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# Health Protection in the Rubber Industry: Engineering Control

By WILLIAM E. McCORMICK
Industrial Hygienist, The B. F. Goodrich Company

With very few exceptions, the industrial health hazards of greatest import to the rubber industry are those accruing from inhalation of toxic vapors, dusts, and fumes, and from skin effects of various compounds. We have learned much during the past few years with respect to the proper handling of these materials. It is not so much now the question of determining the "know how" for safely using these items, as it is to see to it that accepted control measures are being used.

From the standpoint of number of personnel, exposure to solvent vapors seems to constitute the largest health problem. Fortunately the bulk of the solvents used are of the less toxic type. The control measures which can be generally used are substitution, enclosure, and ventilation.

Substitution is the replacement of a toxic material with a less toxic one without loss of productivity. As an almost classic example the replacement of benzol by less toxic solvents—particularly petroleum distillates in the rubber industry—might be mentioned. There are very few cases where the use of benzol as a solvent is a "must." Usually less toxic ones can be found. Numerous other examples can be cited such as the use of trichlorethylene or perchlorethylene in place of more toxic carbon tetrachloride, tetrachlorethane, or ethylene dichloride; also, the use of ethyl in place of methyl alcohol. It should be remembered of course that the mere substitution of a less toxic compound for a more toxic one does not in every case solve the health hazard. Additional control measures may be required. However, it is the first method which should be investigated.

Very frequently enclosure or even complete isolation of a hazardous operation can be effectively used as a control measure. Mechanical ventilation or personal protective equipment may be required in addition. Recently my company had occasion to handle, on a pilot plant scale, one of the more toxic compounds. It was found that the construction of a small temporary building completely isolated from the remainder of the plant, was the safest—and cheapest—method of using the material. The process was carried out in a closed system, but the isolation was necessary as a precaution in case of accidental leaks. Many chemical manufacturing operations, fortunately, can be completely enclosed. In many cases the use of elevated pressures makes this mandatory and, thus, to a large degree controls any health hazards.

The type of control one finds most frequently and I might say promiscuously practiced, is that of exhaust ventilation. Unfortunately it is often used incorrectly. Its use involves more than just locating a wall fan in the general area and moving a large volume of air. Each process involves individual study, and the type and amount of ventilation needed should be carefully determined. By this method the contaminant can be controlled at its source—a "must" in many instances. Even in those cases where general ventilation might be adaptable, the use of local exhaust ventilation is often indicated due to its utilizing a much lower quantity of air. The added initial cost is often cheaper in the long run due to lower heat losses and lower power consumption resulting from less air exhausted. Only a careful study of each individual process can determine this.

Any industrial health control measure should be instituted on the basis of certain basic industrial hygiene engineering principles.

1. It must control the hazard. This requires a thorough study of the process involved, including the raw materials, the products and by-products, quantitative measurements of atmospheric contaminants, and duration of exposure of working personnel. Our present knowledge of industrial hygiene enables us to say that any known health hazard can be controlled. It is a question of adapting the proper measures to the specific problem. No better proof of this than the manufacturing processes related to the atomic bomb is needed. No evidence of health injury to any employee of this vast project has been observed.

2. It must be economically practical. The