

Interoffice Memorandum

TO (Name and Location)	DATE
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FROM (Name and Location)	REFERENCE NO.
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QUANTITATIVE FIT-TESTING

The purpose of this letter is to summarize Bishop's need for quantitative fit-testing of employees required to wear respirators. As you know, the Occupational Safety and Health Act (OSHA - 29 CFR 1910.134) requires that employees receive instruction on the proper "selection, use, and maintenance" of respirators. In addition, "Training shall provide the men an opportunity to handle the respirator, have it fitted properly, test its face piece to face seal, wear it in normal air for a long familiarity period, and finally, to wear it in a test atmosphere."

Respirator fit-testing is essential training for employees required to wear respirators on the job. When properly conducted, it can become a positive teaching tool, giving the employee greater confidence in his/her equipment and the protection that it affords, if it is in good condition and worn according to the manufacturer's instructions.

A number of different respirator fit-testing procedures are being used within the Chemical Company. The qualitative methods use either irritant smoke (Bay City, Pampa), isoamyl acetate (banana oil) or sodium saccharin.

Bishop has designed a Freon 12 quantitative fit-testing trailer but has had difficulty in making accurate and reliable measurements using a halide meter, normally used as a qualitative rather than true quantitative instrument. As a result, a corn oil (aerosol) system is being investigated which has the sensitivity to measure protection factors as high as 100,000. Clear Lake is presently reviewing respirator fit-testing methods available for use.

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Of the qualitative fit-testing procedures available for use, the isoamyl acetate test is very subjective, "the validity of the test result depends on honest indication by the respirator wearer as to whether or not an odor was detected during the test". Isoamyl acetate vapor as a test agent has two major draw-backs:

- a. The odor threshold varies widely among persons.
- b. Olfactory fatigue may cause a person to fail to detect the odor.

Some manufacturers have improved the reliability of this test by testing employees in a hood or chamber containing a known concentration of isoamyl acetate in the air. Still, the method requires that before performing the test, employees must be tested to determine their ability to detect the odor in air. In addition, air-purifying respirators must be equipped with an organic vapor cartridge or cannister.

Disposal dust masks, used widely in the Bishop Engineering Resins Plant, cannot be fitted using isoamyl acetate. However, the irritant smoke test, using an acid mist or titanium tetrachloride, (also stannic or stannous oxychloride) can probably be used with the 3M disposable respirators, since 3M has developed a "beefed-up" probed disposable dust respirators for use in DOP or corn oil aerosol test methods. According to 3M, irritant smoke has a wide particle diameter range of 0.1 micron to 25 microns. Since the "beefed-up" 3M respirators are not high efficiency Hepa filters, some particles or free HCl molecules may pass through the filter. Although the irritant smoke methods are less subjective than isoamyl acetate, the method is still subjective (smokers would be less irritated to the irritant smoke than non-smokers) and there are questions of adverse health effects.

3M has developed a sodium sacharin (sweetner) test that is sprayed into a hood (covering the head only: FT-10 Fit-test Apparatus) or directly around the edges of the respirator. This test is based on the employee detecting a sweet taste in his mouth, since he must breathe with his mouth open. This method is similar to the isoamyl acetate test and requires the honest response of the employee. 3M has improved the reliability of this test by first requiring a sensitivity test prior to the actual fit-test. A very dilute solution of sodium sacharin is sprayed into the test subject's mouth. If he or she can detect the sweet taste, the fit-test can proceed. If not, the test method cannot be used. 3M developed this method for their disposable respirators since the aerosol particle range of sodium sacharin in air via a nebulizer is very narrow. In addition, the particle diameter size is about 2 microns, large enough that special Hepa filters or "beefed-up" filters are not required to conduct the test. This test was approved for use in the OSHA lead standard and according to 3M results in the individual having achieved a protection factor of 100.

Except for the irritant smoke method, in which respirator leakage results in the involuntary coughing of the test subject, the qualitative methods are relatively subjective (based on the sensitivity of the individual) and require the honest response of the employee. Quantitative methods are not subject to these limitations. There is no odor associated with Freon 12 or DOP/Corn Oil Aerosol methods. In addition, these methods yield a quantitative estimate of how well a respirator fits, before and after training, when shaved or unshaved, with the respirator properly worn or improperly worn. As such, these methods can be used to teach how to wear a respirator properly. Finally, these methods (especially the corn oil method) have the sensitivity to be used for supplied air respirators. The corn oil method uses a particle analyzer that can measure protection factors as high as 100,000.

RECOMMENDATIONS

The Bishop Plant is unique to the Chemical Company in that there is a high potential for dust exposure in the Engineering Resins facility. For this reason, it is necessary to use a safe quantitative method for fit testing such as the corn oil system. This system will insure that dust masks and respirators fit properly and give maximum protection.

Another concern is the high protection factors required when screening fire crew members using Scott Air Packs or Bio-Packs. Although some of these are positive pressure masks, they still require a very high protection factor which you cannot measure with a qualitative test system.

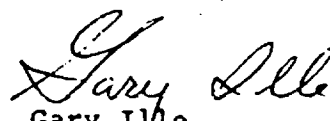
Finally, Bishop is concerned about the subjectivity involved with the qualitative fit-testing methods. Many questions arise about the validity of an isoamyl acetate test system or sacharin or the safety aspects of irritant gases.

For the above mentioned reasons, the Bishop Plant strongly recommends using the corn oil test system. The existing freon test system can easily be converted to a corn oil system. Prices and components for the system are shown below.

<u>Model 264 Portable Test System</u>	
w/o collapsible test chamber	\$8,269
Consumable spare parts kit	788

<u>Modifications to Existing Respirator Trailer</u>	
a) Modify ceiling & floor of chamber	2,000
b) Set up & connect Model 264	---

GI/rgs


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