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OCCUPATIONAL HEALTH HAZARDS IN RURAL AREAS

Report of a Seminar,

Baghdad, Iraq, 8-13 December 1984

WORLD HEALTH ORGANIZATION
EASTERN MEDITERRANEAN REGION
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I INTRODUCTION

The Seminar on Occupational Health in Rural Areas took place in Baghdad, Iraq, from 8 to 13 December 1984. It was organized by WHO in collaboration with the Ministry of Health, Iraq, with the objectives of reviewing occupational health hazards peculiar to the Region in rural areas, studying measures of prevention and control of these hazards, reviewing health care facilities available to agricultural workers and recommending means of health care delivery to agricultural workers within primary health care (PHC). Participants came from Democratic Yemen, Egypt, Jordan and Sudan. Participants from Cyprus and Pakistan were invited but were unable to attend. There were additional observers from the host country. The list of participants and observers is given in Annex II.

Inaugurating the Seminar, H.E. the Minister of Health, Dr Sadek Hameed Alwash, expressed happiness and appreciation that the World Health Organization had chosen Baghdad as the venue for this important Seminar. He indicated the need to promote the health of agricultural workers who shoulder such heavy responsibilities in a nation's economy, and to develop better services to cope with health problems of modern mechanization and increased use of pesticides.

In his message to the participants, Dr Hussein A. Gezairy, Regional Director, World Health Organization, welcomed them to the Seminar and expressed his gratitude to the Government of the Republic of Iraq for holding the Seminar in Baghdad. He indicated that, although countries are increasingly aware of the need to develop workers' health programmes, for the industrial as well as the agricultural workforce, the main constraints still lie in the shortage of adequate information, limited knowledge about the health problems associated with rapid mechanization, new harmful changes in work processes, and the shortage of trained manpower. He further emphasized the need to develop occupational health programmes for the agricultural sector as an integral part of the health services infrastructure, and that education and training programmes should be reoriented towards this objective.

The Seminar took place at the National Centre for Occupational Health and Safety, Ministry of Health. A pre-prepared working document was deliberated upon by the participants who highlighted experiences in their respective

countries. The outcome of the one-week seminar is this report in which an attempt is made to account for the main occupational health hazards in the Region, particularly pesticides intoxication and physical and biological hazards, as well as agricultural accidents. Each hazard is followed by a short synopsis of methods of prevention. A short description of the characteristics of agriculture as an occupation is given prominence, in order to elucidate possible aetiological factors of these health hazards. Health care services in the Region which are available to agricultural workers are also reviewed, along with issues promoting to the development and integration of these services into the comprehensive national health plans and within the premises of PHC.

II GENERAL PROBLEMS AND CONDITIONS OF LIFE IN RURAL AREAS

II-1. Demography

The demographic constitution of the rural areas is characterized by:

II-1.1. High proportion of children consequent to high birth rate. Family planning and birth control measures are, however, practised in some countries of the Region, e.g. Democratic Yemen, Egypt, Jordan and Sudan. In Iraq, family planning is active in the urban societies, and in the main MCH centres in rural areas.

II-1.2. A disproportionately low number of young adult males, resulting from their migration to cities in search of higher wages and more employment opportunities, particularly in industry. Migration may also take place from one rural area to another. The higher the rate of migration, the higher the proportion of aged members of the community.

II-1.3. Women and children participate to a great extent in the workforce in rural areas. In many parts of the world, women are not only the bearers of children and managers of family household but they are also a part of the rural labour force. Sometimes they constitute the entire labour force, e.g. husbands are employed elsewhere in non-agricultural occupations.

II-2. Socioeconomy

Economic difficulties are foreseen in some countries, such as Egypt, due to the diminution of the agricultural land area in proportion to the continuous and progressive increase in population. Land "demudding" for the manufacture of mud bricks, together with the absence of flooding seasons - since the construction of the High Dam - has diminished the fertility of the land. Also the social legislations of the 1960s allowed some of the farmers to co-own, rather than hire the land from the original landowner. This changed the rural society in Egypt from a relatively producer society to a highly consumer one.

Desert land reform constitutes another economic burden.

The end result is a proportionate decrease in both the vertical and the horizontal productivity of the Egyptian rural area. Furthermore, migration of Egyptian farmers to other countries, e.g. Iraq, Jordan and Sudan, where there may be better financial opportunities, has added to the economic burden.

In Sudan the building of the High Dam had a positive impact on the socio-economic well-being of the people living in the Wadi Halfa area. They were living along the narrow strips of both sides of the River Nile, south of the Dam. To avoid being flooded by the collection of water behind the Dam, the people were resettled in well-reclaimed and fertile areas in Khashm El Girba, east of the Atbara River. By this resettlement, they benefited from the various facilities of well-organized plantation schemes, advanced mechanization and the establishment of sugar cane factories and ginneries where they can process their products. This compensated them for the stress they had suffered by being obliged to leave their native land.

II-3. Housing

The building material, whether timber, stone, burnt-mud bricks, etc., differs from one country to another and even in different regions of the same country. As a result of such material, internal planning, sanitary measures such as ventilation, convenient arrangements for food storage, washing and bathing, and measures to combat rodent and insect infestation are often primitive. Another result is thus fire breakage is one of the major hazards in rural communities. The ignition sources are usually matches, cigarettes,

primitive kerosene lamps, sparks, electrical short circuits, heating materials and utensils. A great deal of money is wasted because of fire damage to main crops such as corn, rice, sugar cane and cotton.

In some countries, cattle and other animals dwell with the farmer in the same house or under the same roof. Poultry is raised in the yard of the house where children are left to crawl and play. Overcrowding of family members in the same house facilitates dissemination of contact and droplet infections.

This state of housing had gradually changed in some countries of the Region. For example, in the housing schemes along the Jordan valley, houses are built of cement and various utilities such as piped water supply, proper sewage and waste disposal and electricity are provided. In Iraq, villagers are moved from old villages and settled in modern ones where similar utilities as in Jordan are provided. In these countries separate accommodation is provided for animals and poultry.

II-4. Water

Millions of man-days are lost annually because of morbidity and mortality from water-borne diseases. Water plays a direct and principal role in the epidemiology of some salmonella and shigella infections and in amoebiasis, while it has an indirect relationship in transmission of malaria, filariasis and schistosomiasis.

In Sudan, the Blue Nile Health Project, initiated in 1979, has investigated prevalent water-borne diseases (diarrhoeal diseases, schistosomiasis and malaria) with a view to implementing control measures. The project covers the irrigated areas of El Gezira, Managil and Rahad schemes. To date, it has succeeded in preventing transmission of schistosomiasis from the heavily infested Gezira area to the new Rahad scheme and has reduced the prevalence of malaria and diarrhoeal diseases in all the irrigated areas.

More health benefits can be gained from money spent on water supply programmes in rural areas. Health administrations should take an active interest and play an important role in the promotion, execution and management of rural water supply systems. Such systems have already started to appear in villages in a number of countries, e.g. Democratic Yemen, Egypt, Iraq, Jordan and Yemen Arab Republic.

II-5. Sewage and waste disposal

The traditional practice in some parts of the world of using human excreta and animal dung, either separately or mixed with garbage, as manure on the land is difficult to alter. In very many areas, dung is dried and used as fuel, as in Egypt and Sudan.

Accumulation inside the house of animal dung, with its foul and irritant odour, together with the other insanitary conditions previously described, tends to cause sickness and foster decreased physical and mental vigour - all these factors result in poor land-yield and perpetuate poverty.

Rivers, canals and other water channels may be used as disposal facilities. The risk of contracting disease, through lack of proper facilities for bathing and washing, or through the transmission of agents of infection on washed utensils, is ever-present in most rural areas, although it has disappeared in some modern villages and new housing schemes in Iraq and Jordan.

II-6. Nutrition

Under-nutrition is observed in over-populated rural areas where the land area to population ratio is low and the unit yield of the land is insufficient. Bad nutritional habits, such as (i) lack of consumption of enough milk, eggs or poultry, it being preferred to sell such food in exchange for cash needed for other purchases, and (ii) almost complete dependence on cereals and/or farinaceous roots, have led to malnutrition and concomitant retarded growth of children, low standard of health and low level of resistance to infectious diseases, as well as to deficiency diseases related to low intake of proteins, vitamins and minerals.

In Sudan, cases of endemic goitre were encountered in populations drinking well-water deficient in iodine. This problem was solved by giving iodine tablets to people in the area. It was noted that people drinking river water did not suffer from this problem.

In general it must be borne in mind that the caloric requirements of an agricultural worker are particularly high (rarely less than 3800 calories/day) due to high metabolic expenditure in various agricultural activities.

II-7. Education

In rural areas education is often poor and inadequate; teaching facilities may be scarce or rudimentary. The rural child learns only the meagre fundamentals of hygiene. He has a higher absence rate and leaves school earlier than his urban counterpart.

However, in Iraq, the introduction of a compulsory education system has led to high levels of literacy. In the rural areas, illiteracy is now practically nil for all people below 45 years of age. In Democratic Yemen, there has been a reduction of about 40% in illiteracy in rural areas since the introduction of literacy campaigns. In some countries, e.g. Egypt, the utilization of children in seasonal agricultural jobs is among the many factors with adverse consequences on rural education. In Sudan, illiteracy is still above 80% among agricultural workers.

II-8. Transportation and communication

Country roads are apt to receive little attention and telephone services are often lacking. These deficiencies affect the marketing of crops and products of agricultural industries, thus putting the agricultural worker at an economic disadvantage. Also, this lack of facilities affects the ability of the rural family to seek help in medical or other emergencies. Nevertheless, in modern villages with new housing schemes such as in Iraq and Jordan, these facilities are adequate. In Egypt and Sudan, communication in the very remote areas is still a problem and primitive means of transportation, for example, animals, are used.

II-9. Clothing

Clothing with little protective value is often used and sometimes even work is done without any protective clothing. Personal protective equipment such as boots, gloves, masks, overalls, etc., are needed in some agricultural occupations to protect against certain risks, but unfortunately they are not used because of unfavourable climatic conditions and deep-rooted working habits.

III CHARACTERISTICS OF AGRICULTURAL WORK

Several definitions of "agriculture" and "the agricultural worker" have been proposed, yet none has been universally accepted. A Joint ILO/WHO Committee on Occupational Health agreed for the purpose of the working Committee that:

> "Agriculture means all forms of activities connected with growing, harvesting and primary processing of all types of crops, with the breeding, raising and caring for animals, and with tending gardens and nurseries."
>
> "Agricultural worker means any person engaged, either permanently or temporarily, irrespective of legal status, in activities related to agriculture as defined above."

Participants in this Seminar agreed, for the purpose of their work, to adopt the above definitions.

III-1. The type of work

The most striking feature of work in agriculture is irregularity of working hours. The regular working day of labour in industry is not suitable for agriculture. Harvesting the crop in due time may necessitate extended work from sunrise to sunset. Mechanization, which could help in arranging a regular working day, has often resulted in extended working hours.

Temporary employment is another feature of work in agriculture. This is necessitated by the nature of the work itself. Seasonal activities connected with ploughing, harvesting or pest control are among the causes of extra manpower needed.

Further, workers in agriculture in some countries do not constitute an organized labour force. Therefore, falling sick would be catastrophic for the agricultural worker, because he is not entitled to have paid sick leave nor has he the right to an unemployment pension or a disability compensation.

III-2. Place of work

Unlike the well-defined and easily controlled workplace in industry, the workplace in agriculture is usually the ambient environment. Meteorological changes, over which man has no control, range from extreme cold, which may

cause frostbite, to high temperatures resulting in heat stroke. Droughts and floods are also environmental dangers attending work in agriculture.

Contaminated soil or water can be sources of many occupational diseases for workers in agriculture, particularly when protective measures are not applied. Also, the workplace in agriculture brings the worker in close contact with animals with the markedly increased risk of zoonotic infection.

The inorganic dusts which are prevalent in the work environment are causes of allergic diseases. Whereas it is possible to control dust in the workshop or factory, it may be near impossible to avoid exposure to dust in agriculture.

As a result of the horizontal extension of the workplace in agriculture, we find workers living in remote areas, thus causing difficulty in reaching them as a target population with the consequent difficulty in delivering services to them. The nearest health facility may be many kilometres distant from the home of the agricultural worker.

Living in villages or on small farms may not allow the farmer to avail himself of good sanitary facilities. Safe water may not be available and sewage disposal is usually primitive and defective. These are factors that add to the hazards of taking up agriculture as an occupation.

III-3. The agricultural worker himself

Increased industrialization and urbanization have reflected unfavourably on the rural community. Adult, competitive and active males usually seek employment of a more lucrative and attractive nature in the cities. In consequence, rural communities exhibit a mixture of the very young and the very old, together with physically or mentally disable persons.

Agricultural workers can be classified into four categories[1, 2]:

(i) the sharecroppers who work on land owned by a person to whom they owe a part of their harvest. They live and work in a condition of semi-independence.

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[1] Workshop on Occupational Health Care in Agriculture, WHO, OCH/80.3, 1980.

[2] ILO Encyclopaedia of Occupational Health and Safety, Vol. I, 3rd edition, 1983.

(ii) The self-employed who either own the farms where they work or rent them.

(iii) The paid agricultural labourers, working permanently on plantations, or state-owned farms or in some sort of cooperative agricultural enterprise. In Democratic Yemen, this category is covered by social insurance.

(iv) A fourth category of farm workers is found in many countries, namely the mobile temporary workers. These make up a small part of the agricultural workforce of many countries and are usually employed on farms having high seasonal labour demands. These workers may be nationals of the country in which they are employed or may be temporary immigrants seeking employment to increase their financial well-being. In this Region, fellahin from Egypt work in the fields of a number of other Arab countries. It is often the case that such workers may be of poor health, under-nourished and unaware of the hazards of their employment. This is especially true if the workers are foreigners and have limited or no understanding of the language of the land of their employment. Such workers will undoubtedly have no health records available to indicate their state of health and will probably complain little about problems associated with their work for fear of losing their jobs. It can be said that such workers (men, women and children) are both consciously and unconsciously taken advantage of. Employers are often less interested in the health of mobile temporary workers than in that of their stable workforce.

Except for workers in state-owned farms and big cooperatives, as in Democratic Yemen and Iraq, there is a lack of organized labour. As mentioned above, this situation deprives the agricultural worker of his right to have paid sick leave, disability compensation or retirement or unemployment pension. This thereby adds greatly to the stresses to which workers in agriculture are subject.

Table 1. Characteristics of Agricultural Work[1]

A. Type of work
1. Irregularity of working hours.
2. Temporary employment.
3. Generally unorganized manpower.
B. Place of work
4. Unpredictable changes of ambient environment.
5. Contaminated soil/water.
6. Dusty air.
7. Too far away from health facilities.
8. Sanitarily poor living places.
C. The agricultural worker himself
9. Younger ages due to deficiency in adult manpower.
10. Females also engaged in farm work.
11. Mostly self-employed.

[1] Workshop on Occupational Health Care in Agriculture, WHO, OCH/80.3, 1980.

IV OCCUPATIONAL HAZARDS IN AGRICULTURE

The principal risks to the health of agricultural workers stem from the following causes: environment, kind of work, implements, machines and human factors.

The development of mechanization and automation and the use of chemical products and biological preparations during recent years have brought essential changes to agricultural work. These changes have made physical work lighter, but increased the risk of accidents, poisoning, and allergies. In developing countries, the character of agricultural work has not undergone drastic changes and is essentially concerned with the production of foodstuffs and certain types of raw materials for industry.

Like industrial workers, agricultural workers can be expected to suffer physical, chemical, biological, mechanical and psychosocial hazards.

IV-1. Physical hazards

Extremes of climatic conditions, such as temperature, humidity and solar radiation, may impose additional stress upon the worker. Increased mechanization adds man-made or artificial physical hazards, and stress such as that caused by noise and vibration, to agricultural workers. This combination of natural and man-made hazards and stress produces unique and sometimes unexpected health problems.

IV-1.1. Natural physical hazards

IV-1.1.1. Heat and humidity

The agricultural worker during his outdoor work is exposed to high temperatures and high relative humidity, particularly in the hot humid summer of Upper Egypt and some other Arab and Mediterranean countries.

Acclimatization of heat is the result of processes by which the subject adapts himself to living and working in a hot and perhaps humid climate. Acclimatization is always relative to specific dry or humid atmosphere and to a specific workload. Any increase in this load or in the thermal burden may

result in health damage. An absence from work of one week may result in the worker losing between one quarter and two-thirds of his acclimatization and a three-week absence from exposure, whether in summer or winter, will mean virtually total loss of acclimatization unless he is very athletic and in good physical condition[1].

As heat impinges upon man, his first response is a sensation of discomfort. This discomfort increases as thermoregulatory adjustments are made to counteract thermal stresses on the body. Inefficiency in the performance of non-physical tasks, an increased propensity to minor accidents and changes in the emotional tone of the workers are among the reactions encountered.

Heat disorders: caused by exposure to high levels of environmental heat comprise the following:

(a) Systemic disorders: heat stroke (hyperpyrexia), heat exhaustion (water and/or salt deficiency), heat syncope, heat oedema, heat cramps or sweating deficiency.

(b) Skin disorders: prickly heat (miliaria rubra) miliaria profunda and cancer of the skin (basal cell carcinoma or rodent ulcer).

(c) Psychoneurotic disorders: mild chronic (tropical) heat fatigue and acute loss of emotional control.

Prevention

Selection of exposees and preparing them to work in a hot environment is one of the major measures of controlling heat stress (acclimatization). During and between bouts of work the worker can take rest under a tree or in a shaded area and drink water. For heavily sweating men salt replacement is recommended. This can be achieved by taking salt tablets. In some countries, like Egypt, the type of food e.g., pickles or salted cheese provide enough salt. The workers can wear loose light white clothes of linen or cotton to help counteract loss of heat. Treatment of heat disorders is mandatory.

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[1] ILO, Encyclopaedia of Occupational Health and Safety, Vol. I, 3rd edition, 1983.

IV-1.1.2. Cold

Man's ability to work in the cold is dependent on the functional integrity of brain and limbs. Cooling the brain leads first to confusion and then to incoordination. Cooling the limbs on the other hand results in numbing and clumsiness, making the performance of intricate tasks difficult. Those who work in extreme natural or artificial cold conditions are usually aware of or trained to consider the hazards and as a result take due precautions. However, the majority at risk are those working in so-called temperate climates when the temperature falls below about 10°C, especially if it is also wet.

In some areas of Iraq and Jordan, hypothermia (loss of body heat) may occur in relatively cool wet climates even during physical work. Onset is usually insidious with bizarre usually non-cooperative behaviour followed by general slowing in ability to keep up the work schedule and lethargy. Unconsciousness finally supervenes and death occurs very suddenly from ventricular fibrillation.

Prevention

The protection of workers from the unfavourable effects of cold depends on the development of work regimens which will (a) provide adequate rest from cold so that body thermoregulation can function properly (i.e. short periods of rest (10-15 minutes) every two hours of continuous work are advisable under certain temperature and work conditions); (b) protect the individual by use of appropriate clothing; and (c) limit the exposure (hours of work) during an extremely adverse climatic period.

The only effective treatment of hypothermia is to warm the individual; however, this should not be done too quickly, as there may be deficient circulation because too much blood is going to the surface of the body. After the patient has been warmed, it is essential that he rest completely for several days so as to avoid acute heart failure due to effort.

IV-1.1.3. Solar rays

Burning ultra violet rays have a wavelength of between 2900 and 3200 A.* °

Solar erythema may consist only of mild erythema, blisters and blebs or may be associated with oedema, inflammation and severe constitutional symptoms. The burn is usually followed by itching, tanning and desquamation. Heat urticaria afflicts persons moderately exposed to sunlight with a personal or family history of allergy on exposure to photosensitizers. Photosensitization with blisters followed by pigmentation is caused by exposure to ultra-violet radiations of skin previously sensitized by exposure to substances such as coal tar, asphalt, pitch, lime, etc, Xeroderma pigmentosum is a hereditary disease that follows prolonged exposure to sunlight; there is pigmentation, atrophic areas, telangiectasis and warty and malignant growths occurring in the uncovered areas. Keratosis and ultimately skin cancer can be caused by the actinic rays of the sun.

Some skin such as those of Egyptians are fairly immune to solar radiations due to the type of complexion.[1]

Prevention

Clothing, personal protective equipment, work prohibition of persons with history of allergy or Xeroderma pigmentosa and avoidance of photosensitizers will all protect against the hazardous effects of solar rays.

IV-1.2. Man-made (artificial) physical hazards

Agricultural machinery is designed to till the soil and render it more suitable for crop growth, the sowing of seeds, the application of agricultural chemicals for improved plant growth and control of pests and diseases, and the harvesting and storing of the mature crops. There is an extremely wide variety of agricultural machines, but all are essentially a combination of gears, shafts,

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* A° Angstrom: unit of measurement of ultra-violet wavelength.

[1] Schwartz, L., Tulipan, L. and Birmingham, M. (1957) "Occupational Diseases of the Skin". 3rd edition, Kimpton, London.

chains, belts, shakers, etc., assembled to perform a certain task. The major groups of agricultural machines are those designed for: soil tillage, planting, cultivating, forage, grain-, fibre-, vegetable-, fruit- and nut-harvesting machines, agricultural chemical applicators, transport and elevating machines and sorting and packaging machines. All these mechanical devices have added noise and vibration to the list of occupational physical hazards to which the agricultural worker is exposed.

IV-1.2.1. Noise

High-frequency noise at hazardous levels over prolonged periods of exposure to machinery are compatible with occupational hearing loss. However, even more important are the non-auditory effects of noise, such as interference with speech communication causing annoyance and distraction, reducing output and efficiency and causing fatigue. Physiological non-auditory effects of noise include disturbed sleep rhythm and stress reaction[1]. Adverse effects on some cardiovascular parameters can lead to tachycardia, hypertension and coronary heart disease in exposures of long duration to high levels of noise and toxic substances such as carbon monoxide[2,3]. Increase of the release of A.C.T.H. and rise of the level of corticosteroids in the blood, with consequent systemic effects, can result from chronic exposure to noise. Also, changes may occur in lipid, glucoside and uric acid patterns in the blood. Other stress and noise-related diseases, e.g. diabetes mellitus, peptic ulceration and irritable colon syndromes, are expected to increase in rural areas.

Prevention

Noise prevention and reduction measures of agricultural machinery should be aimed at:

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[1] Yousef, Z.M.A. (1981). "Study of Extra Auditory Effects on Noise". M.Sc. Thesis, Cairo University.

[2] Afifi, E.A.F. (1983) "Study of the Effects of Noise on some Cardiovascular System Parameters among Textile Workers". M.Sc. Thesis, Cairo University.

[3] ILO, Encyclopaedia of Occupational Health and Safety, Vol. II, 3rd edition, 1983.

(a) controlling sources of noise by technical and engineering methods, good maintenance of agricultural machinery, and rest periods to diminish the duration of exposure to noise;

(b) precluding the propagation, amplification and reverberation of noise by dumping and separate isolation of noise-producing machines (N.B. This item is only valid in industrial factories).

(c) Hearing protection and limitation of noise exposure by wearing appropriate hearing protectors and limitation of the length of exposure to noise.

IV-1.2.2. Vibration

Vibration may affect comfort, reduce work output and cause disorders of physiological functions in man giving rise to the development of disease.

Vibration may be general or whole-body vibration which acts on the body of sitting or standing persons through supporting surfaces, and/or local vibration which is mainly transmitted to the hands and arms. Exposure to whole-body vibration of certain frequency ranges (4-8 and 8-12 Hz) is associated with resonance phenomena (increase in oscillation amplitude of the anatomic organ and system structures); vibrations of these frequencies therefore have the most adverse effects. Whole-body vibration affects, in particular, the central nervous system[1]. The stress produced by this vibration exposure gives rise to disturbances of the neuro-humeral regulations and metabolic processes, to dysfunctions of various organs and systems, and to increased energy losses of the organism. Exposure to high levels of whole-body vibration may result in damage to internal organs. Long-term vibration exposure is associated with various types of histological, histochemical and biochemical alteration, leading to dystrophic changes. Furthermore, vibration also affects the sensory systems, impairs the visual acuity, narrows the field of vision, diminishes the light sensitivity of the eye and disturbs the vestibular function.

Prolonged exposure to vibration, especially in combination with other harmful factors such as cold, noise and static loads, may lead to the development of vibration disease which is mostly due to local vibration and is characterized

[1] ILO, Encyclopaedia of Occupational Health and Safety, Vol. II, 3rd edition, 1983.

by a vascular syndrome accompanied by spells of "white finger", resembling Raynaud's phenomenon, and also by impaired sensitivity to vibration, pain and temperature, by radiological changes in the wrist and hand bones in the form of bone cysts, osteosclerosis, osteolysis, osteoathropatic and even pathological fractures[1]. If the disease has been caused by whole-body vibration, it is characterized by considerable changes of the central nervous system associated with general angiodystonia and polyneuritic syndrome, more pronounced in the lower extremities.

Prevention

This includes technical, organizational, hygienic, prophylactic and therapeutic measures such as automation, remote control, lowering the vibration parameters of the vibrating sources, damping the vibrations, work/rest schedules, maintaining tools and machines in good technical condition, setting up of maximum permissible vibration parameters, and pre-employment and periodic medical examinations.

IV-2. Chemical hazards

Although the legislation relating to poisons in most countries of our Region is almost adequate, agricultural chemicals, many of which are highly toxic, are not always fully covered. Agricultural workers, in large numbers, inevitably come into contact with these chemicals and, in view of their toxicity, it is desirable, if not essential, that their marketing and use be properly controlled. Regulations regarding poisoning may allow the importation or manufacture of materials for agricultural purposes, irrespective of their toxicity, with disastrous results.

Chemical hazards in modern agriculture which may pose a threat to human health comprise:

1. pesticides;
2. fertilizers;
3. animal feed additives;

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[1] Abu El-Ata, C.A. (1984). "Evaluation of Vibration Diseases among Workers Exposed to Vibrating Tools in Egyptian Industries". M.Sc. Thesis, Cairo University.

4. disinfectants and detergents;
5. other chemical hazards such as carbon monoxide, oil and solvents, oxides of nitrogen, ammonia and hydrogen sulphide.

IV-2.1. Pesticides

To counteract plant pests that would otherwise reduce yields from agricultural effort, chemical manufacturers specialized in pesticide production have been synthesizing new substances of great chemical complexity and biological potency. So great has been the effect of this activity that the economic well-being of many agricultural countries now depends on the higher yields obtained by the use of these pesticides.

Pesticides continue to play an important global role in the control of vector-borne diseases. In the recent past, a number of disease control programmes have tended to be based solely on pesticides. This state of affairs may be expected to continue for many years to come. However, a gradual shift in approach is already evident, primarily as a consequence of human, socio-economic, biological, political and environmental factors and of a gradual move in disease control programmes away from a vertical administration and towards their inclusion in primary health care (PHC) programmes. The wide application of chemical control agents has led to the development of new types of formulations for use in public health; these include slow-release formulations, flowable concentrates, monomolecular surface active compounds, etc.

During the past decade the three major classes of pesticides - organo-chlorines, organo-phosphorus compounds and carbamates - have continued to be the main compounds used for the control of arthropods. Owing to the prohibitively high costs of development, few new products designed specifically for public health use have been produced by the chemical industry. Developments include the use of synthetic pyrethroid pesticides on an increasing scale. However, there has so far been only limited use of insect growth regulators, such as the juvenile hormone analogue, Methoprene, and the moulting inhibitor, Diflubenzuron. In addition, there has been a gradual shift to the more economical use of pesticides; this had led to modifications in methods of application and in formulation in order to achieve target-dosage efficiency.

Pesticides include insecticides, fungicides, herbicides, rodenticides, molluscicides, piscicides, algaicides, bactericides, avicides, germicides, miticides, and nematocides, according to the target determinal organism to be killed.

General principles

The use of some types of pesticides causes much emotive response in the general public. There is no doubt that side effects can influence the ecology of a region where pesticides are applied. The following points should be taken into account: the toxicity of the chemical, the method of use, the route of absorption, the vehicle in which the chemical is applied and the formulation used.

Classification

Pesticides are classified into inorganic compounds, of lead arsenic copper, fluorine, phosphorus, thallium, cyanide, sulphur, selenium, etc., and organic compounds, either of plant origin, such as nicotine strychnine and pyrethrin, or of animal origin such as organochlorines, organophosphorus compounds, carbamates, nitrophenols, organic sulphur derivatives (armite), organic thiocyanate (lethane) petroleum products (fuel oil, kerosene repellants (phthalates and indolones) dipyridyls (Paraquat) and coumarins (Warfarin, Coumafuryl and Bromadiolene).

A classification of pesticides that would distinguish between the more and less hazardous forms of each pesticide has been developed by WHO. This classification of pesticide by hazard was adopted by the Twenty-eighth World Health Assembly which recommended its use by Member States, international agencies, and regional bodies.

The hazard particularly referred to in this Recommendation is the acute risk to health (that is, the risk of single or multiple exposures over a relatively short period of time) that might be encountered accidently by any person handling the product in accordance with the directions for handling given by the manufacturer or in accordance with the rules laid down for storage and transportation by competent international bodies.

Basis of classification

The classification distinguishes between the more and the less hazardous forms of each pesticide in that it is based on the toxicity of the technical compound and on its formulation. In particular, allowance is made for the lesser hazards from solids as compared with liquids.

The classification is based primarily on acute oral and dermal toxicity to the rat, since these determinations are standard procedures in toxicology. Where the dermal LD_{50} value of a compound is such that it would place it in a more restrictive class than the oral LD_{50} value would indicate, the compound will always be classified in the more restrictive class. Provision is made for the classification of a particular compound to be adjusted if, for any reason, the actual hazard to man differs from that indicated by LD_{50} assessments alone.

The criteria for classification are summarized in Table 1.

Table 1. Recommended criteria for classification[1]

Class		LD_{50} for the rat (mg/kg/body-weight)			
		Oral		Dermal	
		Solids[a]	Liquids[a]	Solids[a]	Liquids[a]
Ia	Extremely hazardous	5 or less	20 or less	10 or less	40 or less
Ib	Highly hazardous	5-50	20-200	10-100	40-400
II	Moderately hazardous	50-500	200-2000	100-1000	400-4000
III	Slightly hazardous	Over 500	Over 200	Over 100	Over 4000

[a]The terms "solids" and "liquids" refer to the physical state of the product or formulation being classified.

[1] WHO Chronicle, 29: 397-401 (1975).

Formulation

Pesticides are not used in pure form. They are prepared for application by dilution in organic solvents and/or water (solutions or emulsions), by adsorption to dust particles or granules, or by mixing into baits. Formulations often contain "adjuvants", which are substances that enhance the effectiveness of the pesticide by improving dispersion, extending persistence, causing the pesticide to adhere to foliage, or enhancing the penetrating power of the active ingredient.

Formulation is a major factor in determining the hazard of pesticidal preparations to handlers. Aerosols of solutions and emulsions are commonly used today. Inhalation of spray droplets may cause poisoning.

Application

Techniques of application are as important as formulation in determining the hazard of specific human exposures to pesticides. Many different machines are used to apply formulated pesticides. These are designed to spread the pesticide uniformly over the crop, foliage, or soil area or to disperse it evenly through the harvested produce to be protected. Their design and the technique of their use should be such as to minimize applicators' exposure. In the case of rodenticides, the skilful placing of baits often determines the effectiveness of the control programme as well as the safety for non-target species.

The Scope of Adverse Effects

Definitions

Toxicity means the potential of a certain chemical for causing adverse effect(s) when ingested, injected, inhaled, or applied to the skin. Acute toxicity is most often expressed as LD_{50} value, i.e the dose (weight of toxicant per body weight of animal) which kills 50% of test animals. Values may be determined for oral, dermal, or parenteral routes of administration.

Adverse effects are manifestations of illness produced by the actions of the absorbed foreign substance throughout the body, i.e., "systemic" effects. Acute (prompt onset, short duration) effects, particularly irritation and poisoning, are the most common adverse effects of pesticides. Much less frequently, some pesticides may produce permanent injury. Among these chronic effects, damage to the nervous system and infertility have been reported. Development of malignant tumours has also been reported by Hardell et al., 1979.*

Some pesticides are corrosive agents. A limited number of acids and oxidants are used in agriculture, chiefly as herbicides. Trichloracetic acid and sodium chlorate are notable examples. Special protective gear must be used to prevent corrosives from coming into contact with the skin and mucous membranes, particularly the eyes. Inflammation and ulceration may result, depending on the potency and concentration of the corrosive. Corrosive substances of all kinds represent a particular threat to the eyes. If a corrosive substance contacts the eye, blindness may result from corneal scarring.

Due to ignorance and lack of health care many accidents of intoxication may occur among the spraymen and the inhabitants of a sprayed area. For example, dermatitis of exposed parts of the worker (limbs and face) were reported in Gezira and Khashm El Girba schemes, in Sudan. Also deaths from pesticide toxicity were reported. A tractor driver died during spray of Eldrin in Gezira in 1963; and 13 schoolchildren died in Tung area from consumption of dressed seeds in 1971.

In Sudan, a survey of spraymen using Dimthaote in agriculture was conducted in 1975 in the area around El Khogalab, 32 km north of Khartoum, to assess minimum requirements for workers' protection in tropical areas. They found no cholinestrase depression and the calculated dose received by the worker was within permissible limits. In Egypt, cases of accidents and death from intoxication with pesticides have been reported during the last few years. Non-occupational cases of intoxications with pesticides have also been reported; however, these reports indicated the need for further investigation. The outbreak of intoxication with alkyl mercury fungicide in Iraq in 1971 is an example

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*Hardell, L. and Sandström, A. Case control study: soft tissure sarcomas and exposure to phenoxyacetic acids or chlorphenols.
Br. J. Cancer, 39-711-717, 1979.

of such non-occupational intoxication with pesticides. The incident occurred when large quantities of wheat and barley were imported to Iraq for planting purposes and distributed to farmers for the purpose of increased yield. These grains were treated with alkyl mercury. Warning against human consumption was written on the sacks in Spanish only. In ignorance, some farmers consumed the treated grain and later fell sick, with signs and symptoms of chronic damage of the nervous system (see: Country statements - Egypt, Iraq, Sudan).

In other countries of the Region, there have been reported cases of intoxication, but these have not been verified; such cases may also need to be investigated.

Toxic mechanisms

It is not possible to describe the toxicology of all the pesticides used today, but Table 2 provides brief synopses of toxic mechanisms, manifestations, and recommended management of some of the most commonly used pesticides that have caused serious poisoning in recent years. Some examples for human health effects of representatives of four groups of pesticides are given, using the information published in WHO Technical Report Series No. 677, 1982.

Table 2

TOXIC PROPERTIES OF PESTICIDES

Pesticide class	Examples of pesticide	Principal toxic mechanism(s)	Common manifestations of poisoning	Diagnostic test	Some principles for treatment
Organo-phosphates	Parathion Phosdrin Diazinon	Acetylcholinesterase inhibition : increased cholinergic activity	Headache, dizziness, nausea, abdominal pain, pinpoint pupils, bradycardia, muscle twitching.	Blood cholinesterase activities Effectiveness of atropine Urine metabolites	Atropine parenterally oximes (ChE reactivators)
N-methyl carbamate Insecticides	Carbofuran Carbaryl Methomyl	Acetylcholinesterase inhibition: increased cholinergic activity	Headache, dizziness, nausea, abdominal pain, pinpoint pupils, bradycardia, muscle twitching	Effectiveness of atropine Urine metabolites	Atropine parenterally
Organo-chlorines	DDT Dieldrin Lindane	CNS axon poison	Apprehension, pallor; tonic-clonic convulsions Induction of liver enzymes	Measure blood for concentration of pesticide	Anticonvulsants
Nitro-chlorophenols	Dinoseb Penatchloro-phenol (DNOC)	Uncoupling of oxidative phophorylation; increased body heat	Fever, tachycardia, tachypnoea, excitement	Measure blood or urine concentration of chloro-or nitrophenols	Reduce body temperature by physical means

Table 2 (cont'd)

Pesticide class	Examples of pesticide	Principal toxic mechanism(s)	Common manifestations of poisoning	Diagnostic test	Some principles for treatment
Dipyridyls	Paraquat	Topical injury to skin mucous membrane or eye, on contact. On ingestion, injury to liver and kidney, and induced proliferation of lung fibroblasts	Injury to skin, fingernails, cornea, on contact. On ingestion, delayed onset of fibroblastic response in lung, leading to asphyxic death	Measure blood and/or urine concentrations of Paraquat	Prompt washing of contaminated surfaces. If ingested, oral bentonite or charcoal and catharsis; Haemoperfusion. Avoid oxygen
Coumarins	Warfarin Coumafuryl Bromadiolone	Inhibition of hepatic synthesis of prothrombin	Prolonged prothrombin time Bleeding from nose, mouth, gut Blood in urine	Prothrombin time	Phytonadione (vitamin K_1)
Nicotine	Nicotine, as alkaloid or salts	Stimulation, then depression of CNS and autonomic NS	Headache, dizziness, tremors, convulsions, nausea, abdominal pain, diarrhoea, paralysis	Nicotine and metabolites in urine	Anticonvulsants; assisted pulmonary ventilation; atropine dibenzaline
Cyanide	HCN gas Sodium cyanide Acrylonitrile	Inhibition of cytochrome oxidase, depressed cell respiration	Headache, nausea, hyperpnoea, unconsciousness	Cyanide and thiocyanate in urine and saliva	Parenteral nitrite and thiosulphate
Strychnine	Strychnine rodenticides	CNS stimulant-convulsant	Violent seizures	Urine spot test	Anticonvulsants, oxygen

Exposure mechanisms and medical treatment

Two basic occupational health problems need to be dealt with to ensure the safe use of pesticides and the protection of the user. First, the user must be aware of and know how to deal with the potential hazards associated with pesticide use. Second, there must exist methodology to measure exposure situations, and if intoxication of workers has resulted, also to provide adequate medical information and treatment minimizing the danger to the exposed individual.

The problem of pesticides itself has become increasingly complicated. The first generation of pesticides - highly toxic and persistent agents - was replaced by the second generation, some of which showed delayed effects. Now the question is of the third generation of pesticides. These are quite new organophosphorus selective compounds, having not only carboxyether groups but peptide binds as well. Substances having aminoacid residues are of particular importance. Waste products of such organophosphorus compounds are related to natural biogenic substances and will not contaminate the environment. Synthetic pyrethroids may also be related to pesticides of the third generation. Evidently, returning of some toxic organophosphorus compounds may be expected but in granulated form. It is proposed that in such form they will be less toxic to the health of man and to the environment than many of less toxic substances that are more persistent and may cause delayed effects. In any case this feature not only remains but will become more pronounced.

Pesticides usually enter the body through one of three routes:

1. Inhalation through the lungs;
2. ingestion through the stomach and intestines;
3. absorption through the skin or conjunctiva.

In occupational exposure, the first and third routes are considered most important[1]. Ingestion plays a major role in accidental or suicidal intake. Treatment and prevention of toxic responses will vary from pesticide to pesticide

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[1] Kundiev, Yu. I, (1975). "Absorption of pesticides through the skin". Kiev, Zdovov'e.

There are medical measures to apply immediately with acute cases of pesticide poisoning; for thorough acquaintance with such measures the relevant medical literature should be consulted. However, effective methods for saving the lives of victims do exist which can be taken by workers who must be instructed on the important steps they should take when a case of acute poisoning is suspected. They should be able to spot early signs of poisoning and administer first aid treatment. Moving a patient well away from any contaminated area and from the vicinity of pesticides, quickly removing any contaminated clothing, cleaning or washing contaminated skin, administration of first aid and, if necessary, artificial respiration can prove to be life-saving.

Determination of the potential for exposure to pesticide poisoning and the results of workers' intoxications is usually done by environmental and biological monitoring. Environmental monitoring measures the concentration of a pesticide or its metabolites to which the worker has been exposed. Biological monitoring measures the concentration of the pesticide or its metabolites in urine and/or blood, or some of the biochemical effects, e.g. cholinesterase activity in exposure to organophosphorus compounds or carbamates. Some of the procedures in these two methods are simple and can be used under field conditions while other techniques require sophisticated laboratories.

The procedures used by any country will obviously depend upon the available personnel, laboratory equipment and surveillance determined to be necessary. In most instances it would be a good practice to start with the simplest laboratory capable of handling the pesticides in use and possibly even prohibit the use of certain pesticides until laboratory skills and medical resources are available to ensure their safe use.

Education

Workers likely to have contact with pesticides must be thoroughly instructed and understand the potential hazards associated with the use of pesticides. They need to know the symptoms of pesticide intoxication and to know when, where and how to seek medical assistance for treatment. Instruction must be provided which clearly describes and demonstrates the use of personal protective equipment. Such equipment is often necessary during the application of certain pesticides,

particularly when pesticides are used in an environmental structure such as a greenhouse. Workers well educated in preventive techniques can minimize the potential hazards associated with pesticide use.

To minimize the dangers of pesticides in agriculture, certain rules should be observed:

1. The choice of the pesticide should not depend on efficacy only, but should depend on relative safety to man and animal. Exchange of information between the manufacturer and the consumer, between agricultural and health authorities and also between international organizations such as WHO, FAO and UNEP as well as different countries, plays an important role in deciding on the appropriate choice. Before importing any pesticide the importing country should be sure that this pesticide is registered and preferably also used in the country of origin.

2. Pesticide storage must be separate from that of the food chain of families and/or livestock. Pesticides should be stored in a safe and separate store inaccessible to children and animals or adults unauthorized to work with them.

3 Sanitation rules must be strictly adhered to in the mixing and handling of pesticides to prevent contamination of the worker, the application equipment and the immediate environment in which he and the members of his family work, live and play. Safety rules such as the prohibition of eating, drinking or smoking in a work area should be strictly observed. An adequate supply of clean water (not contaminated with pesticides) is necessary to immediately remove spills from the body and equipment and to further dilute those which may have fallen to the ground. Washing hands before eating, drinking or smoking should be a standing role.

4. The proper type, shape, size and labelling of pesticide containers also helps in safe handling, storing and transport of the pesticides. Labelling should be in a language understandable to the user.

5. In mixing pesticides certain precautions must be taken to avoid spillage or splashing. Manual mixing should be avoided as far as possible and the operator should wear protective clothes. Such clothes should be washed regularly and separately from any family clothing to prevent cross-contamination. Although protective clothing prevents skin contact with pesticide, it should not be assumed that it is equally effective against inhalation or accidental ingestion.

6. Spraying should be done in such a way as to protect the operators, as for example by spraying upwind or by use of properly maintained sprayers.

7. Empty containers of pesticides should be disposed of properly; either returned to the supplier for repacking or burnt and deeply buried under supervision. Under no circumstances should they be used for any other purpose. Workers must be made to realize that any pesticide remaining in used or empty containers is a serious hazard to them, as well as to children and domestic and wild animals.

8. The worker chosen to handle pesticides should be an adult male, in good health and well aware of the hazards of the chemicals he is handling. Some countries do not allow anyone except those who are licensed to handle pesticides. Pregnant and breastfeeding women should be prohibited from the application of pesticides. Medical supervision should identify, at pre-employment, examinations any health state incompatible with exposure to pesticides, and at periodic examinations any signs or symptoms of early health impairment.

9. Working hours in handling pesticides should be regulated.

IV-2.2. Fertilizers

Fertilizers are substances introduced into the soil in order to obtain plentiful and stable harvest crops. According to their origin they are classified as natural fertilizers (manures) and artificial fertilizers. Manures are mainly organic substances such as dung, fowl droppings, bone-meat, peat, compost, etc. Artificial fertilizers are mainly produced in chemical plants by synthesis or by processing of minerals occurring in nature. According to their chemical composition they can be organic or inorganic (mineral) and they may be sub-divided into nitrogenous, phosphatic, potash and trace element fertilizers according to their main constituents (nitrogen, phosphorus, potassium, trace elements).

Health effects

Dung collection and removal at farms is associated with a more or less close contact with biological material. Thus agricultural workers are exposed to the risk of contracting diseases due to infections and parasitic agents (common to man and animal). As natural putrification takes place in dung heaps, workers loading dung trucks or carts and taking them out to the field may be exposed to gaseous decay products such ammonia, carbon dioxide, carbon disulphide, etc. These gases constitute a serious hazard when manure is kept in closed storage structure or in badly aerated premises. When fowl droppings are collected and removed, there is a danger of contracting psittacosis due to contact with sick fowls.

Of the harmful encountered in work with mineral fertilizers, fluorine and its compounds are especially dangerous. Workers exposed for long periods to fluorine and its compounds released into the air develop fluorosis. The harmful effects of phosphatic material are also determined by the fact that they contain 10% or more of free silica, which may cause pneumoconiosis in workers inhaling dust-laden air.

The biological effects of fertilizer dust depend on its composition: salts of phosphoric, nitric and other acids. The dust of certain highly soluble fertilizers (urea) irritates the mucous membranes of the upper airways.

Prevention

(a) Mechanization of operations to limit workers' contact with animals and their excrement.
(b) Health education of agricultural workers.
(c) Personal hygiene.
(d) Use of protective equipment, i.e. protective clothing, boots, gloves, aprons, etc.
(e) Adequate medical surveillance of workers.

IV-2.3. Animal feed additives

Side by side with the now well established practice of promoting healthy plant life by the use of pesticides and trace elements in fertilizers, a somewhat parallel development has been taking place in animal husbandry: this is by using substances commonly added to animal feed to exchange weight gain such as[1]:

(a) Essential minerals: particularly those in which the unfortified feed is deficient.

(b) Antibiotics and antiparasitics: to suppress organisms which compromise the availability of nutrients to the animal. Antibiotic drugs such as aureomycin and procaine penicillin are being used to check the incidence and control the development of diseases. Furthermore, incorporation of small amounts of these drugs in animal fodder increases growth rate and efficiency of food conversion.

(c) Hormones: used to direct growth in a desired manner, e.g. a pellet of synthetic oestrogen inserted under the skin of young cock acts temporarily as a substitute for caponization as the castration operation is sometimes dangerous to the bird.

Health effects

It is unlikely that minerals or hormones would be taken up by exposed handlers in sufficient dosage to cause injury or illness. It is alleged, however, that regular exposure to the many antibiotics given as feed additives modifies the spectra of natural respiratory and enteric flora of livestock workers to organisms that are resistant to antibiotic action. This has the effect of exposing them to pathogens not readily controlled by antibiotics but there has been no clear demonstration that animal feed handlers are actually at extraordinary risk as a result of this exposure.

Dust from animal feed is irritating, and perhaps sometimes sensitizing to the respiratory tract.

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[1] ILO, Encyclopaedia of Occupational Health and Safety, Vol. I, 3rd edition, 1983.

Prevention

Air filtering masks, if well fitted, reduce inhalation exposure to dust formed from feed and feed additives. Disposable masks are available for this purpose, and they provide reasonable protection to workers who must handle the feed regularly. Persons who became allergic to the dust should be assigned to other work.

IV-2.4. Disinfectants and detergents

Several types of cleaning and disinfectant chemicals are used by dairies and food processing industries to ensure sanitary work sites. Examples are:

- Alkaline salts: tri- and di-sodium phosphate
- Inorganic acids: phosphoric and hydrochloric
- Organic acids: butyronic and citric
- Chlorine-releasing inorganics: sodium and calcium hypochlorite
- Chlorine-releasing organics: isocyanuric acid
- Iodine-releasing organics: polyethoxy polypropoxy-ethanol iodine complex
- Phenols: O-phenylphenol
- Quaternary ammonium compounds: alkyl dimethyl benzyl ammonium chloride.

Health effects

There is probably very limited dermal absorption of these highly ionic compounds. All are irritating to the skin, eyes and mucous membranes and some induce sensitization in a limited number of individuals. The iodine-releasing and quaternary ammonium compounds are most often implicated as sensitizers. Ingestion is likely to cause severe illness, mainly from corrosive effects on the gastrointestinal tract and injury to the liver and kidney.

Prevention

Protective garments, gloves and face shields should be worn when using these compounds, to minimize contact. Contaminated skin, eyes or mucous membranes should be flushed free of chemical, using clean water, whenever accidental contamination occurs. There are no specific antidotes for poisoning and injuries by these compounds.

IV-2.5 Other chemical hazards

IV-2.5.1 Carbon monoxide

Carbon monoxide (CO) causes many poisonings in the technologically advanced societies. A high percentage is fatal. Exhaust from internal combustion engines and fumes from space heating equipment are the commonest source. Maintenance of machinery in a confined space, e.g. house, husbandry, or stove ignition in a closed place can lead to incomplete combustion of carbonaceous material and evolution of CO.

Health hazards

Health hazards associated with carbon monoxide include headache, dizziness, fatigue and mood changes among workers; these should arouse suspicion of CO intoxication, which is due to impairment of oxygen transport to critical tissues, primarily the brain and heart muscle. Measurement of blood carboxyhaemoglobin concentration confirms CO poisoning, and enables the attending physician to ascertain how severe it is. Treatment consists of removing the patient from the toxic environment, administration of 100% oxygen, and, in severely poisoned victims, cardiopulmonary resuscitation.

Prevention

Defence against carbon monoxide poisoning has always depended mainly on education of the public and particularly of workers exposed to combustion effluents. Regular inspection of work sites for (i) adequate exhaust systems and (ii) ventilation of work offers the only safeguard against poisoning.

IV-2.5.2 Oil and solvents

Petroleum products are widely used in agriculture. Various waste oils, including crankcase oil, kerosene and other fuel oils are effective as non-specific contact herbicides. Also, the technical formulations of most insecticides are commonly dissolved in petroleum distillates and then made into emulsions for application.

Dermal contact with these oils often results in defatting of the skin, with resulting dermatitis. This is sometimes complicated by bacterial infection. Dermatitis is, in fact, the most common adverse effect experienced by pesticide handlers, and this is probably due, in large part, to extensive contact with oils. Oils are moderately irritating to the eye, and should be flushed out promptly with copious amounts of fresh water.

IV-2.5.3 Oxides of nitrogen

Exposure to oxides of nitrogen may occur in high concentrations in tower silos where nitrogen-rich silage has been deposited. Carbohydrates in the silage produce acetic and lactic acids which combine with nitrites in the silage to produce nitrogen oxide (NO), nitrogen dioxide (NO_2) and carbon dioxide (CO_2). Both CO_2 and NO_2 are heavier than air and may be found in higher concentrations in concavities in the silage. NO_2 gas will also flow down the outer walls of the silo and fill unventilated spaces adjacent to it.

Farmers working around silos containing fresh silage must be aware of this serious hazard. With direct exposures to high gas concentrations in an unventilated silo, the worker may be overcome by NO_2 and CO_2 within two to three minutes. Such high concentrations of NO_2 may cause severe pulmonary injury resulting in pulmonary oedema. This specific disorder has been referred to as silo filler's disease. Without immediate and intensive medical treatment, workers with such massive exposures will often not survive.

Prevention of silo filler's disease depends upon:

- recognition of the potential for massive NO_2 exposures;
- adequate ventilation of the silo at least 30 minutes prior to entry;
- working in pairs and with a safety harness;
- entering the silo, if necessary, immediately following the last load and not after 24 to 48 hours by which time NO_2 levels may be dangerously high.

Air-supplied respirators may also be used but are expensive and usually necessary only for rescue operations. With attention to the preventive measures listed above, harmful exposure to NO_2 should not be experienced by a well-informed agricultural worker.

IV-2.5.4 Ammonia

With increasing use of anhydrous ammonia as a fertilizer for farm crops, there is a correspondingly increasing opportunity for spills of ammonia and acute exposure to ammonia gas among agricultural workers. Ammonia is a potent mucous membrane and respiratory irritant which will result in conjunctivitis, rhinitis, pharyngitis and bronchitis at relatively low concentrations. Workers will frequently develop some tolerance to ammonia at low levels. With exposure to high concentration of ammonia, which may occur with spills in confined spaces, acute lung injury with pulmonary oedema may occur. Again vigorous and immediate medical attention must be provided to the worker so affected. Some workers who survive a major ammonia spill appear to progressively lose lung function over time.

Another source of ammonia exposure among agricultural workers is from liquid manure pits which are increasingly being constructed underneath farm buildings in which livestock are confined. Although this technology offers the advantage of industrial mass production and economy, it is associated with occupational exposure to ammonia, hydrogen sulphide and respirable particulates (mainly grain dust and air-borne faecal material containing high levels of endotoxin). This combined respiratory exposure is quite irritating and results in a high prevalence of chronic bronchitis and asthma among those exposed. Because these confinement units are humid, adsorption of ammonia on to respirable particulates is enhanced, which in turn allows ammonia-laden respirable particulates to penetrate into distal lung units.

Prevention of exposure to ammonia in agriculture is again dependent upon recognition of the potential risk. Therefore, whenever possible, work with ammonia tanks should be carried out only in a well-ventilated area. Similarly,

adequate ventilation of animal confinement units built over liquid manure pits toward a location away from the work area will largely prevent this problem. Lastly, use of respiratory protection will reduce, but not eliminate, exposure to ammonia gas and respirable particulates in animal confinement buildings.

IV-2.5.5 Hydrogen sulphide (H_2S)

Hydrogen sulphide gas in high concentrations (500 ppm) in combination with methane gas (fire and explosion hazard) has been documented when liquid manure pits, associated with animal confinement buildings, are agitated prior to pumping. Several deaths have occurred among those who have attempted to enter these pits in order to retrieve objects or to work on the pumping equipment. The cause of death in these instances has most commonly been from pulmonary oedema. Lower levels of H_2S (from microbial digestion of liquid manure) have been measured in the confinement units, but are rarely in excess of the Threshold Limit Values (TLV) for H_2S under normal working conditions.

Prevention of acute toxic exposure to H_2S in this agricultural setting is dependent on knowledge of this serious hazard, avoiding entry to a confined space associated with liquid manure, use of a safety harness, always working with a partner, and use of an air-supplied respirator if it is necessary to enter such an exposure area.

IV-3. Biological hazards

These can result from:

IV-3.1. Zoonoses

Zoonoses are diseases and infections naturally transmitted between vertebrate animals and man. Diseases caused by venoms and toxins of vertebrate animals (snake, fish, etc...) are not recognized as zoonoses. The definition includes the paprazoonoses, which are not transmissible directly between animals and man but have a common inanimate reservoir such as soil. However, there are a few diseases which man and animals contract from a common source, such as soil, but

they are not transmitted between man and animals. They are therefore not considered to be zoonoses but under certain circumstances they constitute occupational infections. Some examples of these are tetanus, blastomycosis, coccidiomycosis, etc. Certain other infections, e.g. histoplasmosis, are associated with birds and mammals as the fungus involved grows on the soil mixed with their excreta and saprophytic spores which become air-borne and infect man.

General considerations

It is possible for all zoonoses to be diseases of occupational origin in persons whose work brings them into direct or indirect contact with animals. Many of them are, however, mild and may not cause disability or illness resulting in absence from work. Over two dozen zoonoses have attracted attention in occupational medicine. Others will no doubt be found important in areas where agricultural medicine and veterinary services are still in the early stages of development. In general, information on the extent of occupational risk and importance of zoonoses is scant. In many areas they are not legally recognized as occupational diseases. In general, rural areas are poorly served by specialists in this branch of medicine. Furthermore, the complex natural history of many zoonoses has only recently been understood. Methods of detection, especially by laboratory techniques, are still scantily applied, often because they are expensive but more commonly because of poor development of laboratory services.

Zoonoses as diseases are a part of the ecosystem in which there are interactions between the host, the agent and the abiotic environment. These interrelationships may be balanced for many years but when a certain imbalance occurs for some reason, such as variations in climate or geological events, interactions among organisms change and there may be disease outbreaks.

Classification

The number of zoonotic diseases is relatively large. Over 150 zoonoses are distinguished world-wide, with at least 40 having significance as occupational diseases in agriculture. The joint ILO/WHO Committee on Occupational Health

considered zoonotic diseases of occupational significance to agricultural workers in a report[1] published in 1962. Table 3 lists some common zoonoses of occupational health importance in agriculture.

A brief account of some of them is given below:

(a) Brucellosis (Mediterranean fever, undulent fever or malta fever) which is a world-wide disease transmitted to man through contact with goats, cattle, cows and hogs or contact with contaminated products of these animals.

(b) Leptospirosis (Weil's disease, leptospiral jaundice, spirochaetal jaundice, infective haemorrhagic fever, or mud fever) occurs in many animals and in man in all countries of the world. A few studies have demonstrated the presence of leptospirosis in rats in Egypt. The disease is transmitted to man through direct or indirect contact with the urine of infected animals. Animal carriers such as rats excrete contaminated urine into a suitable medium, e.g. water or mud. Workers in rice and sugar plantations are especially at risk since they spend a long time in contact with water and mud.

(c) Anthrax is found throughout the world. In developing countries occupational anthrax morbidity is related to the incidence of the disease in agricultural animals. Infection in man occurs most frequently from contact with sick animals or infected animal products.

(d) Bovine tuberculosis is still a major public health and occupational problem in Africa, Asia and South America. Human, avian and atypical varieties of tubercle bacilli affect a wide range of animals, man and birds. Man may acquire bovine tuberculosis by drinking contaminated milk or eating improperly cooked contaminated meat, by inhaling contaminated air in farm buildings or by direct contact with infected animals or their tissues. (Farmers and cattle breeders are high-risk occupational groups because of their exposure to tuberculosis during work with infected cattle).

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[1] WHO Technical Report Series No.246, 1962

Table 3

LIST OF SOME COMMON ZOONOSES OF OCCUPATIONAL HEALTH IMPORTANCE IN AGRICULTURE

Type of agricultural work	Diseases	Causative organism	Animals principally involved
Livestock raisers	Anthrax	Bacillus anthracis	Ruminants, equines, swine
Rice-field workers	Leptospirosis	Leptospira species	Rodents, dogs, swine, cattle, bandicoots
Poultry-processing plants	Psittacosis	Psittacosis (Bedsonia)	Psittacines and other birds
Rendering-plant workers	Q-fever	Coxiella burnetii	Cattle, sheep, goats
Woodcutters	Yellow fever	Virus	Monkeys, marmosets, marsupials
	Tick-borne disease	R. australis	Bandicoots, rodents
Poultry raisers	Newcastle disease	Virus	Chickens
Sheep shearers	Contagious ecthyma	Virus	Sheep and goats
Various workers	Rabies	Virus	Carnivores, bats, other wild animals
	Malaria	Plasmodia	Monkeys
	Brucellosis	Brucella species	Cattle, swine, goats, sheep, horses

* Modified from WHO Technical Report Series, No. 378, 1967

IV-3.2. Contaminated environment (air, soil and water)

This can lead to certain infectious diseases such as histoplasmosis, coccidiodomycosis, blastomycosis, creeping eruption, tetanus, leptospirosis, schistosomiasis, ankylostomiasis, leishmaniasis and onchocerciasis.

Schistosomiasis being a major endemic disease in most of the countries of the Region is briefly discussed below.

Schistosomiasis is a national health problem in Egypt as well as in other countries of the Region. It is also important in other tropical and subtropical countries. It is found in rural areas and it affects large sectors of the population. The high incidence of the disease and the reduction in physical efficiency and earning capacity resulting from its complications are grounds for particular concern. Increase in the cultivation of rice and cotton has necessitated the establishment of new schemes of irrigation. In Egypt, the development of perennial irrigation particularly after the construction of the High Dam, has increased the incidence of the disease to more than 60% in rural areas irrigated perennially in contrast to 5-10% in areas irrigated by the basin system.

In our Region two major species of schistosoma are prevalent, i.e. schistosoma haematobium and schistosoma mansoni. These two species and others are also prevalent in other geographical locations. Occupational exposure usually occurs through contact with water infested with snails,the intermediate host, and cercariae. The person's skin is penetrated by the cercaria whilst swimming, during irrigation, whilst working in rice fields or while engaged in other agricultural activities involving the use of water in infested areas.

Recently, a joint team from the Departments of Occupational Health and Community Medicine, Faculty of Medicine, University of Khartoum, carried out a survey to relate the effects of Schistosomiasis and the work capacity of farmers, those in the Gezira area being the exposed group and those in El Rahad area the control group. It was found that the infected farmers in Gezira irrigated area were much lower in their work capacity than the non-infected farmers of El Rahad area.

IV-3.3. Snake bites and insect stings

IV-3.3.1. Snake bites

Between 30 000 and 40 000 persons world-wide die from snake bites every year.[1] The largest number of causes are recorded in South-East Asia,[2] where the death rate may be locally as high as 154 per 100 000 population. Most snake bites occur in rural areas; frequency seems to depend to a large extent on occupational factors, 2/3 of victims being bitten at their workplace. Frequency is higher among men and children; this increase in rainy seasons when floodwater drives snakes out of their hiding places, and also in spring and summer when people congregate more because of holidays. Bites are more serious after the winter or a period of fasting because of the accumulation of venom in the snake's glands.

There are two main types of snake poisons: haematotoxins (injuring the RBCs) and neurotoxins (acting on the nervous system). The viper family produces a venom which is essentially haematotoxic but possesses certain neurotoxic properties. Coral snake venom is essentially neurotoxic and only slightly haematotoxic. Snake bites do not always have harmful effects, as the snake may be ill or may have used up its venom by biting and eating a prey shortly before, or again the venom may have been absorbed by the victim's clothes. Poisonous snake bite is associated with a skin wound and steadily increasing pain unlike other animal bites. The prognosis for victims of poisonous snake bites has improved greatly with the introduction of antivenom sera but these must be administered as soon as possible. Most deaths occur because of lack of treatment. The rapidity of death depends upon (i) the potency of the venom from the offending species, (ii) the site of the bite and (iii) the amount of venom injected.

IV-3.3.2. Insect stings

These occur on hot, clear days when insects are hampered in their search for nectar. They are attracted by bright colours, some scents and some cosmetics. Many persons are stung every year by insects,but statistics of fatality are very vague.

Bees sting only once, because they cannot recover their sting; other insects save their sting and can therefore sting several times, injecting a certain quantity of poison each time. There is a local irritative reaction; an allergic reaction occurs only in persons who have been sensitized: this is because of the

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[1] ILO, Guide to Health and Hygiene in Agricultural Work, 1979.

[2] Swaroop, S. and Grab, B. (1954). Snake bites mortality in the world, Bull. World Health Organization, 10, 35-76.

proteic factors of the poison and the pollens which may be found on the sting. There is a rapid succession of general symptoms, i.e. headaches, nausea, vomiting, dizziness, weakness, dyspnoea, shock collapse and unconsciousness. If there is shock it appears within 5 minutes. There may be some areas of bleeding under the skin, abdominal cramps, coughing and contusions.

IV-3.3.3. Scorpion stings

Scorpions do not attack human beings and stings are due to accidental contact. The majority of scorpions produce a non-lethal poison that gives rise only to pronounced local reaction. However, some North African scorpions have neurotoxic poisons more lethal than snake venoms. The fatality rate due to scorpion stings is much higher among children and the elderly.

Prevention

The following are preventive measures against snake scorpion sting and insect/scorpion:

(i) Wearing long trousers and top boots and being particularly careful in putting a hand or foot in a region of dense vegetation reputed to be infested by snakes; or in putting hand in receptacles, e.g. water jars.

(ii) Eradication of snakes by introduction of their predators, e.g. Indian mongoose.

(iii) Identification of snakes inhabiting rural areas with a view to supplying appropriate and effective anti-snake sera.

(iv) Educating workers about the venomous snakes to which he could be exposed during his occupation.

(v) Hyposensitization management of allergic reactions to insect stings by special antigens which are usually extracts of a mixture of frozen live insects.

IV-4. Organic dust

Organic dust is derived from mouldy hay, straw, cereals, animal hides and skin, hair and feathers and excrement from hens, pigeons, ducks, rabbits, geese, etc. It may cause immune reactions of type I or type III. Type I reaction is manifested by allergic rhinitis, bronchial asthma and dermatitis. Type III reaction is manifested by allergic alveolitis and diffuse fibrosis, as in

farmer's lung, bagassosis and pigeon breeders' disease of which the causative organisms are thermophilic actinomycetes (micropolysporafaeni, and thermo-actinomyces vulgaris; rarely by the mould fungus aspergillus) or by the protein serum in bird excrement.

The more important vegetable dust exposures are listed in Table 4. Occupations and industries where occupational exposure associated with adverse health effects have been documented are also noted in Table 4. Several of these dusts have been associated which more than one type of respiratory response; these health effects are also listed in Table 4. The most common respiratory disorder to arise from these exposures is obstruction of the airways - either the acute response, i.e. asthma, or chronic airways obstruction, i.e. chronic bronchitis, or non-specific airways obstruction. Byssinosis is the disease most specifically associated with the textile vegetable dusts. Workers exposed to these organic dusts do not appear to be at increased risk to cancer, except those exposed to some wood dusts; such workers have been found to have increased rates of nasal cancer. Exposure to organic dust involves virtually all agricultural workers to some degree.

Prevention

Prevention of respiratory disease from exposure to organic dusts is best achieved through environmental control of dust exposure and prevention of contamination with bacteria, fungi, rodents and insects. Whenever vegetable material is harvested, care should be taken to dry the material thoroughly prior to storage. Similarly, care should be taken to store the vegetable material in a dry and well-ventilated area to prevent bacterial and fungal contamination. When working with these organic dusts, one should always seek to provide good ventilation which will remove the dust from the workers' breathing zone. This may be accomplished by natural ventilation, but is more effectively done with an exhaust fan. Enclosure of certain dusty processes, which can be operated from outside the enclosure, is another efficient environmental control measure.

Where these primary environmental control procedures cannot be employed effectively, efficient dust masks or respirators may be used.

The worker can minimize his exposure by adopting proper work practices. These include attention to proper ventilation, avoiding exposure to mouldy vegetable material, good housekeeping to prevent accumulation of organic dust

Table 4. Organic Dust Exposures Associated with Adverse Health Effects[1]

Type of dust	Principle occupational occurrences	Reaction type	Lung disease	Observations
Milled or crushed grain and bran	Grain milling and storage, bakeries	Irritation, immune reaction (type 1)	Allergic rhinitis, chronic rhinitis, bronchial asthma, COPD	Mould fungi produce similar symptoms (frequently found as impurities)
Wood, particularly exotic types	Manufacture of veneers, furniture industry (polishing), wood turning	Irritation, immune reaction, carcinoma	Allergic rhinitis, bronchial asthma, COPD, carcinoma of the nose and nasal cavity	Dermatitis
Animal hides and skins, hair, feathers, scales	Agriculture, zoo attendants, laboratory animal keepers, furriers and fur dealers	Immune reaction (type 1)	Allergic rhinitis, bronchial asthma	Dermatitis
Mouldy hay, straw, cereals and bagasse	Agriculture, grain silos, sugar industry	Immune reaction (type III), allergic alveolitis, diffuse fibrosis	Farmer's lung, bagassosis	Caused by thermophilic actinomycetes (Micropolyspora faeni, thermoactinomyces vulgaris) rarely by mould fungus (Aspergillus)

[1] ILO, Encyclopaedia of Occupational Health and Safety, Vol. I, 3rd edition, 1983.

Type of dust	Principle occupational occurrences	Reaction type	Lung disease	Observations
Excrement from hens, pigeons, parakeets	Poultry keeping and zoos	Immune rection (type III), allergic alveolitis, diffuse fibrosis		Caused by protein serum in bird excrement
Cotton, flax, hemp, sisal, jute	Cotton carding, cotton and flax spinning, combing (hackling)	Irritation, release of histamine, immune reaction(?)	Byssinosis, COPD	"Monday" symptoms probably due to release of histamines and related substances. Immune reaction uncertain Chronic symptoms due to long-lasting irritation of mucous membrane

in the workplace, and by avoiding practices which create dust clouds in the work area. The worker must also be trained to understand the importance of proper ventilation and how to recognize when ventilation systems are not working properly. Lastly, the worker must understand how respirators work and when they should be used and properly maintained and stored. He should work with his employer to ensure the respirator is properly maintained and stored.

Periodic medical surveillance is another preventive measure which may be employed among those exposed to organic dusts. Pre-employment examinations may be done in order to detect those with pre-existing respiratory diseases, those with multiple allergies, those with impaired lung function and those with previous significant occupational exposures, and to obtain smoking and family histories. Periodic examinations can then be conducted, utilizing a standard respiratory questionnaire and pre- and post-work shift pulmonary function test in order to detect those individuals developing respiratory symptoms or functional abnormalities from their organic dust exposure. It is important to inform workers fully of their medical findings and to keep a complete file on each worker for both clinical and epidemiological evaluation of the individual work-place. Such medical surveillance data, when linked with environmental data, will provide a valuable assessment as to whether environmental controls and other preventive measures are adequate to prevent respiratory disease in the workplace.

IV-5. Agricultural accidents

IV-5.1. General

Agricultural accidents, trauma or insults to the body are usually the result of a number of basic energy sources which are mechanical, chemical, thermal or electrical by nature.

While such accidents are considered work-induced, they should not necessarily be treated as separately from any general health facility providing health care to rural areas. Their uniqueness from a clinical point of view lies in their potential for contamination from the agricultural environment via a new route to the body, namely the open wound. Tetanus is a major medical concern associated with agricultural accidents. However, for an occupational health programme such a concern can be minimized through an appropriate vaccination programme.

The rapid spread of mechanization in the agriculture of industrialized countries as well as many developing countries has had the beneficial effect of reducing human effort and increasing yield, but has brought with it hazards that up to now had seemed peculiar to industry. For example, in Iraq, there is a significant increase in the number of tractors and in the number and quality of operations performed by them; the number of trators used in agriculture by the Ministry of Agriculture increased from 2552 in 1968 to 4372 in 1980. Such an increase in agricultural machinery service was followed by a corresponding increase in the number of occupational accidents (see Country Statement, Iraq).

Agricultural accidents in a rural area in Egypt were studied in 1965[1]. Besides fire breakages, which were inaccurately estimated, there were 264 cases of agricultural accidents divided as follows: 86 due to automobiles, machines and implements; 79 due to buffalo and cow injuries and crushes especially to hands and feet; 69 due to falling from the backs of animals such as donkeys, horses, cows and from trees during fruit collection, and 30 due to bites of animals such as horses, donkeys and camels. Some of these bites, e.g. camel bites, were associated with violence resulting in internal injuries and tissue avulsion. Wounds were usually grossly contaminated and treatment was often delayed. Antigas gangrene and antitetanic sera were given plus appropriate antibiotic therapy. Surgical dressings and plaster casts were resorted to.

A broad and admittedly somewhat oversimplified classification of the interrelated situations and activities in which occupational injuries may occur in agriculture would include the following headings: handling of tools and implements; operation of different kinds of agricultural machinery; utilization of various types of motor vehicles; construction and maintenance of buildings; use of electricity; accidental fires; and the presence of dangerous animals and insects. Detailed technical specifications and codes of good practice to control many of the related accidents have been drawn up, at both national and international level.

In Iraq, the State Committee for Manpower Training, Ministry of Agriculture, organizes training courses on the methods of cultivation, agricultural machinery,

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[1] El Hadidy, Kh. (1965) "Occupational Hazards of Egyptian Agricultural Labourers"

agricultural safety and other subjects relevant to agricultural economics. Several seminars are held on health and safety in agricultural work. The number of training courses and trainers increased through the years; courses increased from 119 in 1968 to 3781 in 1981 and trainers from 12 957 in 1974 to 24 478 in 1980. The centres providing such training courses have increased more than tenfold since 1972. Although it is not clear how trainers impart information to agricultural workers, the above courses were considered as the determining factor in the reduction of occupational agricultural accidents in Iraq.

While most health care programmes have provisions dealing with the transport of the injured, special training should be given to the emergency personnel in methods of extricating the injured worker from agricultural equipment without further injuring or contaminating him and in the proper techniques for rescue of victims trapped in toxic environments without endangering the rescue workers.

IV-5.2. Mechanically-induced trauma

In some countries more than 10% of all accidents occurring on the farm involve some type of agricultural machines. The proportion varies widely according to the degree of mechanization and the methods of working.

Often these accidents cause serious or fatal injuries. The results of some farm accident surveys indicate that machinery accounts for nearly half of all fatal accidents. The most dangerous types of machines include threshing machines, chaff cutters and root choppers. The main risk is coming into contact with moving parts (shafts, belts. pulleys, gears, tools, etc.). All dangerous parts should therefore be fully protected by adequate guards or so positioned, behind bars or rods of such strengths, spacing and distance from the moving part(s) or danger point(s), as to prevent access to them. Projecting pins, bolts, etc. on rotating parts should be so designed, sunk or protected as to prevent entanglement of clothing; feed openings should be so designed or guarded as to prevent accidental contact with the working parts. Mobile machines working in the fields give rise to peculiar risks: people may fall off them or be run over by them. Covers and shields should be strong enough to retain or deflect stones, broken tools or other flying objects. Warning recalls may be useful in reminding operators of the presence of danger spots; acoustic signals should be provided on large machines to warn the operator of machine motions continuing after the power has been disconnected.

To prevent falls from and collisions with moving machines, operators' stands should be safely and easily accessible and, if at a height of more than 1.5 m, they should be fenced and fitted with toc-boards. Wherever access to the operating stations necessitates steps or gangways, these should be equipped with non-slip floor surfaces, hand and guard rails and, where the access passes close to moving parts, adequate fencing. Drivers of any moving machine should have good visibility and be able to emit a warning signal. They should be responsible and mature persons who have received adequate training and, under normal circumstances, they alone should be allowed on the machine; other persons should be allowed to travel on the machine only when a specific and properly equipped station is provided for them.

IV-5.3. Thermally-induced trauma

While hot surfaces are not a new experience to most individuals, the mechanization of agriculture does add new dimensions to the potential for thermal insults to the body.

Gasolene- and diesel-powered engines have hot surfaces, especially the exhaust system, which under operating conditions is hot enough to create instantaneous full thickness burns if contact with the body is made.

Cooling systems for engines and boilers improperly installed are thermal hazards. Freezing techniques used in food processing may also constitute a thermal hazard. All of these thermal insults are amenable to educational programmes, design features and regulatory constraints.

IV-5.4. Electrically-induced trauma

As agricultural mechanization progresses, electrification of agricultural enterprises may be expected to follow. Such electrified systems may be self-contained, where large agricultural enterprises are far removed from generating sources, while others may be dependent upon the construction of transmission and distribution systems connected to a central generating station. In either instance, electric shock, burns and the potential for death are present.

As an occupational health problem, the application of electrical energy to farming operations is dependent upon the knowledge of the worker of the prevention of inadvertent contact with this energy source and the installation of wiring and equipment in an approved, safe manner.

All electrically operated machines should be adequately guarded and extreme care must be exercised when operating high-lift trucks or moving agricultural elevators near power lines to avoid inadvertent contact and electrocution of the operator or worker.

Prevention

An ergonomic approach to organization of work in agriculture for reduction of work hazards should also consider several important human factors, regardless of level or place of employment. These factors include the existing knowledge and level of technology, existing work and health regulations, worker attitude and behaviour, as well as the socio-economic aspects of the locality. Age, work experience, personality, psychomotor performance, motivation, and social norms are individual factors relevant to the question of accidents. Younger people have a higher accident rate than older people; fewer accidents occur as experience is gained. Environmental stress or pathological changes in a worker may increase accident risk. Motivation may lead a worker to attach more importance to production than to safety. All intensification in agriculture represents a source of agricultural accidents.

Effective fire prevention and protection measures are essential. Straw and hay must be stored in places with fire-resistant partitions, which must also be so designed to prevent draughts promoting the spread of the fire. Fire-fighting equipment must be available at strategic points, maintained in good condition and regularly checked. Electrical equipment must be of high quality so as to withstand the wear and tear inherent in rough agricultural work. Stores and dumps must be planned and located in accordance with fire-prevention rules.

A high level of work organization is indispensable for the prevention of accidents, particularly when new techniques are being introduced in agriculture. No hazardous work should be performed when vigilance, dexterity and physical fitness are diminished. No heavy physical work should be undertaken immediately after having a heavy meal or on an empty stomach when the blood sugar level is low. The work must be so organized so as not to increase the risks inherent in subsequent operations, e.g. water should not be poured on the floors of sheds and cattle yards before work involving the transport of loads on these surfaces.

First aid kits, which must be available in all rural areas, should contain everything necessary for the emergency treatment of bleeding, wounds and fractures, sera against snake bites, etc.

IV-6. Psychosocial hazards

Psychosocial hazards in rural areas, unlike those in urban areas, do not constitute a major problem. The underlying factors for this hazard differ completely from rural to urban areas.

The isolation of certain rural areas, life in small communities, the interaction between agricultural groups differing in their background and type of activities, in ethical characteristics and religion, and facilities of amusement for the young, all influence the psychic faculty and morale of the agricultural worker.

An agricultural worker is definitely undergoing a change in his work habits and way of life and is therefore under considerable mental stress. The introduction of new equipment, the use of fertilizers and pesticides, financial burdens, some workers or members of the family having to leave the farm because they have been replaced by mechanical means, could all cause emotional problems of serious consequence. Also the death of an owned animal or loss of crops due to fire breakage or heavy rainfall, or lack of rain in areas where it is highly needed and expected, may add to the emotional and psychic upset of the agricultural worker.

Furthermore, labour in an environment where animal diseases are prevalent may cause social and psychological stress which creates in the susceptible worker feelings of uneasiness. In some countries of the Region, the possibility that such adverse working and living conditions could be responsible for additional social and psychological problems such as drug dependence, (involving inter alia, cannabis or opium) or at least heavy smoking, can never be sufficiently emphasized.

V OCCUPATIONAL HEALTH CARE FOR AGRICULTURAL WORKERS

V-1. General

The greater part of the Region's workforce is engaged in agriculture. Agricultural workers, as noted earlier, have a multitude of health problems, some of which are the result of work hazards. This problem is often forgotten because of the widespread misconception that occupational health is concerned mainly with industry and industrialized countries and because of the lack of information about health problems in agriculture. Agricultural workers, by virtue of being exposed more often to certain parasitic diseases at work, have a higher prevalence of these diseases than non-occupational groups. Zoonoses are occupational hazards acquired by agricultural workers handling animals or animal products. With the increased use of chemicals, particularly pesticides and agricultural machinery in developing countries, occupational chemical intoxications and injuries are becoming more frequent. All these facts leave no doubt that where there are rural health services, these should be concerned with agricultural work hazards and be responsible for instituting preventive measures.

Occupational health in agriculture concerns the greater part of the workforce of the Region. It is the task of occupational health to collaborate with other disciplines in making agricultural work less burdensome, healthier and safer so as to reduce the number of agricultural accidents, pesticide intoxications and rural occupational diseases and improve the social and economic conditions of the agricultural worker. The organization of occupational health for agricultural workers must be based on two factors: a knowledge of work in the agricultural environment and a knowledge of occupational medicine. The nature and methods of agricultural work vary considerably from country to country in relation to geographical and climatic conditions, which in turn affect the crops, in relation to traditions, availability of labour, the social, technical and economic development of the area and so on.

V-2. Rural health centres and units

Occupational hazards in agricultural work have been described in earlier chapters. These hazards, though mostly occupational health problems, can also affect the population at large, specifically rural folk. Therefore, the same health facilities that serve the general population can and should serve the agricultural workers. In the countries of the Region, health services for the rural sector of the population are provided through rural district hospitals, rural centres and/or rural units and/or mobile medical units, depending on the system in individual countries. Services are mostly curative. Preventive programmes, such as maternal and child health, communicable diseases control (e.g. malaria, schistosomiasis, filariasis, tuberculosis, etc.), water supply and disposal and sanitation may be integral activities of the local health care services or may be activities administered by another health service or health-related sector. It is important to consider the worker's total need for health and medical care in relation to the available health services. Coordination and cooperation between the Ministry of Health and other sectors are prerequisites for the success of all endeavours to provide occupational health care for agricultural workers.

The integration of the occupational health component with public health services in the rural areas can solve the problem of supply of health services, but it brings into prominence another set of problems which should be tackled if an efficient service is to be supplied. Allowing for differences in different countries, the smallest health unit, be it a rural health unit, a health centre or subcentre, manned by physicians, nurses, sanitary officers or by medical assistants or even simply by trained local personnel, is overloaded with work. Such a unit is usually responsible for such varied activities as maternal and child health, vital statistics, vaccination, sanitation, communicable disease control and health education, besides simple medical care and first aid in emergencies. If, to all these activities, are added the responsibilities of early detection and care of chemical intoxication, first aid in agricultural accidents, dealing with zoonotic diseases, inspection of agricultural machinery and of pesticide storage and handling, a basic change in the system of rural health services and appropriate training of health personnel must be considered.

It is evident that the health personnel dealing with agricultural occupational health should be well-informed about the health hazards of work in agriculture. The toxicity of chemicals, their antidotes, early diagnostic procedures, enough information about respiratory diseases resulting from mineral or vegetable dust, the signs and symptoms of different prevalent zoonotic disease, are but some of the information and experience needed. To achieve these abilities it is necessary to revise medical and paramedical education, adding to it the important aspects of rural health services, including agricultural occupational health.

Health education of agricultural workers and of the general rural population should receive due emphasis, as most of the occupational health hazards in agriculture are preventable being to a large extent the result of ignorance or negligence.

V-3. Occupational health services in agriculture should basically have functions as described in Recommendation 112 of ILO. These functions, slightly modified in order to meet the circumstances of agricultural workers, are as follows:

1. Medical examination - pre-placement, periodic and special medical examinations, including, where necessary, biological and radiological examinations.

2. Supervisions of the working environment - surveillance and advice on all factors which may affect the health of agricultural workers.

3. Supervision of the hygiene of sanitary installations for agricultural workers - surveillance of the hygiene and sanitary installations (in liaison with other appropriate bodies) of all facilities to ensure the healthful life of agricultural workers.

4. Health counselling - advice provided to individual workers regarding any disorders that may occur or be aggravated in the course of work.

5. Accident prevention - participation with other appropriate departments or bodies in the prevention of accidents and the supervision of personal protective equipment and its uses.

6. First-aid and emergency treatment.

7. Measures for health protection and promotion - including the application of public health techniques for the protection and promotion of the health of agricultural workers.

8. Medical care - care of minor ailments or complete medical care for the worker and his family, depending on local circumstances.

9. Health education - education of the agricultural worker in the essentials of healthful living.

10. Maintenance of records and compilation of statistics - medical records with periodic review of statistical data concerning health conditions of the agricultural worker.

11. Research in occupational health - research or participation in such research in association with specialized services or institutions.

V-4. Agricultural occupational health within primary health care

The need for immediate attention to be paid to the provision of occupational health services to a high-risk, vulnerable and under-privileged sector of the working population such as the agricultural sector cannot be over-emphasized. The following three fundamental principles are considered basic to the development of an occupational health service:

1. Occupational health services must be provided through the existing national health service system by a process of integration.
2. The services must be for the total health of the workers and if necessary their families.
3. The primary health care approach must be the chosen system for the delivery of such services.

V-4.1. The concept of primary health care

The Alma-Ata Declaration made by the International Conference on Primary Health Care in 1978 emphasizes that health, as a fundamental human right, requires the concerted action of many other social and economic sectors in addition to the health sector. The Declaration also states that primary health care addresses the main problems in the community and that the people have the right, and duty, to participate individually and collectively in the planning and implementation of their health care. Primary health care is essential care

based on practical, scientifically sound and socially acceptable methods and technology made accessible to individuals and families in the community through their participation and at a cost that the community and country can afford to maintain at every stage of their development, in a spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and the community with the national health system, bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process.

V-4.2. Primary health care strategy

Within the working population, workers in agriculture were identified as requiring the provision of urgent and relevant health care services. To achieve these policy objectives a primary health care strategy should be considered. The WHO publication entitled "Global Strategy for Health for All by the Year 2000" states that the strategy is based on the concept of country-wide programmes that reach the whole population. These programmes include measures for health promotion, disease prevention, diagnosis, therapy and rehabilitation. The strategy involves specifying measures to be taken by individuals and families in their homes, by communities, by the health services at the primary and supporting levels and by other sectors. It also involves selecting technology that is appropriate for the country concerned. It is necessary to ensure political commitment at the highest level. Professional groups, both inside and outside the health sector, will have to be enlisted. Inseparable from the strategy is the action required to generate and mobilize all possible resources. All human resources, including all types of health personnel as appropriate, will have to be motivated and mobilized. The implications of these strategy components for occupational health for agricultural workers are as follows:

(a) Occupational health services for agricultural workers must be an integral part of or fully coordinated with national rural health services.
(b) The services provided must be for total health and not limited to diseases related to occupations.
(c) The participation of the agricultural worker must be a constituent part of the health services.

(d) Coordination with other sectors, particularly agriculture and labour, is essential.
(e) The health system must be developed and personnel trained to support the primary health care services.
(f) Health manpower must be motivated to function in their given roles.

V-4.3. The primary health care worker and his function in occupational health

In developing countries, the need to bring health care to where people live and work has led to the recognition of the importance of non-physician primary health care workers. Their duties may vary from one country to another or from one locality to another within the same country. Basically they are health workers with basic general education followed by a period of technical training which should enable them to recognize the most common diseases, to care for the simple ones and to refer problem cases to the nearest health centre or other facility or to act as a direct assistant to a physician. They are trained and accustomed to meet the circumstances found in a particular country and not according to some international standard.

Proper selection of a qualified primary health care worker is vital to their success. He/she must be adequately educated and somewhat more educated than the group to be served in order to command its recognition and respect. He/she clearly must have a good working knowledge of agriculture, the community, its language and its people. Selection of the primary health care worker is best accomplished as a joint exercise between the community, health officials and those who will train him/her. As much as possible, he/she should be selected from a work group for work practice and be trained as its primary health care worker.

The skills and functions of the primary health care worker will clearly vary from country to country and community to community, depending on local needs. General functions, however, have been set forth at the international conference on "Occupational Health in Developing Countries" organized by the Permanent Commission and International Association on Occupational Health and the World Health Organization in Colombo, Sri Lanka, in 1981. These functions were listed as follows:

(a) to survey workplaces, using simple methods;
(b) to collect biological or environmental samples;
(c) to identify possible sources of injury in the workplace;
(d) to recognize general health problems of workers, whether or not they are work-related;

(e) to refer patients when necessary to the appropriate unit in the health service;
(f) to educate and advise workers about health and safety problems;
(g) to give first aid;
(h) to keep simple records of individual workers, as well as records of working groups and surveys.

In order for the primary health care worker to be effective in dealing with occupational health and safety problems in agriculture, he must be both adequately trained and able to relate to health service professionals similarly trained in the principles of occupational safety and health. Adding the primary health care worker to the occupational health service team provides a tangible means of bringing these services to the agricultural worker. The challenge is to broaden the application of this innovative strategy in order to have a measurable impact on occupationally related morbidity and mortality in the agricultural sector.

VI PROGRAMMING FOR OCCUPATIONAL HEALTH IN RURAL AREAS

VI-1. General

Most developing countries do not at present have ongoing occupational health services for their working populations, including agricultural workers; indeed, where there are occupational health services, the health needs of agricultural workers are generally not covered. This state of affairs prevails in the countries of the Region without exception: hence the need to recognize the special health problems of agricultural workers which justify the development of appropriate services to satisfy their unmet needs, particularly in view of the emergence of new and complex health problems and hazards associated with the introduction of new agricultural technology.

The structure and organization of an occupational health programme will obviously vary from country to country and even within a country. They should be designed to be adequately adapted to local conditions, taking into consideration such factors as socio-economic standards, the present status of health services as well as their future trends in development; and also, the available resources as regards manpower and agricultural health problems.

VI-2. Education and training of personnel

The type of personnel will vary from country to country according to the objectives, needs and resources of the programme. However, the following categories of personnel are considered the key persons in planning, implementation and evaluation of the programme.

(i) Physicians

These should be either occupational health physicians or the general practitioners who may already be working in the existing national rural health services or newly assigned/recruited to work in one of these services. Any one of these categories of physicians should be sufficiently trained to carry out the following tasks:

- provision of general advice on occupational health problems and services;
- routine medical examinations (pre-placement, periodic and special examinations);
- provision of medical care to the agricultural worker and his family within the available facilities;
- supervision and control of the working environment;
- supervision of hygiene and sanitary installations;
- health education through personal contact with the worker during examinations, health counselling, in mosques or churches, etc.;
- first aid and emergency treatment;
- maintenance of records and compilation of statistics;
- accident prevention;
- action-oriented research studies in association with specialized services and institutions.

(ii) Medical assistants

Where there is a shortage of physicians, medical assistants can be given appropriate training in order for them to perform a useful role.

(iii) Sanitary engineers/occupational hygienists

Sanitary engineers/occupational hygienists should be trained in the application and promotion of public health techniques for the protection and promotion of the health of agricultural workers as well as in the supervision of working processes in agriculture and of protective equipment and its proper uses.

(iv) Sanitary inspectors

Sanitary inspectors can be substituted for engineers or hygienists when the latter categories are not available and could be given appropriate training to fulfil these roles.

(v) Occupational health nurses

Occupational health nurses should be trained in clinical nursing procedures as well as preventive measures for the health care of agricultural workers.

(vi) Other categories of nurses

Public health and community health nurses can be given appropriate training to enable them to act for occupational health nurses whenever the latter are not available.

(vii) Laboratory technicians

Laboratory technicians should be trained to perform laboratory examinations or field investigations required for clinical diagnosis or assessment of the working environment.

(viii) Others

Other categories of personnel, such as primary health care workers, volunteers, agricultural extension workers, veterinary personnel etc., will require training depending on their educational background, their normal duties and additional tasks they may be required to perform.

VI-3. Programme development process

The initiation or review of an existing occupational health programme should be carefully planned and follow a logical process that is acceptable to the appropriate authorities of the country. The following steps are suggested as a possible plan if such a plan is not yet in existence[1].

1. A governmental agency should be charged with assuming temporary leadership in setting up a national body or committee of which representatives of the departments of health, agriculture and labour would be core members; there may be others, depending upon the form of government involved. If needed, an external specialist should be employed to present cases and describe various solutions. The national body may then select an implementor that can assume the responsibility for developing the programme.

2. The programme implementor must examine, possibly with the aid of a team and some temporary external technical advisers, the occupational health needs of the agricultural sector and prepare an intervention plan.

3. An information system has to be established. Some basic statistics have to be accumulated on morbidity as well as mortality if future programming is to be effective. More sophisticated information will be accumulated as the methodology and system mature.

4. The development of the infrastructure to support programme activities and permit changes in emphasis will depend upon an analysis of facilities available to the programme. As an example, it might be possible for the laboratories used for analysis of pesticides intended for agricultural purposes to serve a dual role by adding to their existing technical capabilities the ability to assay pesticide poisonings of men and animals. Veterinary laboratories are able to assist through their diagnostic activities, particularly in zoonoses control in man. Other components of the veterinary infrastructure services may also prove useful inputs, such as reagent preparation, cold-chain, etc. Similarly, the health-oriented laboratories of the tertiary and secondary

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[1] Workshop on Occupational Health Care in Agriculture, WHO, OCH/80.3, 1980.

hospitals, which are equipped to assist in diagnostic problems, can add their technology to deal with the environmental contaminants and pollutants resulting from agricultural activities. Such efforts would permit the allocation of resources on a least-cost basis and help establish priorities for future programming.

5. Training programmes need to be established to train the trainers. Temporary experts alert to national problems and well schooled in occupational health techniques should be used at this level.

6. These trainers will in turn establish extension-type efforts within all segments of their respective organizations (health, agriculture, labour, education and others). There is a need for concerted activity at all other levels.

7. Training programmes would be instituted through the auspices of the advisory committee and be directed at informing primary health care and extension workers of the overt symptoms of occupational health problems in agriculture. This training would develop a cadre of individuals who would be more cognizant of occupational health problems and thereby bring them to the attention of health workers and appropriate authorities before irreversible health conditions arose.

8. A simple reporting system on occupationally suspected maladies in agriculture should be developed. Figures reported on the prevalence of agricultural maladies could be used to determine trends and establish potential sites for the conduct of pilot investigations and/or future epidemiological studies.

9. Ultimately, an advisory committee should evolve within this programme. It should be composed of staff members in areas such as medicine, veterinary medicine, toxicology, agricultural engineering and social sciences. This committee would work with the initial national body to evaluate findings, establish goals, conduct research and act in an advisory capacity to appropriate authorities.

10. Field screening laboratories where in simple tests an evaluation could be made by lay persons with a minimum of technical expertise, should be established. Such tests would serve to alert the proper health authorities concerning any hazardous situations that could be developing. Such facilities are crucial to the development of rapid health responses to acute health situations, particularly in areas where primary health care assistance is minimal.

VI-4. Priorities

For a country wishing to develop or enhance its occupational health programme within the existing primary health care services, it is fairly easy to choose some of the priority areas to which attention should be primarily directed, e.g. pesticidal use, zoonotic diseases and control of agricultural accidents, etc.

VII CONCLUSIONS AND RECOMMENDATIONS

VII-1. Conclusions

The greater part of the Region's working population is engaged in agriculture. Occupational health problems in agriculture, as well as constraints in the delivery of occupational health care to agriculture workers in the countries of the Region, have been reviewed and considered extensively.

Recognizing that the problems are prevalent and expanding rapidly in both nature and extent, a suggested programme for development of occupational health care is incorporated in this report.

VII-2. Recommendations

A. To the World Health Organization

It is recommended that WHO play a more active role in initiating and developing a programme directed towards the promotion of the health status of those engaged in agriculture as an economic activity.

1. Technical cooperation with countries is envisaged in the following areas:

(a) the establishment and development of occupational health programmes for workers engaged in agriculture, within the framework of rural health services and primary health care;
(b) the identification and control of occupational hazards to which agricultural workers are exposed in rural areas;
(c) the training of personnel at different levels in the field of occupational health in agriculture;
(d) the development of regional or interregional centres for training and education in occupational health in rural areas to cover countries' needs;
(e) the organization of meetings, seminars and workshops aiming at promoting intercountry collaboration.

2. Guidelines and manuals

The following action is proposed:

(a) a series of guidelines and manuals on identification and control of health hazards in agriculture should be developed;
(b) guidelines on the organization of occupational health services for agricultural workers within existing health set-ups catering for health of rural populations, should be drawn up.

3. Research

Encouragement should be given to research projects in the field of occupational health in agriculture, particularly in areas not yet adequately studied.

B. To the countries of the Region

The following recommendations are made:

1. Agricultural workers, should be covered by the umbrella of labour codes and social security laws.

2. Curricula on the protection and promotion of the health of agricultural workers should be components of all educational and training courses for all categories of health personnel, whether at under or post-graduate levels.

3. There should be coordination among all concerned with occupational health for agricultural workers, e.g. ministries of health, labour, agriculture, research institutions, universities, trade unions, etc.

4. Occupational health services for agricultural workers should be integrated within the health services in general and with primary health care in particular.

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ANNEX I

PROGRAMME

Saturday, 8 December 1984

08.30 - 09.00	- Registration of participants
09.00 - 09.45	- Formal opening of the Seminar - Inaugural address by H.E. the Minister of Health (or his representative) - Message from Dr Hussein A. Gezairy, Regional Director, WHO Eastern Mediterranean Region
09.45 - 10.30	- Recess
10.30 - 11.00	- Election of Officers (Chairman and Rapporteur) - Adoption of the Agenda - Programme of work
11.00 - 11.30	- Introduction to the Seminar - Objectives of the Seminar - Introduction of the Working Document, Dr A.M. Emara, WHO/TA
11.30 - 12.15	- Country presentations
12.15 - 14.00	- General consideration of agricultural work

Sunday, 9 December 1984

08.30 - 09.00	- Occupational Hazards in Agriculture: Introduction, Dr M.A. Khalil
09.00 - 10.30	- Physical Hazards
10.30 - 11.00	- Recess
11.00 - 11.45	- Country Presentations
11.45 - 13.30	- Chemical Hazards - Pesticide Intoxication, Dr A.M. Emara WHO/TA
13.30 - 14.00	- Other Chemical Hazards

Monday, 10 December 1984

08.30 - 10.00	- Other Chemical Hazards (cont.)
10.00 - 10.30	- Biological Hazards
10.30 - 11.00	- Recess
11.00 - 12.00	- Biological Hazards (cont.)
12.00 - 12.45	- Country Presentations
12.45 - 13.45	- Organic Dusts
13.45 - 14.30	- Psychosocial Hazards

Tuesday, 11 December 1984

08.30 - 10.30	- Agricultural Accidents
10.30 - 11.00	- Recess
11.00 - 11.45	- Country Presentations
11.45 - 14.00	- Health care system in rural areas, Dr A.M. Emara - Occupational health care for agricultural workers, Dr M.A. Khalil - Discussions

Wednesday, 12 December 1984

08.30 - 10.30	- Health care for agricultural workers within primary health care services, Dr M.A. Khalil
10.30 - 11.00	- Recess
11.00 - 14.00	- Continuation of above item and discussions

Thursday, 13 December 1984

08.30 - 10.30	- Conclusions and Recommendations
10.30 - 11.00	- Recess
11.00 - 13.00	- Presentation and adoption of draft report of the Seminar
13.00 - 14.00	- Closing Session

ANNEX II

LIST OF PARTICIPANTS

CYPRUS	Dr A. Georgiou* Occupational Health Physician 7, Griva Digeni St. Aglantzia Nicosia CYPRUS
DEMOCRATIC YEMEN	Dr M. Ali Al-Bousi Director Occupational Health Project Ministry of Public Health Aden DEMOCRATIC YEMEN
EGYPT	Dr Ahmed Taher Shaker (Rapporteur) Supervisor of Occupational Health Industrial Health Department Ministry of Health Cairo EGYPT
IRAQ	Dr Jassem Khadem Al Ajzan (Chairman) Director of National Centre of Occupational Health and Safety Ministry of Health Baghdad IRAQ
JORDAN	Dr Fares Khouri Occupational Health Specialist c/o Ministry of Health Amman JORDAN

*Unable to attend

PAKISTAN	Dr Mohamad Akbar Khan* Director Health Services Government of Baluchistan Quetta PAKISTAN
SUDAN	Dr Nagm El Din Hemat Sherif Occupational Health Department Ministry of Health Khartoum SUDAN
OBSERVERS FROM HOST GOVERNMENT	Dr Hikmat Jamil c/o Ministry of Higher Education & Scientific Research College of Medicine
	Dr Fouad Shaaban Directorate of Army Health Services
	Mr Saadallah Attiya Director Labour Relations General Federation of Labour

WHO SECRETARIAT

Dr M.A. Khalil (Secretary)	Regional Adviser on Occupational Health	WHO Eastern Mediterranean Regional Office
Dr A.M. Emara	WHO/Temporary Adviser	Prof. of Industrial Medicine, Faculty of Medicine, Cairo University, Cairo
Ms A. Atallah	Secretary	WHO Eastern Mediterranean Regional Office.