

**SENSITIVITY OF A COMMERCIALY AVAILABLE QUALITATIVE FIT
TEST AGENT (DENATORIUM BENZOATE) IN FULL FACE RESPIRATORS
WITH FIXED LEAKS VERIFIED WITH CONTROLLED NEGATIVE
PRESSURE QUANTITATIVE FIT TESTING**

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ABSTRACT

In this research, a solution of Denatorium Benzoate (Bitrex™, Macfarland Smith Ltd., Montvale, NJ), developed and commercialized by 3M Corporation for qualitative fit testing (QLFT) of respirators was evaluated for its ability to be detected in the presence of controlled fixed leaks in full-face respirators. Prior to inducing leakage, 26 subjects wearing a full-face respirator were evaluated with a Controlled Negative Pressure fit test system (CNP) to verify a fit factor above 500. Then, a controlled leak was induced by loosening (i.e. turning) the exhalation valve retainer, without perturbing the respirator's fundamental fit, until a nominal fit factor between 60 and 100 was obtained by CNP. A qualitative fit test using a commercial solution of Bitrex™ was conducted using a modification to the OSHA protocol. This was accomplished by substituting the head straight-ahead maneuver for the entire protocol to prevent additional sources of leakage. The data were analyzed to see if they supported the null hypothesis that there is no significant sensitivity in qualitative respirator fit testing as measured by taste of the commercial solution of denatorium benzoate (Bitrex™) for detecting fixed leaks in full face respirators equipped with high efficiency particulate filters and having an average fit factor slightly less than 100 measured with QNFT.

For the test of sensitivity we followed, the ANSI Draft Guidelines Z88.10 for validation of fit test methodologies that states that those subjects with a fit factor less than 100 must detect the test agent greater than 95% of the time.

We found that only 23% of participants were able to taste the Bitrex™ Test Solution through a leaking exhalation valve retainer with a mean fit factor of 89, a range of 71 to 96, and a mean percent leak of $\pm 1.123\%$.

The results reflect a dramatic 77% of False Negatives (accepting an inadequate fit) when the commercial solution of denatorium benzoate – Bitrex™ - is used for fit testing in North™ full-face respirators models 7600 with induced leaks and fit factors less than 100.

Dedication

To my mother Mrs. Luisa Maria Medina de Rodriguez, in appreciation for her continuous love, spiritual support and for inculcate early in my life constancy and perseverance in all my endeavors. Father, you would have been proud.

To my wife Sonia, who ease my hard days with her deep love, comprehension, and, encouragement.

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