THE EFFECT OF INDIVIDUAL SENSITIVITY AND PHYSICAL EXERTION IN POISONING WITH SMALL DOSES OF TOXIC SUBSTANCES

F. KALOYANOVA-SIMEONOVA

Institut po ochrana na truda i professionalni zaboljavania, Sofia, Bulgaria

The safety limits of the concentrations of toxic substances in industrial plant are considered essential and have already been introduced in our country. Maximum allowable concentrations (M.A.C.'s) have been established for a large number of chemical substances. Nevertheless, there is incomplete agreement among our medical specialists in hygiene as to the importance of M.A.C.'s of chemical compounds in industrial air. Some consider that M.A.C.'s are in fact an admission of our shortcomings in the face of the poisonous content of the atmosphere which is due to the backward state of the technology.

As in many other countries, we define as the " maximal allowable concentration " that concentration which does not cause even the slightest symptoms of poisoning as the result of daily work over the whole working life of a man. Such a concentration can be determined only if sufficient data are available on even the smallest changes in the organism caused by the substance in question. The effect of many possible synergistic and antagonistic factors must also be kept in mind.

We consider that, in determining the allowable concentrations, individual sensitivities, and various factors which affect the resistance of the organism to these substances, must be taken into account.

It is recognized in toxicology that different organisms react differently to poisonous substances. In our country, as elsewhere, workers who are in contact with such substances are given regular medical examination. In this way, those persons with a lowered resistance and those with pathologically changed organs can be eliminated. However, all persons are liable to periods of lowered resistance after operations, illnesses, overwork, *etc.*, and this condition is often missed by the factory doctor. It is because of this that we consider that the *personal*, individual sensitivity, and all factors affecting the organism's resistance, must be taken into account in defining the allowable concentrations. We shall now adduce some of our results in support of this.

We noticed in our experiments with parathion on animals that there were striking differences between individuals. We therefore treated guinea pigs with single doses of $LD_{50}/10$ or $LD_{50}/2$. The activity of serum cholinesterase and the white cell blood count were used as indications. We found that at the low doses there were marked differences between individuals; at the higher dose of $LD_{50}/2$, the reaction was the same for all individuals. The interesting fact was observed that, at both doses, the time

for recovery varied from individual to individual. The recovery time is related to the functional and material accumulation of the substance and determines the likelihood of chronic poisoning.

We shall now consider another factor which affects the organism's resistance: physical exertion. We carried out experiments on rats with small, near-threshold doses of tetra-ethyl lead. The rats were tired by being made to swim; one group was conditioned to this work, in the other exhaustion was induced. As indicators of poisoning, we used a set of stereotyped conditioned reflexes. Small, repeated doses of tetra–ethyl lead, in the group which was exhausted by the exertion, produced a more rapid intensification of the process of inhibition and the time required for the conditioned reflex to die down was shortened. The trained animals showed disturbances of the conditioned reflex activity after a much longer time.

These experiments show that physical exertion may lead to two opposite effects in the reaction to poisonous substances: exertion which results in training gives a higher resistance, while exhaustion lowers it.