, if any, additional research is needed to support rescinding the prohibition.
- Willingness to participate in a collaborative agreement with NIOSH/NPPTL to conduct research on this topic and support willing to provide.
- Other comments on the subject.

Reevaluation of NIOSH limitations on and precaution for safe use of positive-pressure closed-circuit self-contained breathing apparatus Docket # NIOSH-123

Stakeholder Input can be submitted by

- Mail:

NIOSH Docket Office

Robert A. Taft Laboratories, M/S C 34

Reference: Reevaluation of NIOSH limitations on and precaution for safe use of positive-pressure closed-circuit self-contained breathing apparatus, Docket # NIOSH-123

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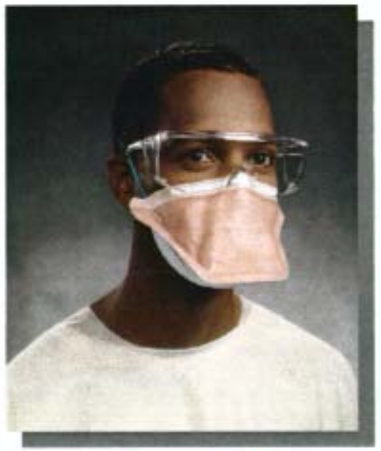
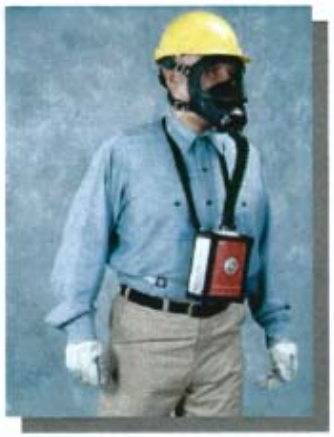


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