irritant gases. Even though this is not approved practice, it has been frequen... and safely used with a modified gas-mask facepiece in certain situations. Th... apparatus protects the wearer against atmospheres deficient in oxygen, as well as from contaminants immediately dangerous to life. However, in the use of the device as well as the hose mask, the wearer is limited by what the skin will endu... either from the standpoint of irritation or absorption—for instance, in atmosphere containing hydrogen cyanide. The oxygen-breathing apparatus is the heavy respiratory protective device, and is a rather complicated mechanical apparat... It requires training and experience in its use and maintenance, and it is impor... that the wearer have a clear understanding of its mechanical parts before attempting to wear it into an immediately dangerous atmosphere. Since all state codes and the ASA code covering approved respiratory protective devices, are based upon the results of the approval tests of the United States Bureau of Mines, it is logical to be guided by the current list of approved devices from the Bureau...

3. *Newly Developed Air- or Oxygen-Supplying Devices*

New and somewhat simplified self-contained air- or oxygen-supplying devices utilizing compressed air or oxygen, as well as self-contained oxygen-breathing apparatus having potassium peroxide regeneration cartridges to supply oxygen and remove carbon dioxide, have found useful application. Each cylinder or canister for these devices is approved for either 30 or 45 minutes use. These devices are simplified and more adaptable to certain industrial uses than the conventional type. However, they require training and experience for their ... use and should never be considered as either foolproof or as simple as a gas mask...

C. UNAPPROVED EQUIPMENT

There are many unapproved devices offered for sale to be used in many situations, but before selecting one of these devices it is well to consider the responsibility involved. If a respiratory protective device is proposed as a means of preserving health, or of saving a life in the event of an emergency, it is not something one can take chances with in order to save a few cents or to obtain a favorite salesman. If the atmospheric contaminant is harmful, or suspected of being harmful, and United States Bureau of Mines approved respiratory protective devices are provided, there is evidence of an attempt to protect the health of the persons involved; but if unapproved devices are provided, negligence might be inferred. Few employers are in a position to establish the efficiency of respiratory protective equipment by dependable experimentation, and in the main they are therefore dependent upon outside advice. To use unapproved equipment in industrial situations is to assume the role of guinea pig to find possible shortcomings.

[1] *List of Respiratory Protective Devices Approved by the Bureau of Mines*, obtainable currently from the U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Penna.

1. *Filtering Efficiency against Paint Mist*

The percentage collecting efficiency of a respirator is perhaps not of as much importance as is the amount of contaminant passing through the filter under various circumstances, because the amount passing through the filter determines the degree of a workman's exposure. It is only fair to state that practically any mechanical filter arrangement will remove some particulate matter from the air passing through it. Where the exposure is a borderline one, that is, near or only slightly above accepted "safe" practice, a device of low efficiency may lower the exposure to within accepted limits. This is, of course, not true of gases or solvent vapors, as these are not affected by mechanical filters. Table 2 indicates the

TABLE 2

Filtering Efficiency of Respirators in Paint Mist

Filter material	Resistance (inches of water) to air flow at 85 liters/min.		Lead (mg./cu. m. in air)		Filtering efficiency (per cent)
	Before test	After test	Before filter	After filter	
Source ...	0.3	0.3	395	63	84.0
... ply	1.0	1.6	397	10.7	97.3
... ply	0.2	0.6	374	15.0	96.0
... plies	0.5	0.9	353	6.0	98.3
... tissue paper, 4 plies	0.5	0.8	498	39.8	92.0
Cotton flannel, 2 plies	0.2	0.4	458	22.9	95.0
... ply cheesecloth	0.05	—	450	117.0	74.0
... wool between cheesecloth	0.2	0.2	351	21.1	94.0
... cartridge with 20 plies of fuzzy tissue paper	3.5	4.4	524	1.6	99.7

... efficiency of some unapproved respirators in restraining lead in paint-spray mist.[1] The tests upon which the table is based were conducted for approximately one-half hour at an air flow of 32 liters per minute.

Although each of these materials has an efficiency of 74 per cent or better, none approaches the requirement of delivering air having less than 0.15 mg. lead per cubic meter of air. These tests indicate that even a layer of absorbent cotton between cheesecloth may remove 90 per cent or more of the lead pigment in paint mist. For an isolated short exposure with no other protection available, this would be worth while. However, when a workman is exposed to a mist containing, say, 350 mg. lead per cubic meter, his exposure through the respirator would still be over 100 times that of accepted safe practice. Obviously, percentage efficiency is not an acceptable means of rating respirators. The significant factor is the amount of leakage through the filter and such is now used in...

[1] E. G. Meiter, F. H. Gibson, *U. S. Pub. Health Service Bull.* No. 177, 1928.