AGRICULTURAL HAZARDS

FARM HAZARDS - INDUSTRIAL HYGIENE ASPECTS

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FARMING IS AN INDUSTRY

Traditionally industry has been viewed as having been spawned by a socio-economic-political revolution in which an agrarian society moved toward division of labor. It was capital intensive, high in energy use, profit motivated, with a functional distinction between management and labor. Presumably it produced a societally desirable product for a profit by an appropriate blending of capital, raw materials, physical resources, operational know-how, and labor.

This master-servant, management-labor, employer-employee relationship may cloud professional thinking. Public Law 91-596, the Occupational Safety and Health Act of 1970, has a general clause which states that the intent of the law is to:

> "...assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources..."

Yet a management-labor relationship is inferred when this shall be done by:

> "...encouraging employers and employees in their efforts to reduce the number of occupational safety and health hazards at their places of employment..."

If we look at agriculture, whether operated by a family as the labor unit, with the traditional "hired hand", or corporate farming on a large scale, the ingredients of industry are there. It is capital intensive. A large tractor can easily cost $25,000. There is high energy use associated with the operation of farm machinery. Hidden is the high energy use in making steel and agricultural chemicals. Certainly the end product is societally desirable - food and fiber. The profit motive must be present. The money market is the source of borrowed funds. Profits are calculated on the basis of cost per unit of product and return on capital investment.

It is true that there may be some blurring in certain instances with respect to traditional industrial roles. Management and labor may be the same. There may be no age or sex barriers to duties - or to wages and hours. There may be no unemployment and workmen's compensation - or no specific exclusions under laws, regulations or standards that relate to non-agricultural industry.

Modern agriculture is an industry. It cannot be excluded in a parochial view of what should be of professional concern to the industrial hygienist.

FARMING IS AN INDUSTRIAL HYGIENE SPECIAL CASE

The current official definition of industrial hygiene is:

> "...Industrial Hygiene is that science and art devoted to the recognition, evaluation and control of those environmental factors or stresses, arising in or from the workplace, which may cause sickness, impaired health and well being, or significant discomfort and inefficiency among workers or among citizens of the community..." (American Industrial Hygiene Association brochure, Industrial Hygiene, Definition, Scope, Function and Organization)

On the basis of the above definition farming cannot be excluded from industrial hygiene thinking or concerns. It should be noted that:

1. Workplace is the term used for the site where the activity is carried out. It does not say factory. It does not say mine. It is a <u>place</u>.
2. Environmental factors or stresses are not terms which, as used, make a distinction between those occurring naturally and those created as a part of the activity.
3. These factors or stresses may be endogenous or exogenous in the sense that they may arise <u>in</u> a specific location or <u>from</u> an operation.
4. The shift from homeostasis ranges from discomfort to overt, clinical illness.
5. The worker, the workplace and the activity are all part of a larger milieu, the community, whose members may be affected, individually or collectively.

Farming because of variety associated with climate, terrain, plants and animals involved, methods and techniques employed will still

have the potential for many of the exposures that are usually classified by type as being chemical, physical or biological in nature.

At this point there should be little quarrel with the premise that the industrial hygienist can and should be interested in the hazards of agriculture. Before describing exposures inherent in farming that fall within the purview of the industrial hygienist, it may be desirable to speculate as to why farming has been largely ignored by industrial hygienists up to the present time. There may be a variety of reasons:

1. Governmental groups providing services may feel that their responsibilities, by definition, begin and end at a factory gate.
2. One sees most clearly those things that are close by, and there have never been enough industrial hygienists (or physicians) practicing in rural areas.
3. Evaluation and control of identified hazards would be professionally frustrating. Exposures would be intermittent, multiple, and usually done with the maximum of general ventilation - the open air.
4. Exploring the problems of a few workers, miles apart, would be an expensive and inefficient use of technical manpower.
5. Farmers have traditionally resisted any activity which might ultimately result in restrictions or controls over their activities.
6. The quantity and quality of medical practice in agricultural areas would not provide clinical and laboratory data that would contribute much to relating exposure to physiological response.

Our starting point in looking at the industrial hygiene aspects of farm hazards involve the following hypotheses:

1. Experience in the industrial sector must be extrapolated to its maximum in the agricultural area.
2. The agricultural worker is less inclined and on technical aspects is least able to understand industrial hygiene objectives and procedures.
3. The industrial hygienist must make his greatest progress in protecting the farmer in that time frame that precedes farmer involvement.

In sifting through the occupational protective approaches that are used in industry it becomes quickly apparent that medical aspects

of control do not exist. There are no preplacement and periodic physical examinations. There is no medical monitoring, no rotation of workers or prophylactic measures. Only sheer professional naivete would allow serious consideration of requiring blood cholinesterase levels for migrant farm workers.

If medical controls are out of the question, we are then forced to rely on engineering controls. Some of the traditional ones would have minimal application such as isolation, remote control, enclosure, exhaust ventilation, substitution or change of process.

Only a few engineering control measures remain that would have application in agricultural pursuits. These are general ventilation, good housekeeping, personal protective equipment and personal hygiene. But there is little universality in the application of these measures. General ventilation would relate to climate, weather and season. Housekeeping would relate to limitations imposed by physical facilities and work tempo. Personal protective equipment may not be available or be inappropriate for agricultural use. Personal hygiene would vary widely in applicability, being affected by the facilities available and inclination of the worker to use them.

It is tempting to provide a litany of farm hazards of industrial hygiene interest or concern. Instead, industrial hygiene approaches will be viewed against midwest agricultural practices with the expectation that some can be transposed to other crops in other geographical areas. Tacitly assumed here is feasibility - physiological, sociological, political, financial and engineering.

CHEMICAL HAZARDS

Brought to the farm: The farmer is the end user of chemicals in a wide variety and in large amounts. Examples would be insecticides, herbicides, rodenticides, defoliants, soil sterilizers, growth regulators, fumigants, nematocides, fungicides, acids, alkalis, solvents, fuels, lubricants, veterinary pharmaceuticals, feed additives, fertilizers, soil modifiers, and others.

The agricultural worker cannot be expected to have the degree of toxicological expertise, the engineering know-how, and the time and resources to insure adequate protection against chemical hazards. He should be protected in spite of himself. The product should be "fail safe". In the area of labeling and usage instructions engineers and industrial hygienists have failed the agricultural worker.

Asking why is usually a good way of pointing up problems. In the handling of chemicals from the agricultural point of view I could ask why:

1. Why would a pesticide bagging operation at the producer's facility be protected but the farmer left to his own devices. Is he told how to open, pour, level and dispose of the bag? Is he instructed to burn or bury the container, bag, can or drum? Where does he bury it? And how deep?

2. Why are the reservoirs for the field application of farm chemicals, granular or liquid, designed with little regard for height, accessibility or size of charging opening needed?

3. Why, basically, must spraying and dusting place so much of the material on non-target areas?

4. Why is not greater attention given to problems that might be associated with the mixing of two chemicals from different manufacturers (such as herbicides)? Who has the responsibility to indicate any synergistic effect that may be involved?

Produced on the farm: A well-established exposure to oxides of nitrogen has been associated with recently filled silos. If the forage put into the silo has been raised under drought conditions and high nitrogen fertilization, then the problem seems to be more severe.

Sometimes a yellow gas can be seen above the surface of the silage within a day or two after filling. It may persist for several weeks. It may cascade down the chute and kill small animals, such as fowl, at the bottom of the silo. A brief exposure, such as that associated with entering the silo to recover a tool, may be fatal. Running the blower with which the silo was filled for a short while makes the silo safe to enter.

More and more silos are sealed after forage addition. Under these anaerobic fermentation conditions carbon dioxide may build up and oxygen be depleted. Self-contained respiratory equipment is usually not available, ventilation requirements are different than for the silos mentioned above, and entry into the silo is usually fatal. There are several such deaths annually.

Of growing interest are the hazards to personnel of gases present in large confinement feeding operations, usually in swine and poultry producing operations. Exposures above the TLV have been measured in swine feeding facilities for carbon monoxide, ammonia and hydrogen sulfide.

Of course there are exposures to exhaust gases from internal combustion engines - diesel, gasoline or liquified petroleum gas. Exposure problems can result from operations where these engines, large or small, may be operated in enclosed spaces.

In speculating why there is such a dearth of information on chemical exposures associated with agricultural pursuits some hypotheses may be noted:

1. Many farmers who have been made ill by exposures to chemicals recognize an acute response, stop work, use supportive home therapy and place heavy emphasis on rest.
2. Medical reports on chemically caused illnesses are sparse because the farmer does not present himself. If he does present himself the physician may be unsure of the diagnosis. Most of the time the physician has neither the time nor the inclination to write up the case for the medical literature.
3. The intermittent and/or seasonal aspects of chemical use allow detoxification to occur.
4. Work habits and personal hygiene are adjusted to minimize difficulties, based on personal experiences or those among other agricultural workers.

PHYSICAL HAZARDS

The farmer is exposed to a fair number of physical hazards that have been of traditional interest to industrial hygienists. Ordinarily one thinks of physical agents representing a significant departure from energy exposures which act deleteriously on the body. Those energy-related phenomena which result in physical trauma will be excluded here since they will be covered in another paper.

Extremes of pressure would not normally be considered a problem among agricultural workers. They might do some scuba diving but this would be avocational. They might fly their own light plane but probably not to unusually high altitudes and in the absence of oxygen equipment.

Heat and cold extremes are encountered. Cold is considered to be of lesser concern. Agricultural pursuits are at a minimum during winter weather. Where climate makes it necessary to anticipate severely cold weather the farmer is usually prepared with suitable clothing and shelter.

Extremes of heat constitute a more general, more widespread problem. I know of no data on the heat load on a worker in a field, at noon,

where the ambient temperature is 100 degrees Fahrenheit or more, the humidity is almost 100%, the sun is blazing down from a cloudless sky and not a leaf is stirring. Such a situation definitely establishes a stress situation that is in excess of that recommended in the NIOSH Criteria Document, Occupational Exposure to Hot Environments. A wag predicted that this document, if made into a Standard, would outlaw agricultural pursuits in most parts of the United States.

Any problems of light would be comparable to those of concern in industry. For indoor seeing tasks there would be a need for enough light, from the right direction, of the correct color, with appropriate contrast, no glare and so forth. Sunlight is probably the larger problem, if a serious one exists, with a potential for snow blindness in the winter and skin cancer after years of exposure to non-covered surfaces of the body.

Vibration represents another unknown. If we consider the resonant frequency of human viscera to be in the 5-10 Hz area then one is concerned about someone spending long hours riding an unsprung vehicle over non-smooth terrain. Family physicians in rural areas have voiced the opinion that they see more cases of prostatitis during the corn harvesting season.

Chain saws are not uncommonly found on the farm and one might think of the possibility of encountering "white fingers" or Raynaud's phenomenon. It would be expected that chain saw usage would be highly infrequent and of relatively short duration.

Noise seems to be the one physical agent which is clearly identified as an industrial hygiene problem among farmers. There are protracted exposures to machine noises in excess of 90 dBA. The noise sources extend beyond unmufflered internal combustion engines to power transfer devices (gears, chains, belts, sprockets, tumbling rods) to fans, vibrating metal panels and other sources.

It is interesting that the left ear is usually more affected than the right ear. This may be explained by the position assumed by the operator as he works with trailed equipment. His left ear is closer to the source of the noise and the right ear is in the "shadow" of the head. Also, in the use of shoulder-held firearms the left ear will be closer to the discharge blast for the right handed individual and most people are right handed.

BIOLOGICAL AGENTS

This is a most difficult area for the industrial hygienist. In the first place, he has not considered the biohazard area to be of more than casual professional interest. He has felt much more comfortable working with chemical and physical hazards. In the second place, the medical literature has taken very little notice of the occupational aspects of biological agents. Currently, for example, a great deal of attention is being given to angiosarcoma and vinyl chloride with less than 50 cases, total, world-wide, with little mention being made of the several hundred deaths each year from insect stings.

Perhaps the point to be made here is the occupational aspect. The angiosarcoma cases were associated with an occupational exposure in an industrial setting. The insect sting deaths may not have been related to bee-keeping and thus were not occupational. Still, an agricultural worker might very well encounter bumblebees, wasps, yellow jackets, hornets and other stinging insects in the course of his duties.

The World Health Organization has listed about 170 diseases common to animal and man. Probably no more than a third of these have a possibility of infecting agricultural workers and perhaps a tenth of them could be regarded as having significant potential for producing an occupationally related disease. Again, it is the occupational aspect that is giving us the difficulty here. For example, if a farmer acquires brucellosis from handling infected swine fetuses, few would argue that the disease is occupational. If he acquires brucellosis from drinking raw milk, then this would not be occupational.

With the possible exception of medical concern associated with rabies and tetanus it would seem that there is little reason for the practitioner in rural areas to place undue emphasis on any unique occupational etiology. After all, histoplasmosis may appear in a child playing where starlings have roosted or it might be found in a farmer after cleaning out a chicken house.

Equine encephalitis might be of occasional interest but many more people seek medical care from falling off horses. Leptospirosis might be of occasional interest from an occupational standpoint, but more cases occur after splashing around in the old swimming hole and more people drown in the swimming hole than acquire leptospirosis. Poison ivy might affect someone cleaning out a fence row, but more calamine lotion would be needed in a scout camp.

CONCLUSIONS

The industrial hygienist, in viewing the agricultural sector, would probably feel that the following conclusions are justified:

1. Little epidemiology and related medical research has been done for the detection-evaluation phases of industrial-hygiene-for-the-farm. Controls must await such data.

2. In acknowledging that industrial hygienists have given little attention to the agricultural sector in the past, one must predict that this probably will change little in the near future.

3. Health and safety professionals in the industrial sector should extend their efforts into the end-user area, the farmer, and provide him with the protection not otherwise available to him.

4. Until now the farmer has been fortunate that his exposures have been mixed and highly intermittent. Specialization is occurring and the size of operations is increasing. Fewer people will be exposed longer and more severely, with probable difficulties resulting.

5. At the present time it would appear that chemical exposures are more important than biological or physical agents.

SUMMARY

Farming presents potential for industrial hygiene exposures - chemical, physical and biological - wherever done, by whatever method and at every scale. Illustrative examples are given of industrial hygiene problems associated with farming. Reasons why industrial hygienists have largely ignored the farming sector are discussed. Possible means for professionally serving this occupational group are voiced.

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