Respirator Workplace Protection Factor Studies

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Supplied Air
Abrasive Blasting Helmet

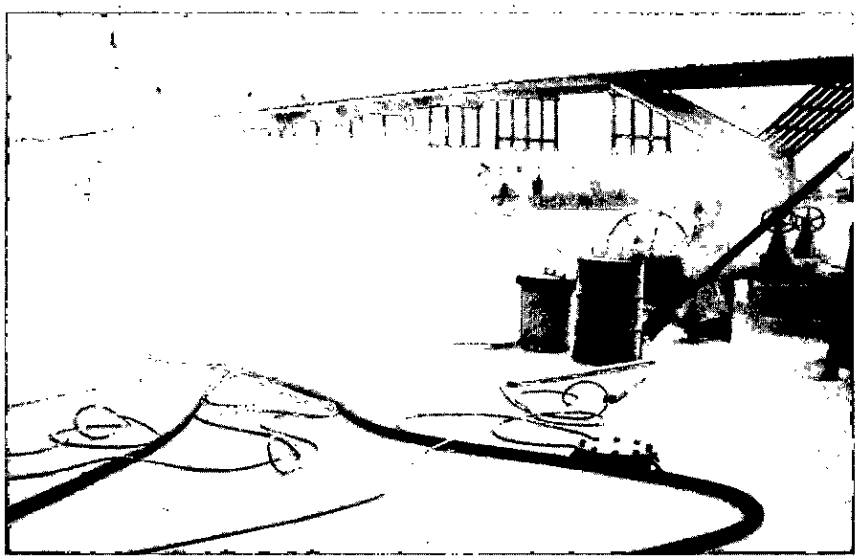
Study Objective

Assess the Workplace Protection Factor (WPF) for a supplied air, abrasive blasting helmet and approved components.

The WPF is the result of the effective protection provided by a respirator during the actual work tasks.

$$WPF = \frac{\text{Outside Sample}}{\text{Breathing Zone Sample}}$$

Four workers were studied while using silica sand grit to blast paint from a flat top barge.



Product Evaluated

Four NIOSH approved 3M Whitecap® II abrasive blasting helmets (model W-8100) combined with the following approved supplied air components:

Breathing Tube (W-5114)

Vortex Air Control Valve (W-2862)

50 Feet of Compressed Air Hose (W-9435-50)

Sample Set-Up

Each worker was equipped with three Spectrex™ sampling pumps (PAS 3000), tubing, filters, and cyclone.

Pump	Filter Size (mm)	Type (μm)	Placement	Sampling (LPM)
Total Dust	37	0.8 Polycarbonate	Lapel, Breathing Zone	2
Respirable Dust	37 (Placed in Cyclone)	0.8 Polycarbonate	Lapel, Breathing Zone	1.8
Inside Sample	25	0.8 Polycarbonate	Ben Liu Probe (Faceshields)	1.5

Sampling pumps were calibrated daily and checked for proper liter flow three times daily.

Calibration was performed using a TSI model 67 mass flow meter with a linear signal conditioner.

Sampling Procedure

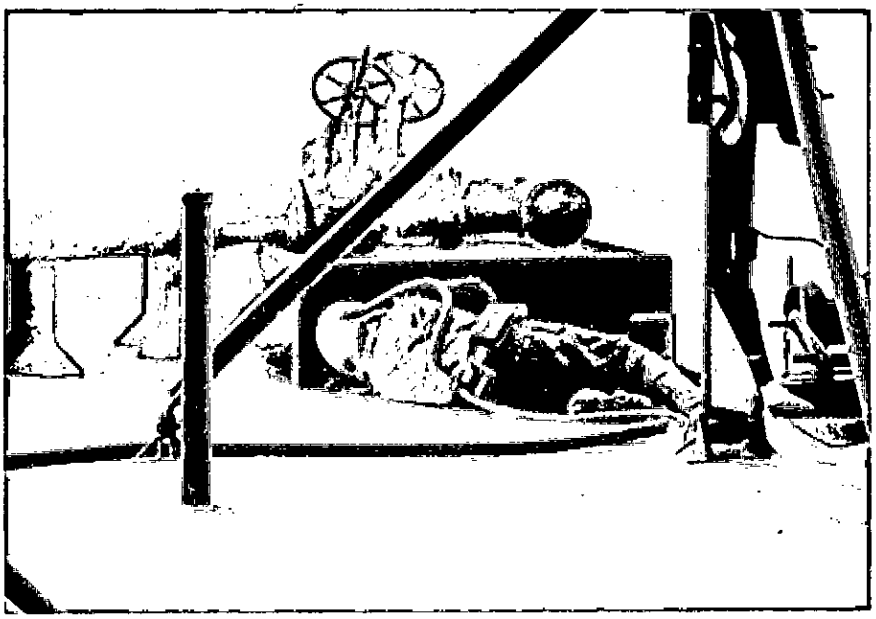
Workers were assisted with donning the helmet and placement of the sampling equipment.

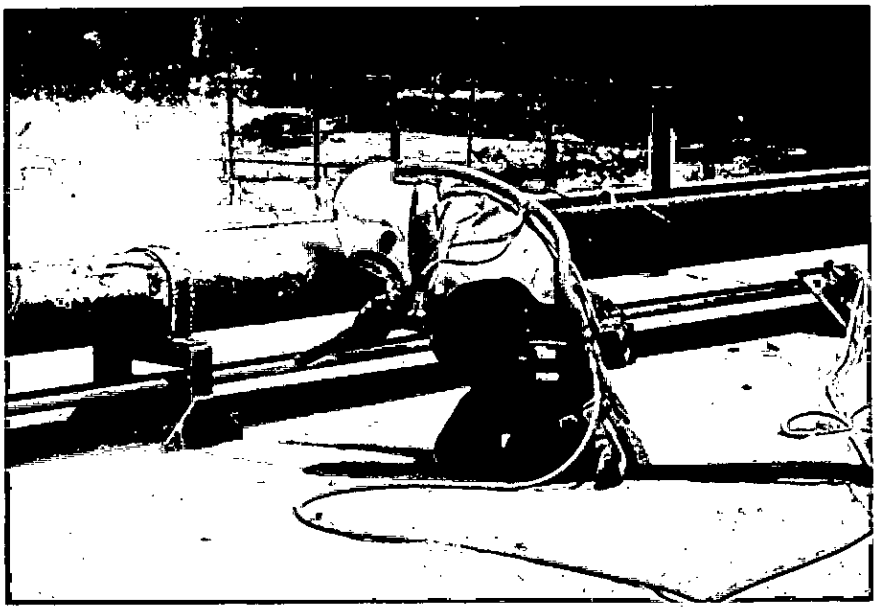
Work performed did not deviate from the normal scheduled routine.

Sampling periods ranged from 30 minutes to one hour for three days.

Each worker was observed at all times during sample collection to ensure proper use, wear time, and sample validity.

Samples were obtained at minimum and maximum flows into the helmet by adjustment of Vortex Control Valve





Sample Analysis

Sample analysis was done by proton induced X-ray emission (PIXE).

PIXE analysis is performed by bombarding protons onto the captured filter elements. An X-ray is emitted that will identify the composition and quantity of the substances.

Advantages:

Excellent sensitivity (10 to 100 $\mathscr{N}$g).

Simultaneous analysis of multiple elements.

Nondestructive to the filter or elements.

Results include confidence levels.

Results

WPF results were derived by the following calculations.

1. Blank levels were determined by PIXE analysis.

2. Blank levels were averaged to determine the mean value.

3. The mean blank value was subtracted from all inside and outside samples.

4. All outside samples used in the final calculations were greater than 500X the mean blank value.

5. $$\text{WPF} = \frac{\text{Outside value}}{\text{Inside value}}$$

Results

Respirable Dust
Values Are 500X Above The Blank Level

	Sample Size	Geometric Mean	Geometric Std. Deviation	5th Percentile
Total Samples	13	4023	2.1	1096
Minimum Flow (6.7 cfm)	8	3600	1.9	1154
Maximum Flow (14.4 cfm)	5	4808	2.4	916

All values expressed with a 95% confidence level

Summary

The ANSI Z88.2 1986 Committee on Practices for Respiratory Protection has proposed a revised respirator protection factor of 500X the permissible exposure limit (PEL) for continuous flow supplied air helmets.

The workplace protection factor (WPF) for this study achieved a geometric mean of 4023 and a fifth percentile of 1096.