and Canada—whose progress is somewhat similar to our own—but several of them have set up training centers at home. One of the most notable is that established at Lima, Peru, with the co-operation of the Institute of Inter-American Affairs.[10] Japan has established an Industrial Hygiene Association. There is ample evidence of a widespread and growing interest in industrial hygiene and health engineering in nearly all countries.

IV. Industrial Hygiene in the United States

We have seen that the United States lagged behind other countries in providing control measures or compensation for occupational diseases, and that it was not until the late Twenties that industrial hygiene became more than an incipient dream in the minds of a relatively few individuals. A few farsighted pioneers in the field of public health saw the possibilities of making the control of industrial health a vocation and of enlisting the technical aid of professions other than medicine to do the job. Industrial hygiene in the United States has from the start been kept on a high professional plane and has therefore attracted men with a liberal leaning toward technical research.

One of the outstanding reasons that industrial hygiene has been so successful in controlling adverse environmental conditions and in preventing or controlling occupational disease is that pronounced rivalry has developed between the medical men and the men of the sciences, as well as between the scientific professions involved, for instance, chemists and mechanical engineers. This rivalry, as has been pointed out before,[11] has been wholesome and has resulted in advancing accomplishments in the field of industrial health that would have been improbable without it; competition and wholesome incentive have always inspired accomplishments. Advances in industrial process ventilation have been almost solely the achievement of the industrial hygienist: the heating and ventilating engineers, either from lack of interest or understanding, have remained aloof. As a result, many grotesque ventilating systems and ideas have appeared under the sponsorship of sheet-metal men who did not even pretend to understand the physical laws applying to air flow and air movement but were attempting to supply a demand for protection of workmen as best they could.

V. Prospective Roles of Industrial Hygiene

Industrial hygiene has laid aside its swaddling clothes and entered a vigorous stage of advancement. It is no longer seen by industry as the aimless effort of intellectuals collecting bottles filled with nothing so that they can prepare long and useless discourses that few would read or understand, or, if they did understand, would know what action to take. The safeguarding of industrial health is on a business basis of evaluation and control and is recognized as such by both

[10] J. J. Bloomfield and A. S. Landry, *Am. Ind. Hyg. Assoc. Quart.*, **16**, 65 (1955).
[11] C. D. Selby, *Am. J. Pub. Health*, **30**, 1422 (1940).

labor and management. The purpose of the industrial hygienist is no longer merely to "lock the stable door after the horse has been stolen" but to anticipate and prevent harmful situations, or to control them before serious injury results.

The industrial hygienist has done much toward bringing medicine and safety engineering into close co-operation, partly because his interests overlap these two fields. For instance, the safety engineer looks to the industrial hygienist for assistance in problems involving the technical phases of the flammability or explosibility of solvents, gases, vapors, and dusts. Likewise, the technical differences between the classes of respiratory protection devices and the chemical absorbents used are somewhat confusing and require special study. Medical men with no engineering experience, on the other hand, will be more concerned with the toxicological aspects and in their desire to prevent harmful exposures may consider only the promotion of health without due regard for practical economic measures or the problems of the plant production and maintenance engineers. It is the industrial hygienist's job to become acquainted with these engineers and get the benefit of their reactions to any of his major recommendations so that his control measures will be more sound and acceptable. One of the most urgent needs today is a common understanding between the heating and ventilating engineer and the industrial hygienist. The former thinks in terms of comfort and air conditioning and frequently is unable to grasp the problems involved in the control of gases, vapors, and dusts, which are designated in parts per million or million particles per cubic foot. The industrial hygienist is going to have to take the initiative in getting his control recommendations into terms of volume or rate of flow or something more familiar to the heating and ventilating engineer. He should make it understood more generally that the control of all air contaminants, even excess heat, is something the heating and ventilating engineer needs to become acquainted with and reckon with—not a thing to be added as an afterthought or left to be planned by unskilled persons who may thereby upset the functioning of an otherwise carefully planned heating and ventilating or air-conditioning installation.

Then there are the architects, the plant layout men, and building designers as well as the designers of machine tools and equipment. The basic principles of industrial hygiene must be presented to these men so that industrial hygiene will start with the blueprints of factories and machines. All too frequently still industrial hygiene becomes a matter of telling management what their mistakes have been and how many tremendously expensive changes will have to be made, rather than getting these ideas into design where the most good will be accomplished easily and cheaply.

In one of the most modern aluminum foundries built during World War II, one frequently pointed out as a model of perfection, the mechanization was excellent, the sand-handling and dust-control equipment was good, but some fume, smoke, and heat sources were uncontrolled and the general ventilation left much to be desired. No one had ever made the designer aware that dust- or fume-laden and heated air had to be moved out of any enclosure by removing all of the