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Health Protection in the Rubber Industry: Engineering Control

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THE OLD ADAGE of "An ounce of prevention is worth a pound of cure" is a truism in industrial health, and the key to the prevention of occupational disease is proper engineering control. The rubber industry has always been, by its very nature, a user and processor of chemicals, but it has been within the past few years that this has become especially true. As an industry we are now processors and, in some cases, manufacturers of huge quantities of many different chemicals. In order to properly safeguard the health of working personnel and concomitantly protect the best interests of the company, the necessary methods for using safely these various materials must be followed.

With possibly 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 dermatitis 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 that accepted control measures are being used.

From the standpoint of number of personnel, possibly exposure to solvent vapors constitutes the largest health problem. Both for this reason, and because time does not permit a more lengthly discourse. reference will be made to the general industrial health control methods which are applicable to this group of materials. 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

QUITE frequently a toxic material can be replaced with a less toxic one without loss of productivity. As an almost classical example now, 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 alcohol in place of methyl. 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.

Enclosure or Isolation

VERY FREQUENTLY enclosure or even complete isolation of a hazardous operation can be effectively used as a control measure. Again, this may not in itself completely control the hazard; mechanical ventilation or personal protective equipment may be required. Recently our company had occasion to handle on a pilot plant scale one of the more toxic compounds. After investigating the various possibilities of control, 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 make this mandatory, and, thus, to a large degree controls any incident health hazards. In other cases, particularly at the institution of process, enclosure can be effectively and economically used.

Ventilation

The type of control one finds most frequently is that of exhaust ventilation. Unfortunately it is often used incorrectly. Its

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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 carefully determined. In many cases general ventilation—either natural or mechanical—is satisfactory. In others, usually those involving exposure to the more toxic materials, local exhaust ventilation is a necessity. 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 times cheaper in the long run due to lower heat losses and lower power consumption resulting from less air exhausted.

Only the most careful study of each individual process can determine this. The type of installation made should be on the basis of both effectiveness and economy of control. Enclosure should be used to the maximum extent with any local exhaust ventilation.

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. The control measures must be sufficiently effective to maintain a safe working environment for 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.

2. It must be *economically practical.* The ideal method of instituting health control measures is in the initial design of the plant or process. However, one must frequently work with existing equipment. Redesign may not be economically possible. The writer recently had occasion to review a graduate engineer's paper dealing with the control of a health hazard. The proposed solution was theoretically excellent, except that the manufacturer would have been put out of business financially in order to effect the control measures proposed. Industrial health and safety still need to be sold. Every opportunity should be taken to indicate means of writing off the expenditures involved in lower compensation costs, lower absenteeism, better employee-employer relationships, less product contamination.

3. It must not *interfere with the employee's production.* This is particularly true of those operations involving piecework wages. Little comment on this is necessary. The location of exhaust hoods and ventilating equipment must be such as not to interfere with production. Personal protective equipment particularly respiratory, should be used only as an adjunct to other control measures, or where other measures are wholly impractical. Notwithstanding the fact that many commercial respirators are efficient devices, working personnel resist wearing them and often will do so only when actually compelled to. This, of course, is usually impractical, and frequently impossible.

4. It must *meet local and state codes.* This is particularly true with respect to maximum allowable concentrations of atmospheric contaminants, ventilation codes, and the release of atmospheric contaminants out of doors. Little uniformity exists between different states and municipalities with respect to these various codes. Some are only advisory; others are legal statutes. A thorough investigation should be made of any existing codes before an installation is made. Following the installation, the necessary measurements should be made to determine the effectiveness of the control.