AN OCCUPATIONAL HEALTH AND SAFETY PROGRAMME FOR CROP FARM WORKERS IN THE MANGAUNG MUNICIPAL DISTRICT, FREE STATE

Carien Weyers

Thesis submitted in fulfilment of the requirements for the Degree

DOCTOR TECHNOLOGIAE:

ENVIRONMENTAL HEALTH

in the

School of Agriculture and Environmental Sciences
Faculty of Health Sciences

at the

Central University of Technology, Free State

Promoter: **Prof L de Jager (B.Sc., B.Med.Sc.Hons., M.Med.Sc., Ph.D.)**
Co-promoter: **Dr B de Klerk (MB.Ch.B., DTM + H, DGG, DBG, M.HPE)**

BLOEMFONTEIN
May 2006

DECLARATION OF INDEPENDENT WORK

I, CARIEN WEYERS, identity number [redacted] and student number 9317422, do hereby declare that this research project submitted to the Central University of Technology, Free State for the Degree DOCTOR TECHNOLOGIAE: ENVIRONMENTAL HEALTH, is my own independent work; and complies with the Code of Academic Integrity, as well as other relevant policies, procedures, rules and regulations of the Central University of Technology, Free State; and has not been submitted before to any institution by myself of any other person in fulfilment (or partial fulfilment) of the requirements for the attainment of any qualification.

SIGNATURE OF STUDENT **DATE**

SUMMARY

The occupational health and safety of South African farm workers have been largely neglected because of the emphasis specifically put on the industrial environment. Although some studies have been done on the pesticide exposures of farm workers, the occupational health and safety of farm workers have not been studied as a whole and therefore there is no comprehensive occupational health and safety programme for farm workers. The aim of the study was to compile an applicable occupational health and safety programme for crop farm workers in the Mangaung local municipal district. Twenty-five farms in this region were selected and a list that included the different activities on the farms, the number of workers on each farm and the work hours of the workers was completed. The different health and safety hazards and associated risks were identified on each of the selected crop farms. A hazard identification risk assessment (HIRA) was compiled and completed to rate the different health and safety risks. The results of the study indicated that the main activities executed on the farms were preparation and ploughing of land, planting of crops, application of pesticides and the harvesting of crops. The HIRA indicated eleven “high” risks, seven “moderate” risks and only one “low” risk. An applicable overall occupational health and safety programme that included the abovementioned “high, moderate and low” risks was compiled. Individual occupational health and safety programmes for the control of each identified hazard were designed. The suggested occupational health and safety programmes were presented to nine selected crop farm owners and/or managers as an identified focus group. They completed a questionnaire to indicate whether they found the suggested programmes feasible and acceptable. The majority indicated that the programmes were both feasible and acceptable. However, the focus group indicated that training of both farm owners/managers and farm workers in the Mangaung local municipal district is essential. The group further indicated that legislation that forces the farm owner/manager to implement occupational health and safety programmes are necessary. The designed occupational health and safety programme may thus now be implemented with applicable education and training.

OPSOMMING

Die beroepsgesondheid en veiligheid van Suid-Afrikaanse plaaswerkers is as gevolg van die klem wat veral op die industriële omgewing gelê is, grotendeels nagelaat. Alhoewel sommige studies op die pestisides blootstelling van plaaswerkers gedoen is, is die beroepsgesondheid en veiligheid van plaaswerkers nog nooit as a geheel bestudeer nie en daarom bestaan daar nie „n omvattende beroepsgesondheid en veiligheidsprogram vir plaaswerkers nie. Die doel van die studie was om „n toepaslike beroepsgesondheid en veiligheidsprogram vir plaaswerkers op saaiplase in die Mangaung plaaslike munisipale distrik saam te stel. Vyf-en-twintig plase in hierdie streek is geselekteer en „n lys van die verskillende aktiwiteite op plase, die getal werkers op elke plaas en die werksure van die werkers is voltooi. Die verskillende gesondheids- en veiligheids gevare en die geassosieerde risiko's op elk van die geselekteerde plase is geïdentifiseer. „n Gevaar identifisering risiko assessering (GIRA) om die verskillende gesondheids- en veiligheidsrisiko's te klassifiseer is saamgestel en voltooi. Die resultate van die studie het aangedui die hoofaktiwiteite op plase die voorbereiding en die ploeg van lande, die plant van gewasse, die toediening van pestisiede en die oes van gewasse was. Die GIRA het elf "hoë" risiko's, sewe "matige" risiko's en net een "lae" risiko aangetoon. „n Toepaslike totale beroepsgesondheid en veiligheidsprogram wat al die bogenoemde "hoë, matige en lae" risiko's insluit, is opgestel. Individuele beroepsgesondheid en veiligheidssubprogramme vir die beheer van elke geïdentifiseerde gevaar is ontwerp. Die voorgestelde beroepsgesondheid en veiligheidsprogramme is aan nege geselekteerde saaiplaaseienaars en/of bestuurders as „n geïdentifiseerde fokusgroep voorgelê. Hulle het „n vraelys voltooi om aan te dui of die voorgestelde programme uitvoerbaar en aanvaarbaar is. Die meerderheid het aangedui dat die programme beide uitvoerbaar en aanvaarbaar is. Die fokusgroep het egter ook aangedui dat opleiding van beide plaaseienaars/bestuurders en plaaswerkers in die Mangaung plaaslike munisipale distrik essensieël is. Die groep het verder aangedui dat wetgewing wat plaaseienaars/bestuurders dwing om beroepsgesondheid en veiligheidsprogramme te implementeer nodig is. Die ontwerpte beroepsgesondheid en veiligheidsprogram kan dus nou geimplementeer word deur toepaslike opvoeding en opleiding.

THE CHANCES THAT A MAN IS IN THE RIGHT INCREASE GEOMETRICALLY BY THE VIGOR WITH WHICH OTHERS ARE TRYING TO PROVE HIM WRONG

- MICHAEL PALMER -

TO MARTELIZE

ACKNOWLEDGEMENTS

I would like to express my thanks and appreciation to the following:

- God, for giving me the patience and endurance to complete my doctorate degree which I never thought possible
- My child, Martelize, for her patience and support during all my study years which lasted her whole life
- My family for their support that I know they gave with love
- The National Research Foundation for the financial support for the research project
- Prof. L. de Jager for her guidance during the completion of my doctoral study
- Dr. B. de Klerk for her guidance during this study
- Mrs. N. Lotter for the editorial assistance that she provided
- The Central University of Technology, Free State for providing the facilities to conduct the research and providing funds through the Innovation Fund to complete the study
- Library personal of the Central University of Technology, Free State for their support

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 2

LITERATURE REVIEW

CHAPTER 3

A WALK-THROUGH SURVEY OF CROP FARMS IN THE MANGAUNG LOCAL MUNICIPALITY

CHAPTER 4

HAZARD IDENTIFICATION RISK ASSESSMENT ON CROP FARMS IN THE MANGAUNG MUNICIPAL DISTRICT

LIST OF FIGURES

CHAPTER 3

A WALK-THROUGH SURVEY OF CROP FARMS IN THE MANGAUNG LOCAL MUNICIPALITY

CHAPTER 5

AN OCCUPATIONAL HEALTH AND SAFETY PROGRAMME FOR CROP FARM WORKERS IN THE MANGAUNG MUNICIPAL DISTRICT, FREE STATE

CHAPTER 1

GENERAL INTRODUCTION

1. BACKGROUND

An estimated 1.3 billion workers are active in agriculture production world-wide (Myers, 2004). Agriculture is however one of the most hazardous occupations in the world after mining, quarrying and construction (Muchiri, 2001, Forastieri, 2001).

One of the distinguishing characteristics of agricultural work is that it is carried out in an essentially rural environment where working and living conditions are interwoven. Agricultural workers are subject to the health risks inherent to a rural environment as well as those deriving from the specific work processes involved. In terms of occupational health and safety, agriculture is a sector traditionally neglected as a result of the emphasis on the industrial environment (International Labour Organisation, 2000). This situation may be partially explained by the fact that agriculture is a very heterogeneous and multi-faceted sector and there are difficulties involved in dealing with its various safety and health problems (Regoeng, 2001). In the agricultural sector, information on the incidence of occupational accidents and diseases are imprecise and notoriously underestimated, irrespective of the level of development of the country (Forastieri, 2001).

Diseases associated with agricultural work vary substantially from country to country. There are a range of factors which condition their existence: climate, fauna, population density, living conditions, eating habits, standards of hygiene, level of education, occupational training, working conditions, technological development and quality of and access to services (Forastieri, 2001). The major diseases occurring in agricultural work are infectious diseases such as those transmitted through contact with domestic or wild animals, respiratory infections, dermatosis, allergies, cancer and illnesses arising from working in the open air environment (Fenske, Hidy, Morris, Harrington and Keifer, 2002). Poisoning may

also occur, as well as musculoskeletal disorders arising from repetitive work or working in unsuitable positions such as when carrying heavy loads for excessively long hours. Noise and vibration may also have detrimental effects (Fenske *et al.*, 2002). These diseases and conditions may lead to premature ageing, absenteeism from work, declining productivity and high social and health costs at national level (Pantry, 1997).

An occupational health or safety hazard is anything in the workplace that has the potential to cause harm to the human body (United States Department of Labour, n.d.). Occupational hazards experienced by workers in the agricultural environment include multiple contacts with animals, plants and biological agents which may give rise to allergies, respiratory disorders and lung diseases. Noise-induced hearing loss, musculoskeletal disorders, stress and psychological disorders are also frequently experienced by agricultural workers.

Exposure to pesticides and other agrochemicals constitutes one of the major occupational risks for agricultural workers, causing poisoning, certain work-related cancers and even death (Berkowitz, Orr, Kaye and Haugh, 2002; Arcury, Quandt and Russell, 2002; Macha, Rwazo and Mkalanga, 2001). The magnitude of health damage caused by agrochemical exposure will vary according to the type of crop cultivated, the type of agrochemical used, the mode of application / exposure, individual susceptibility and climatic conditions (Forastieri, 1999).

With reference to the occupational environment of agricultural workers, some of the specific features of agricultural work entail the following:

- Most of the tasks are carried out in the open air, exposing employees to climatic conditions.
- The seasonal nature of the work and the urgency of completing certain tasks in specific periods.
- The variety of tasks to be performed by the same person.
- The type of working postures and the length of time taken for the tasks to be performed.
- Contact with animals and plants and exposure to bites, poisoning, infections, parasitic diseases, allergies, toxicity and other health problems.

- The use of chemicals and biological products.
- The sometimes considerable distances between the living quarters and workplaces (Forastieri, 2001).
- Safety aspects involved in for example tractor maintenance, manual handling, machine guarding, workshops, horse-riding, electrical hazards, fire-fighting, hay-baling, which could lead to physical injuries.

All these occupational health and safety aspects must be taken into account in an occupational health and safety programme to protect agricultural workers. Investment in occupational health and safety is a means of adding value, and will provide for improved working conditions, higher productivity and healthier labour relations.

2. PROBLEM STATEMENT

Perhaps more than any other occupational group, agricultural workers are exposed to a wide variety of environmental hazards that are potentially harmful to their health and wellbeing (Bradley, 2002). The exposure of South African farm workers to occupational health and safety hazards has not been studied extensively. Although some studies in South Africa have been done on pesticide exposure, occupational health and safety exposure has not been researched as a whole (Arcury, Quandt and Russell, 2002; Engel, 1998). Therefore, there is a need in South Africa for the quantification of occupational health and safety risks and the exposure of farm workers. It is known that farm workers worldwide are exposed to a variety of different occupational health and safety hazards, including both health and safety aspects. These aspects include dust, fumes, noise, temperature, pesticides, insecticides, ergonomics, trip and slip and vibration (Zhao, 1993; Estill, Baron and Steege, 2002).

Although farm workers are exposed to certain hazards while working their shifts, the circumstances differ from those in a normal industry. The farm is an open space where workers work in an outdoor environment, except for specific tasks that are carried out indoors. This environment results in the dilution of certain air contaminants. Occupational health and safety structures have established

different types of threshold limit values (TLVs) or standards to protect the health and safety of employees. A time weighted threshold limit value (TWA.TLV) refers to the maximum concentration of a hazardous substance that an employee may be exposed to for an 8-hour work shift, day after day, without any adverse effects to his health. An environmental threshold limit value (e.TLV) refers to the maximum concentration that the general public may be exposed to for 24 hours every day without any adverse effects to their health (Schoeman and Schröder, 1994). Taking into account the agricultural work environment, the question arises as to whether agricultural workers should be treated in the same manner as industrial workers, or as the general public. The exact occupational health and safety exposure levels or risks of South African agricultural workers are not known and therefore further research is necessary to quantify these exposure levels. The above-mentioned problem includes the frequency of exposure: in the maize industry for example there are certain times during the year that dust production is high because of certain activities. The composition of dust must also be taken into account, as the composition of soil (and therefore of dust) differs throughout South Africa.

The research seeks to clarify and provide answers to various questions and to utilise the information to compile an occupational health and safety programme for crop farm workers. These questions include, whether the workers work normal 8-hour work shifts or whether they work longer hours with longer rest periods? Do they work in shifts and are there specific workers for specific tasks or are they employed in a variety of different tasks?

3. AIM AND OBJECTIVES OF THE STUDY

The aim of the research project was to compile an occupational health and safety programme for crop farm workers in the Mangaung municipal district, Free State, South Africa. The objectives included the following aspects:

- Identification of possible farms in the Mangaung municipal district that could be included in the study;
- a walk-through survey of the selected farms to anticipate and identify possible hazards and risks;

- the development of a Hazard Identification Risk Assessment (HIRA) that could be used to rate hazards and establish possible risks;
- an assessment of problem areas and risk rating utilising the compiled HIRA;
- the compilation of an occupational health and safety programme with regard to occupational health and safety hazards and risks on crop farms; and
- the determination of whether the suggested occupational health and safety programme is feasible and acceptable to the Mangaung municipal district crop farm owners and / or managers.

4. STRUCTURE OF THE THESIS

Each chapter will be presented as independent section and the layout of the thesis is as follows:

- In Chapter 2 the relevant literature will be discussed
- Chapter 3 describes the information collected during a walk-through survey of crop farms in the Mangaung municipal district
- In Chapter 4 an applicable hazard identification risk assessment was compiled and completed utilising the information gained in Chapter 3
- An overall occupational health and safety programme as well as sub-programmes for the minimisation, reduction or elimination of each identified health and safety risk on crop farms were designed in Chapter 5
- Chapter 6 indicates the feasibility and acceptability of the suggested programmes to farm owners/managers
- Chapter 7 discusses the conclusions and reflections of the research

5. REFERENCES

Arcury, T.A., Quandt, S.A., Russell, G.B. 2002. Pesticide safety among farm workers: perceived risk and perceived control as factors reflecting environmental justice. *Environmental Health Perspect.* 2:233-240.

Berkowitz, Z., Orr, M.F., Kaye, W.E., Haugh, G.S. 2002. Hazardous substances and emergency events in the agricultural industry and related services in four

mid-western states. *Journal of Occupational and Environmental Medicine.* 44(8):714-723.

Bradley, K.R. 2002. Health hazards in agriculture - an emerging issue. Retrieved on January 21, 2005, from http://www.cdc/gov/nasd/docs/d001001-d001100/d001050/d001050.html

Engel, L.S. 1998. Neurophysiological function in farm workers exposed to organophosphate pesticides. *Archives of Environmental Health.* Retrieved on March 24, 2006, from http://www.findarticles.com/p/articles/mi_m0907/is_n1_v53/ai_20598439

Estill, C.F., Baron, S., Steege, A.L. 2002. Research and dissemination needs for ergonomics in agriculture. *Public Health.* 117(5):440-445.

Fenske, R.A., Hidy, A., Morris, S.L., Harrington, M.J., Keifer, M.C. 2002. Health and safety hazards in Northwest agriculture: setting an occupational agenda. *American Journal of Industrial Medicine.* 2:62-67.

Forastieri, V. 1999. The ILO Programme on Occupational Safety and Health in Agriculture. Retrieved on May 13, 2005, from http://www.ilo.org/public/english/protection/safework/agriculture

Forastieri, V. 2001. Challenges in providing occupational safety and health services to workers in agriculture. *African Newsletter on Occupational Health and Safety*. 11(2):33-38.

International Labour Organisation. 2000. Occupational Safety and Health in Agriculture. Retrieved on May 13, 2005, from http://www.ilo.org/public/english/protection/safework/agriculture/intro.htm

Macha, M., Rwazo, A., Mkalanga, H. 2001. Retail sale of pesticides in Tanzania: Occupational human health and safety considerations. *African Newsletter on Occupational Health and Safety.* 11:40-42.

Muchiri, F.K. 2001. Towards better occupational health and safety services in the agricultural sector. *African Newsletter on Occupational Health and Safety*. 11(2):31-32.

Myers, J.E. 2004. Globalisation, occupational health and the agricultural sector. *Occupational Health Southern Africa.* 10: 6-11.

Pantry, S. 1997. Agriculture: the killing fields. *Health & Safety World, re-published courtesy of Ovid Technologies*.

Regoeng, K.G. 2001. Occupational health and safety: A challenge to the agricultural sector in Botswana. *African Newsletter on Occupational Health and Safety*. 11(2):42-44.

United States Department of Labor. n.d. Occupational Safety and Health Administration (OSHA). Retrieved on January 21, 2005, from www.osha.gov/SLTC/youth/agriculture/

Zhao, W. 1993. Preventing cold-related illnesses in agricultural workers. Rutgers Cooperative Extension. New Jersey, New Brunswick: Rutgers, the State University of New Jersey, Publication.

CHAPTER 2

LITERATURE REVIEW

1. BACKGROUND

Occupational health and safety is defined as the science and art devoted to the anticipation, identification, evaluation and control of those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well-being or significant discomfort and inefficiency among workers or among the citizens of a community (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994).

Farming has been an essential human activity since prehistoric times (Centre for Occupational and Environmental Health, 2005). An estimated 1.3 billion workers are active in agricultural production worldwide (Forastieri, 2001; Myers, 2004). Agriculture is also one of the most hazardous occupations worldwide (Forastieri, 2001; Amweelo, 2001; Elkind, 2002; DeRoo and Rautiainen, 2000).

Occupational health and safety in the agricultural sector has been traditionally neglected as a result of the emphasis placed on the industrial environment (Forastieri, 2001; Amweelo, 2001). This situation may be partially explained by the fact that agriculture is a heterogeneous, multi-faceted sector and because there are difficulties involved in dealing with its various health and safety hazards (Forastieri, 2001; Amweelo, 2001). Agricultural workers are one of the groups at highest risk of occupational injury and diseases (Australian Centre for Agricultural Health and Safety, n.d).

One of the distinguishing characteristics of agricultural work is that it is carried out in an essentially rural environment where working and living conditions are interwoven (Forastieri, 2001). It is a unique industry because so many of its workers live, work and enjoy recreational activities at the worksite. This often exposes them to diverse hazards associated with machinery, chemicals and livestock. Weather, farmstead terrain and atmospheric conditions together

present a host of hazards and risks to agricultural workers. The natural environment that constitutes the work environment of the agricultural worker also complicates the hazards to which he/she may be exposed (Bruce, 2001).

Farmers and farm workers are exposed to mechanical, chemical and environmental hazards daily. Health risks in farming are relatively high when compared to other industries (Centre for Occupational and Environmental Health, 2005). The problems encountered in the agricultural sector include, as mentioned in Chapter 1, diverse working conditions (Muchiri, 2003), the fact that most tasks are carried out in the open air, the seasonal nature of the work, the urgency of certain tasks in specific periods, the variety of tasks to be performed by the same person, the type of working posture, the length time needed for the tasks to be performed and the use of chemical and biological products (Forastieri, 2001). Mechanical, chemical and environmental hazards may increase the risk of accidents for agricultural workers. The principle risks to the health and safety of agricultural workers stem from the nature of the work, the condition of tools or equipment and exposure to chemicals (Regoeng, 2001).

2. OCCUPATIONAL HEALTH AND SAFETY HAZARDS AND RISKS

A hazard is any situation, activity, procedure, plant, equipment or animal that may result in injury or harm to a person (Centre for Occupational and Environmental Health, 2005). Hazards may be identified in the environment, in substances, workplace layout, work organisation, equipment, location and in the presence of electricity. Once a hazard has been identified, the likelihood and possible severity of injury or harm still needs to be assessed, before a determination can be made on how best to minimise the risk. Having identified the hazards, risks must then be assessed, based on factors such as frequency and manner in which a task is undertaken (Centre for Occupational and Environmental Health, 2005). High risk situations will need to be addressed with more urgency than low risk situations. The greater the risk of an injury or dangerous incident occurring, the more urgent the need for changes to be made to minimise or eliminate the risk (Graham, 2005).

The relationship between hazard and risk must be treated very cautiously. If all other factors are equal, especially the exposures and the people subject to them, then the risk is proportional to the hazard. The characterisation of risk has both quantitative and qualitative components. It is clear that the degree of exposure is a very important determinant of risk (Centre for Occupational and Environmental Health, 2005).

3. OCCUPATIONAL HEALTH AND SAFETY HAZARDS AND RISK ASSOCIATED WITH AGRICULTURAL WORK

Hazards in agriculture are universally the same (Regoeng, 2001). As previously mentioned, agricultural work is subject to the health and safety risks inherent to a rural environment and also those deriving from the specific work processes involved (Forastieri, 2001).

There is however no universal definition of agriculture or agricultural work in occupational health and safety laws (Muchiri, 2001). According to the International Labour Organisation (ILO), agriculture covers all activities (whether indoor or outdoor) directly associated with: cultivating, growing, harvesting and primary processing of agricultural products, animals and livestock, including aquaculture and agro-forestry (Muchiri, 2001).

Perhaps more than any other occupational group, agricultural workers are exposed to a tremendous variety of environmental hazards that are potentially harmful to their health and well-being (Bradley, 2002). Occupational health and safety stressors may be placed in one of the following categories: chemical, mechanical, psychological, biological, physical and ergonomic. Chemical stressors are toxic or irritating to the body, physical stressors can cause tissue trauma of other damage and ergonomical stressors include factors or situations encountered in the workplace that create stress, emotional strain or interpersonal problems (Guild, Ehrlich, Johnston and Ross, 2001). In the agricultural sector all of these categories of stresses are present (Kirkhorn and Schenker, 2004).

The concept of “safety” is complex, although it generally refers to the prevention of injury (Schoeman and Schröder, 1994). In the agricultural sector the safety of the farm worker needs to be taken into account. The International Labour Organisation (ILO) has estimated that worldwide, out of a total of 330 000 fatal workplace accidents in 1997, about 170 000 casualties were agricultural workers (ILO, 2000).

Agricultural work may comprise of a variety of different types of work, for instance field crop workers or livestock farm workers. A field crop worker’s main job is to drive and operate farm machinery to plant, cultivate, harvest and store various crops (ILO, 2000). These workers operate various types of machinery under changing conditions and are therefore subject to time pressures and long working hours especially during harvest time. Various distractions are common in field work causing increased accident risk (ILO, 2000). Machinery such as tractors and harvesters are responsible for the highest frequency of injuries and fatalities. Injuries associated with modern harvesting operations typically relate to tractors, machinery, grain-handling equipment and grain-storage structures (Field, n.d.). Though harvesting equipment is used for fewer hours during the year than tractors are, such machinery is involved in about twice as many injuries per 1 000 machines (Field, n.d.). Safety of agricultural machinery is often inadequate due to potentially hazardous design and use of old and unreliable machinery (ILO, 2000).

According to the Agricultural Research Centre of Finland and The Tampere University of Technology (2006) the following safety risks exist on crop farms:

- Risk of crushing injuries to head, chest and pelvic areas when a tractor without ROPS (rollover protection structure) turns over;
- risk of limb amputation and crushing or shearing of limb or body as a result of entanglement in moving machine parts;
- risk of limb or body crushing injuries as a result of carrying out various tasks e.g. hitching and unhitching implements, reversing mounted equipment, folding and unfolding discs and harrows;
- slips and falls when climbing into or climbing down from tractor cabin or when climbing on top of other farm implements; and

- burns from heated surfaces or materials (exhaust pipes, engine blocks, fuel, oils, chemicals etc.).

4. HEALTH HAZARDS ASSOCIATED WITH AGRICULTURE

The health hazards associated with agricultural work include both chemical and physical stresses.

4.1 Chemical stresses associated with agriculture

Farmers and farm workers suffer from increased incidence of respiratory diseases, noise-induced hearing loss, skin disorders, certain types of cancers, chemical toxicity, and heat-related illnesses (United States Department of Labor, n.d.).

The use of chemicals in the work environment (including pesticides, herbicides insecticides and fungicides) is regarded as a chemical stressor. Agricultural workers are exposed to, excluding those found in the natural environment, additional chemicals on a daily basis. If they do not observe proper precautions, illness or even death may ensue (Bradley, 2002). These additional chemicals may be absorbed through the skin and fumes, vapours and dusts may be inhaled or accidentally swallowed while eating, drinking or smoking, resulting in adverse health effects. The effects of exposure to chemicals generally include skin irritation, dermatitis, asphyxiation, respiratory tract irritation, poisoning and in some instances cancer (Amweelo, 2001).

A variety of disabling gases, including nitrogen dioxide (NO_2), hydrogen sulphide (H_2S), ammonia (NH_3), carbon dioxide (CO_2), and methane (CH_4), are produced during many routine operations in the agricultural environment. Exposure to low levels of NO_2, H_2S, or NH_3 will produce lung and eye irritations, dizziness, drowsiness and headaches. High levels of H_2S particularly, and NO_2 to a slightly lesser extent, will quickly render a worker unconscious and death will follow (Centre for Occupational and Environmental Health, 2005; Occupational Health and Safety Administration, 2003).

Farming situations also present several respiratory hazards to farm workers (Bradley, 2002). Agricultural work is essentially carried out in the open air environment. This exposes the worker to environmental dust. The concentration of environmental dust rises with certain activities, such as the ploughing of fields. Therefore, an inhalation hazard is present when conducting tasks that increase the concentration of environmental dust. Exposure to dust may cause respiratory problems, irritation and dermatitis (Centre for Occupational and Environmental Health, 2005).

Suspended dust particles not containing spores from mouldy organic matter are considered nuisance dusts. Nuisance dusts and gases are hazards that farm workers are also exposed to, and repeated exposure can turn portions of the lung into hardened, non-functioning tissue causing chronic bronchitis and occupational asthma (Bradley, 2002).

Contact dermatitis is a skin disorder that occurs among agricultural workers (Kundiev and Chernyuk, 2001). There are two general categories: irritant and allergic dermatitis. Irritants act directly on the skin at the place of contact. Allergic sensitizers, however, cause changes in the immune system so that subsequent contact produces a reaction (Bradley, 2002). Phototoxic or photo allergic reactions occur when light, in combination with certain substances, causes skin disease. Other types of agricultural dermatitis include heat rash, origin infections, and insect and plant irritants. A number of factors predispose an individual to dermatitis, such as age, sex, race, temperature and humidity, previous skin disorders, skin damage and personal hygiene. Work-related skin diseases are often easy to detect yet difficult to diagnose (United States Department of Labor, n.d.).

Welding is a work-related activity that exposes the farm worker to welding fumes that may cause arc-eye and respiratory problems as well as being a known carcinogen. There are also safety issues related to welding, which include the hazards of fire and explosion, burns from the heated metal and electric shock (Centre for Occupational and Environmental Health, 2005).

4.2 Physical stresses associated with agriculture

The open air work environment exposes the agricultural worker to environmental temperature extremes (Rosenberg, 2006). Heat stress occurs when the body builds up more heat than it can handle. High temperatures, high humidity, sunlight, air movement and heavy workloads increase the likelihood of heat stress. The effects of heat stress range from simple discomfort to life-threatening heat stroke. Heat stress causes increased sweating which leads to loss of body fluids and then to reduced heat tolerance (Rosenberg, 2006). This results in reduced capacity for work, inefficiency and increased risk of hazardous accidents. Heat stroke, a rare condition, is when sweating stops and the body temperature rises (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994). This is a life-threatening condition and requires immediate medical attention.

Dehydration is the cause of most heat disorders (Rosenberg, 2006). Energetic activity on hot days can cause the body to lose one to one-and-a-half litres of fluid per hour. As much as 6% of the body weight may be lost in a few hours of exposure to extremely high temperature. A loss of only 2 to 3% body weight decreases blood circulation, leading to extreme discomfort and thirst, along with higher body temperature and rapid pulse. Employees could then suffer from heat cramps, dizziness, headaches, excessive sweating and a feeling of weakness. All of these symptoms are signs of heat exhaustion. Heat stroke will ensue when 3 to 6% of body weight is lost. The body stops perspiring and the temperature increases rapidly. Convulsions, unconsciousness and death are possible (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994).

Agricultural workers have a high risk of developing skin cancers, as their work can expose them to long periods of ultraviolet radiation (Bernhardt and Langley, 1993). The back of the neck may be especially vulnerable to the rays of the sun and therefore is an area of particular concern (Bernhardt and Langley, 1993). Skin cancer is the most common form of cancer, with about 450 000 newly-diagnosed cases in America each year (Bradley, 2002). People at high risk include those with fair skin, blue eyes and red or blond hair. Ninety percent of all

skin cancers occur on parts of the body usually not covered by clothing (Bradley, 2002).

Agricultural noise is another common health hazard on the farm (Toombs, 1996). The agricultural worker is continuously exposed to high levels of noise. The exposure to noise may cause noise-induced hearing loss and a permanent threshold shift (Schoeman and Schröder, 1994; Hattingh and Acutt, 2003).

5. SAFETY HAZARDS ASSOCIATED WITH AGRICULTURE

The agricultural environment presents a variety of safety risks to the employee. These risks may or may not occur independently. Depending on the type of work being done and the risks involved, the accidents that may occur will vary. Accidents relating to activities on farms can be classified as:

- being struck by objects;
- stepping on, striking against or being struck by objects;
- being caught in, on or between objects;
- falls from above;
- falls at ground level;
- strain, over-exertion or strenuous movement; and
- electric contact or exposure (Hattingh and Acutt, 2003).

Falls are the most common type of accident in agriculture. Falls often result in serious injuries or death. Many falls occur because of slips and trips and can be avoided by wearing proper shoes and following safe working procedures (United States Department of Labor, n.d.).

Most farm accidents and fatalities involve machinery. Getting hit or run over by, or entangled in, machinery can lead to death or severe injury. Proper machine guarding and maintenance of equipment according to manufacturer's recommendations can help prevent accidents (United States Department of Labor, n.d.). Many fatal accidents on farms occur when workers are struck by farm machinery. One of the main hazards of front-end loaders and skid-steer loaders is being struck and crushed by the bucket, bucket arms or material falling

from the bucket. Crushing injuries or deaths are also caused by getting caught under the loader bucket or between the loader and the tractor frame (United States Department of Labor, n.d.). There are many hazards associated with driving tractors including roll-overs, run-overs, collisions, exposure to moving machinery, hazardous weather conditions and uneven terrain (United States Department of Labor, n.d.).

Electrocution, which is one of the most overlooked hazards of farm work, can also cause death (United States Department of Labor, n.d.). The most common causes of electrocution are portable grain augers, oversized wagons, large combines and other tall equipment coming into contact with overhead power lines (Occupational Health and Safety Administration, 2003).

Confined work spaces can be very dangerous. Agricultural workers may be at risk of being overcome by gases when entering a confined area such as a manure pit, silo, grain bin or other confined area that may not have enough ventilation. Gases that build up in manure pits and silos can quickly kill an unsuspecting worker. Workers entering grain bins while the bin is being emptied may risk being crushed or suffocated by flowing grain, and explosions may occur because of high concentrations of airborne dust (Petrea, 2002).

6. AGRICULTURAL EXPOSURE

Table 2.1 gives an outline of the agricultural health and safety hazards and risks (Occupational Health and Safety Administration, 2003).

TABLE 2.1: Recognised safety, physical and chemical hazards pertinent to agriculture

Safety and physical risks	Chemical risks
Commodity storage and transfer	Asphyxiation / suffocation
Electricity	Confined space
Ergonomics	Entrapment
Back injury	Fumigation

Lifting	Carbon monoxide (combustion)
Repetitive trauma	Silo gases (NO_2 and CO_2)
Farm machinery	Detergents
Balers	Diesel exhaust
Chain saws	Disinfectants including
Roll-over protection	Chlorine
Safety guards	Quaternary ammonia compounds
Tractors	Organic iodides
Fire	Cresol-based compounds
Fuel storage (leaks and fires)	Formaldehyde emitters
Illumination	Dusts (inorganic aerosols)
Lightning (shock and fire)	Hydrogen sulphide (a key manure gas)
Liquefied Propane [LP] gas	
Liquefied anhydrous ammonia	Nitrogen dioxide (silos and welding)
Physical / environmental hazards	Organic dusts - e.g.
Noise	Grain dust
Thermal (heat and cold)	Wood dust
Ultraviolet (sunlight)	Pesticides (including application and harvest activities)
Vibration	
Transportation (on and off road)	
Welding	

The activities associated with farming are essentially the same worldwide. The machinery used in agricultural operations may differ in design, but the activities that they are used for remain the same. Activities on crop farms include the preparation and ploughing of fields, the planting of crops, the application of pesticides and the harvesting of the crops. Most of these activities include the use of farm equipment or machinery such as tractors and harvesters, and are carried out in the open air environment (Kundiev and Chernyuk, 2001). South Africa is no different: the same types of activities, machinery and equipment are used on crop farms.

The open air environment exposes agricultural workers to different environmental stressors. These include heat exposure from the environment and ultraviolet

radiation from the sun. The health effects of these exposures include heat rash, heat cramps, heat exhaustion, heat collapse, heat stroke and skin cancer (Kundiev and Chernyuk, 2001).

The use of equipment and machinery exposes the farm worker to whole body vibration, noise, ergonomics, dust (both organic and inorganic) and gases. Exposure to vibration may lead to a variety of health effects depending on the frequency of vibration exposure. The health effects include an influence on muscle tone and speech, chest pain, spontaneous muscle contraction, stomach ache, general feeling of discomfort, respiratory problems, increased heart rate, increased blood pressure and the deterioration in clarity of sight. Agricultural workers may experience hearing loss, respiratory problems, lung cancer, irritation, chronic bronchitis and occupational asthma, amongst other things, from the exposure to dust and gases (Kirkhorn and Schenker, 2004).

The use of pesticides and fertilizers exposes the agricultural worker to chemical stressors. The risks involved include the inhalation, absorption and ingestion of these chemicals, which, in turn, could cause adverse health effects to agricultural workers. The health effects from exposure to chemicals range from skin irritation to pulmonary cancer (Kirkhorn and Schenker, 2004).

Agricultural workers are also exposed to safety risks during the execution of their work. These safety risks include, for example, being struck by objects, being caught in, on or between objects, falls from above and falls at ground level (Hattingh and Acutt, 2003).

7. HAZARD IDENTIFICATION RISK ASSESSMENT (HIRA)

The control or elimination of stressors is essential to maintain the health of the workforce. To control or eliminate the different types of stressors effectively it is important to determine first of all the most critical exposures that may lead to death or serious illness. Hazard identification and risk assessment is used in industry to determine the probability and severity of exposure to certain types of stressors. The resulting hazard identification risk assessment (HIRA) rates the

hazards and risks in order to compile a comprehensive occupational health and safety programme to control the various hazards and associated risks (Guild *et al.*, 2001).

A first critical step in developing a comprehensive safety and health programme is the identification of physical and health hazards in the workplace (Nonprofit Risk Management Center, 2005). This process is known as a hazard assessment. A hazard assessment determines whether potential hazards exist in the workplace. Exposure assessment determines whether or not the hazard identified exists at levels that are dangerous to the employees (NPS Risk Management Division, 2005). Potential hazards may be physical or health-related and a comprehensive hazard assessment should identify hazards in both categories (NPS Risk Management Division, 2005). The hazard assessment should begin with a walk-through survey to develop a list of potential hazards in the workplace (Nonprofit Risk Management Centre, 2005). The data should be organised and analysed when the walk-through survey is complete in order to determine the appropriate actions that need to be taken (Nonprofit Risk Management Centre, 2005). The workplace should periodically be reassessed for any changes in conditions, equipment or operating procedures that could affect the occupational hazards (Department of Consumer and Business Services, n.d; Occupational Health and Safety Administration, 2003).

A HIRA might be more useful since each hazard has specific risks associated with it. After initial identification of the associated risks, the risks should be assessed in terms of probability and severity on a high, medium or low scale (Tixier, Dusserre, Salvi and Gaston, 2002). The resulting risk rating is used to determine courses of action.

This HIRA should be conducted during the initial walk-through survey. The nature and effect of hazards can be deduced by identifying environmental factors or stresses, equipment and human errors that could occur within the work environment (Hattingh and Acutt, 2003). Thereafter risks in connection with each hazard should be identified. An estimation of the incidence and severity of the adverse health effects (risk assessment) likely to occur due to actual or predicted

exposure to a workplace hazard can be used to develop strategies to minimise, reduce or eliminate exposure (Hattingh and Acutt, 2003).

The successful application of an occupational health and safety programme depends on the successful completion of a HIRA. Therefore, to control, minimise, reduce or eliminate agricultural hazards effectively, a HIRA must first be completed. Thereafter a comprehensive occupational health and safety programme for agricultural workers can be compiled, this being one of the objectives of this study.

8. OCCUPATIONAL HEALTH AND SAFETY PROGRAMME

The practice of occupational health and safety includes the development of remedial actions used to control health hazards by minimising, reducing or eliminating exposure to hazardous substances or conditions (The Hartford Loss Control Department, 2002). It can be deduced from the definition of occupational health and safety that the basic principles included in an occupational health and safety programme are the anticipation, identification, evaluation and control of hazards in the workplace.

The major function of an occupational health and safety programme is the anticipation of a risk or potential problem. This includes the minimising, eliminating or reducing that risk (The Hartford Loss Control Department, 2002).

Five major categories of hazards have been recognised and identified, namely chemical, physical, biological, ergonomic and safety hazards (GENS8003, 2004). Employees may be exposed to chemical hazards through inhalation, ingestion, skin contact or skin absorption (GENS8003, 2004; The Hartford Loss Control Department, 2002; Hattingh and Acutt, 2003; Schoeman and Schröder, 1994). The degree of risk depends on the particular substance and the level and duration of exposure (Guild *et al.*, 2001).

The potential for exposure to physical hazards exists in many work environments. These physical hazards include noise, extreme temperatures, ionising or non-

ionising radiation and pressure extremes (GENS8003, 2004; The Hartford Loss Control Department, 2002; Hattingh and Acutt, 2003; Schoeman and Schröder, 1994; Guild *et al.*, 2001).

Biological agents are agents that produce allergenic, toxic, carcinogenic reactions or infections in workers. Agricultural and medical workers are most at risk in terms of occupational biological hazards (GENS8003, 2004; The Hartford Loss Control Department, 2002; Hattingh and Acutt, 2003; Schoeman and Schröder, 1994; Guild *et al.*, 2001).

Ergonomics deals with the interaction of technology and the human body in a work environment. Specifically, ergonomics is defined as the science of fitting the work environment to the worker, in order to improve the match between the physical requirements of the job and the employee who performs the job (Halloran and Sage, 2002). Ergonomic stresses can arise from virtually any work situation (The Hartford Loss Control Department, 2002). Some of the ergonomic aspects include the physical environment, biomechanics, workload stressors, work task design, workstation design, workplace design, work tool design and work-related musculoskeletal disorders (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994; Guild *et al.*, 2001).

Evaluation may be defined as a careful investigation of the workplace. This investigation will result in an informed opinion as to the risk posed by a hazard. The determination that a hazard or potential hazard exists requires information gained from observations and interviews. Subsequent measurement of a chemical or physical hazard will determine the effectiveness of control measures in use. Measurement and quantification of chemical and physical stresses in any operation is the key step in safeguarding the health and safety of workers. After sampling, the interpretation of the results is the final step in the evaluation of stressors. The results of the survey must be compared to relevant legislation and/or guidelines (The Hartford Loss Control Department, 2002).

Control measures involve the reduction of environmental stressors to levels that the worker can tolerate without adverse effects on the health or productivity of the

worker (Mechanical Engineering English I, n.d.). Control measures for workplace hazards fall into three main categories: engineering control measures, administrative control measures and the use of personal protective equipment (The Hartford Loss Control Department, 2002).

Engineering control measures involve the removal of the contaminant or hazard. This should be considered as a first option when attempting to limit or reduce exposures. The best time to implement engineering control is during the design stage of a process. Engineering control measures include substitution, isolation, enclosure, modification and ventilation (Ali, 2001; Schoeman and Schröder, 1994).

In general administrative control measures reduce exposures by re-scheduling or rearranging work in exposure areas. Administrative control includes job rotation, employee training and education and alternate work practices (Ali, 2001; Schoeman and Schröder, 1994).

Employees wear personal protective equipment (PPE) to protect themselves from hazardous conditions and / or environments. PPE is used when engineering and administrative control measures are either not possible or are not satisfactory in reducing exposure to acceptable levels. In order for PPE to be effective it must be properly chosen, fitted, used and maintained. PPE includes respiratory protection, protective clothing, hearing protection and eye and face protection (Ali, 2001). PPE should only be used as a last resort when engineering and administrative control measures fail to reduce the exposures to acceptable levels (Schoeman and Schröder, 1994; Hattingh and Acutt, 2003)

Regardless of which environmental stressors are encountered the occupational health and safety programme must be consistent. The programme should include all of the above-mentioned principles (The Hartford Loss Control Department, 2002).

Perhaps more than any other occupational group, agricultural workers are exposed to a wide variety of environmental hazards that are potentially harmful to

their health and well-being (Bradley, 2002). Occupational health and safety exposures of South African farm workers have not been studied extensively. Occupational health and safety exposures have not been researched as a whole, although some studies have been done on pesticide exposure (Arcury, Quandt and Russell, 2002; Engel, 1998). Therefore, there is a need in South Africa to quantify the occupational health and safety risks and exposures of farm workers. It is known that farm workers worldwide are exposed to a variety of different occupational health and safety hazards, including aspects related to both health and safety factors. These aspects include, for example, dust, fumes, noise, temperature, pesticides, insecticides, ergonomics, trip and slip and vibration (Zhao, 1993; Estill, Baron and Steege, 2002).

Currently, no comprehensive occupational health and safety programme exits for agricultural workers in South Africa. To effectively control or eliminate hazards associated with agricultural work on crop farms, a comprehensive occupational health and safety programme for such workers is essential. The study will attempt to compile an exact applicable occupational health and safety programme for agricultural workers to ensure the health and well-being of these workers.

9. REFERENCES

Ali, B.O. 2001. Fundamental principles: occupational health and safety. International Labour Organisation. 94.

Amweelo, M. 2001. Occupational health and safety problems in Namibian agriculture. *African Newsletter on Occupational Health and Safety.* 11(2):44-47.

Agricultural Research Centre of Finland and the Tampere University of Technology. 2006. International Hazard Datasheets on Occupations: Field crop worker.

Arcury, T.A., Quandt, S.A., Russell, G.B. 2002. Pesticide safety among farm workers: perceived risk and perceived control as factors reflecting environmental justice. *Environmental Health Perspect.* 2:233-240.

Australian Centre for Agricultural Health and Safety. n.d. Practical occupational health and safety. Retrieved on October 16, 2004, from www.farmsafe.org.au/mfs.htm

Bernhardt, J., Langley, R. 1993. Agricultural hazards in North Carolina. *North Carolina Medical Journal*. 54:512-515.

Bradley, K.R. 2002. Health hazards in agriculture - an emerging issue. Retrieved on January 21, 2005, from http://www.cdc/gov/nasd/docs/d001001-d001100/d001050/d001050.html

Bruce, T.F. 2001. Occupational health and safety in agriculture in Ghana. *African Newsletter on Occupational Health and Safety.* 11(2):48-49.

Centre for Occupational and Environmental Health. 2005. Respiratory risks in agriculture. Resources for health-care professionals. Retrieved on February 14, 2005, from www.coeh.man.ac.uk/teaching_learning/resources/farms.php

Department of Consumer and Business Services. n.d. Personal protective equipment. Retrieved on March 24, 2005, from http://www.cbs.state.or.us/external/osha/educate/training/pages/203xm1.html

DeRoo, L.A., Rautiainen, R.H. 2000. A systematic review of farm safety interventions. *American Journal of Preventative Medicine.* 18:51-62.

Elkind, P.D. 2002. Correspondence between knowledge, attitudes and behavior in farm health and safety practices. *Journal of Safety Research.* 24(3):171-179.

Engel, L.S. 1998. Neurophysiological function in farm workers exposed to organophosphate pesticides. *Archives of Environmental Health.* Retrieved on

March 24, 2006, from http://www.findarticles.com/p/articles/mi_m0907/is_n1_v53/ai_20598439

Estill, C.F., Baron, S., Steege, A.L. 2002. Research and dissemination needs for ergonomics in agriculture. *Public Health.* 117(5):440-445.

Field, E.F. n.d. Harvesting operations. *Encyclopeadia of Occupational Health and Safety*. International Labour Organisation.

Forastieri, V. 2001. Challenges in providing occupational safety and health services to workers in agriculture. *African Newsletter on Occupational Health and Safety.* 11(2):33-38.

GENS8003. 2004. Work and Safety. Retrieved on April 15, 2005, from http://www.safesci.unsw.edu.au/gens8003

Graham, A. 2005. Policy and procedure documents. South Africa. Retrieved on July, 21, 2006, from http//196.33.85.12/~intranet/health/policy.htm

Guild, R., Ehrlich, R.I., Johnston, J.R., Ross, M.H. 2001. *Handbook of Occupational Health Practice in the South African Mining Industry*. The Safety in Mines Research Advisory Committee. 68.

Halloran and Sage LLP. 2002. OSHA's New Ergonomics Plan Puts Employers on Alert. M. Lee Smith publishers, Connecticut, employment law letter. Retrieved on March 24, 2006, from http://www.halloran-sage.com/Publications/Publication/702/Default.aspx

Hattingh, S., Acutt, J. 2003. *Occupational health management & practice for health practitioners*. South Africa: Juta & Co Ltd. 88-90, 198.

International Labour Organisation. 2000. Occupational Safety and Health in Agriculture. Retrieved on May 13, 2005, from http://www.ilo.org/public/english/protection/safework/agriculture/intro.htm

Kirkhorn, S., Schenker, M.B. 2004. Human health effects of agriculture: physical diseases and illnesses. Retrieved on October 16, 2004, from www.cdc.gov/nasd/docs

Kundiev, Y., Chernyuk, V.I. 2001. Planting and growing operations. *Encyclopedia of Occupational Health and Safety*. United States International Labor Organisation.

Mechanical Engineering in English I. n.d. Industrial Health and Safety. Retrieved on March 21, 2005, from www.nuancekk.com/Virtual_U/Webpages_mech_1/Mech1-IndustrialHealth.html

Muchiri, F.K. 2001. Towards better occupational health and safety services in the agricultural sector. *African Newsletter on Occupational Health and Safety.* 11(2):31-32.

Muchiri, F.K. 2003. Occupational health development in Africa. *African Newsletter on Occupational Health and Safety.* 13(2):44-46.

Myers, J.E. 2004. Globalisation, occupational health and the agricultural sector. *Occupational Health Southern Africa.* 10: 6-11.

Nonprofit Risk Management Center. 2005. Workplace toolkit. Retrieved on March 16, 2005, from http://www.nonprofitrisk.org/ws-ps/topics/PPE/dress-ps.htm

NPS Risk Management Division. 2005. Personal protective equipment. Retrieved on March 16, 2005, from http://www.nps.gov/training/tel/Guides/ppe_pguide

Occupational Health and Safety Administration. 2003. Farming is one of the most dangerous occupations in the United States. Retrieved on February 14, 2005, from http://www.osha.gov/Publications/osha3151.pdf

Petrea, C. 2002. Farm Safety & Health: Farm Electrical Safety. *National Safety Council's Agricultural Division, University of Illinois.*

Regoeng, K.G. 2001. Occupational health and safety: A challenge to the agricultural sector in Botswana. *African Newsletter on Occupational Health and Safety.* 11(2):42-44.

Rosenberg, H. 2006. Department of Agriculture and Resource Economics. Retrieved on March 24, 2006, from are.berkeley.edu/heat

Schoeman, J.J., Schröder, H.H.E. 1994. *Occupational hygiene*. South Africa: Juta & Co, Ltd. 222, 450.

The Hartford Loss Control Department. 2002. Loss control tips. Technical information paper series. Innovative safety and health solutions. Retrieved on March 24, 2005, from http://mb.thehartford.com/insurance_info/pdfs/820-001.pdf

Tixier, J., Dusserre, G., Salvi, O., Gaston, D. 2002. Review of 62 risk analysis methodologies of industrial plants. *Journal of Loss Prevention in the Process Industries.* 15(4):291-303.

Toombs, M. 1996. Noise control on farms. Retrieved on October 16, 2004, from www.cdc.gov/nasd/docs

United States Department of Labor. n.d. Occupational Safety and Health Administration (OSHA). Agricultural Hazards. Retrieved on January 21, 2005, from www.osha.gov/SLTC/youth/agriculture/

Zhao, W. 1993. Preventing cold-related illnesses in agricultural workers. Rutgers Cooperative Extension. New Jersey, New Brunswick: Rutgers, the State University of New Jersey, Publication.

CHAPTER 3

A WALK-THROUGH SURVEY OF CROP FARMS IN THE MANGAUNG MUNICIPAL DISTRICT

1. INTRODUCTION

Occupational health and safety is defined as the science and art devoted to the anticipation, identification, evaluation and control of those environmental factors arising in or from the workplace that may cause illness, impaired health or adverse effects on employees or people not involved in the work activities (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994).

An occupational health or safety hazard is anything in the workplace that has the potential to cause harm to the human body (Farmsafe Queensland, 2002; Occupational Health and Safety Administration, 2003). Many aspects of working life can cause health or safety hazards. Equipment, processes, chemical, biological or physical agents, work procedures and the design of the workplace are all potentially hazardous (Centre for Occupational and Environmental Health, 2005; Occupational Health and Safety in Ontario, n.d.), and health and safety hazards vary greatly depending on the type of work involved. Work hazards are usually associated with mines, construction sites and other industrial workplaces; all workplaces, however, have their own particular hazards (Tixier, Duserre, Salvi and Gaston, 2002; Occupational Health and Safety in Ontario, n.d.).

A health hazard is something that has the potential to cause an adverse health effect. An occupational illness is a condition that results from exposure in a workplace to a physical, chemical or biological agent to the extent that the normal physiological mechanisms are affected and the health of the worker is impaired. An adverse health effect might be a minor skin rash or it might be a life-threatening disease like lung cancer (Occupational Health and Safety in Ontario, n.d.).

The three major categories of agents that may be hazardous to health are chemical, biological and physical agents (Tixier, *et al*., 2002; Occupational Health and Safety in Ontario, n.d.; Occupational Health and Safety Administration, 2003). Chemical agents take many forms and can appear in the workplace as gases, liquids or solids. Chemicals may be the product being manufactured, an input to a process or may be a by-product of a process (Occupational Health and Safety in Ontario, n.d.). Biological agents are living organisms or products of living organisms. Most biological agents found in the workplace are microscopic organisms. These include bacteria, viruses and fungi, all of which feed on plant or animal tissue (Schoeman and Schröder, 1994; Occupational Health and Safety in Ontario, n.d.; Occupational Health and Safety Administration, 2003). Physical agents are forms of energy or force. These include noise, vibration, electricity, heat and cold, pressure and radiation. Some, like electricity, are usually an integral and deliberate part of a production process. Others, such as noise and vibration, are most often unwanted by-products of a process (Occupational Health and Safety in Ontario, n.d.).

A safety hazard is something that has the potential to cause an injury. An injury is physical harm or damage to a person resulting from contact between the body and an outside agent or from exposure to environmental factors. Injuries can range in severity from a minor scratch or burn to the loss of a limb or even death. Injuries are usually the result of accidents. An accident is an unplanned event that causes harm to people or damage to property (Farmsafe Queensland, 2002; Occupational Health and Safety in Ontario, n.d.).

Recognition and assessment of health and safety hazards prepare the way for control or elimination of such hazards (Centre for Occupational and Environmental Health, 2005; Occupational Health and Safety in Ontario, n.d.). The first critical step in developing a comprehensive safety and health programme is thus to identify physical and health hazards in the workplace (Occupational Health and Safety Administration, 2003).

Correcting the occupational health and safety problems begins with the recognition of problems (Schenker, 1995). However, health and safety hazards are not always obvious. Hazard recognition means the identifying of potential hazards in the workplace, identifying the adverse effects that may be associated with these hazards and determining whether there is a possibility of people being exposed or affected. Potential hazards may be physical or health-related and a comprehensive hazard assessment should identify hazards in both categories (Occupational Health and Safety Administration, 2003).

Once a potential hazard has been recognised, assessment of the severity or the potential negative impact of the hazard follows (Occupational Health and Safety in Ontario, n.d.). The hazard assessment should begin with a walk-through survey of the work environment to identify and assess any health and safety hazards (Occupational Health and Safety Administration, 2003). The walk through survey is thus used to identify all sources of hazards (Center for Disease Control and Prevention (CDC), 1997).

The walk-through survey is the starting point of the exposure assessment, representing a sequence of events that must take place to determine the potential for overexposure, taking into account all routes of exposure, including inhalation, ingestion and skin contact, as well as safety aspects (Nisga'a Valley Health Board, 2004). A qualified person who has adequate training and experience in occupational health and safety should complete the assessments to recognise and identify health and safety hazards (Nisga'a Valley Health Board, 2004).

The Center for Disease Control and Prevention (CDC) (1997) states that the presence of any sources of hazards must be identified, and these include the following:

- Sources of motion, i.e. machinery or processes where any movement of tools, machine elements or particles could exist or where there is movement of personnel that could result in collision with stationary objects;
- sources of high temperatures that could result in burns, eye injury or ignition of protective equipment, etc.;
- chemicals that could come into contact with the skin and eyes;

- sources of hazardous atmospheres;
- sources of light radiation, i.e. welding, brazing, cutting, furnaces, heat treating, high intensity lights, etc.;
- sources of falling objects or objects that have the potential to fall;
- sources of sharp objects which might pierce the feet or cut the hands;
- sources of rolling or pinching objects which could crush the feet; and
- electrical hazards (CDC, 1997).

Following the walk-through survey, the data and information are organised for use in the assessment of hazards (CDC, 1997). The risks involved in every hazard are identified since one hazard may include more than one risk. Following the identification of the hazards, the risks associated with the hazards are assessed.

1.1 Problem statement

Agriculture is amongst the most hazardous occupations, with a death rate approximately four times that of all other industries combined. Farming is underreported as an occupation (Western Center for Agricultural Health and Safety, 2004) and agricultural workers are often exposed to agents that may be harmful to their health or that may cause injury to them (Manjabosco, Morata and Marques, 2004). While agriculture is recognised as being amongst the most hazardous occupations, most occupational health efforts have concentrated on mining and heavy industry (Schenker, 2004). The health and safety of farm workers has thus been neglected worldwide because of the emphasis placed on the industrial environment.

While it is true that farm workers are exposed to certain hazards during their work shifts, their circumstances differ from those in a normal industry. Farm work is generally executed in the general outdoor environment except for specific tasks that have to be done indoors.

Agriculture ranks with mining as one of the two most hazardous industries in the United States (Schenker, 1995), yet while mining and other industries have

become markedly safer in recent years, agriculture has not. One reason for this is that the preventive health care effort directed at mining and other industries has largely been absent from agriculture. Schenker (1995) argues that, far from being the inevitable result of an inherently dangerous industry, agricultural deaths, injuries and illnesses constitute preventable health problems. California farm workers, for instance, face the possibility of numerous serious acute and chronic work-related injuries and illnesses. Some of the conditions associated with agricultural exposures include asthma, hypersensitivity pneumonitis, organic dust toxic syndrome (ODTS), skin cancer, prostate cancer, leukaemia and non-Hodgkin's lymphoma. In addition, machine-related fatalities and injuries are prevalent as are drownings associated with irrigation canals and aqueducts. However, few studies have focused on these risks or on the California farmer's perceptions of the health hazards in agriculture (Schenker, McCurdy, Farrar and Morrin, 1995). In general, farmers' knowledge concerning the health hazards of the farm worker is not sufficient to change their behaviour (Rathinam, Kota and Thiyagar, 2005).

Perhaps more than any other occupational group, agricultural workers are exposed to a wide variety of environmental hazards that are potentially harmful to their health and well-being (Bradley, 2002). Although some studies have been done on pesticide exposure, occupational health and safety exposures of farm workers in South Africa have not been researched as a whole (Arcury, Quandt and Russell, 2002; Engel, 1998). It is known that farm workers are exposed to a variety of different occupational health and safety hazards which includes dust, fumes, noise, temperature, pesticides, insecticides, ergonomics, trips and slips and vibration (Zhao, 1993; Estill, Baron and Steege, 2002). It is therefore evident that attention needs to be paid to the occupational health and safety hazards faced by farm workers in South Africa. Such hazards must be assessed, and problem areas identified should then be addressed to ensure the well-being of the farm worker.

On South African farms a variety of activities occur according to the type of farming done. Different farming activities present their own particular types of hazard; for instance, farming with animals presents specific hazards associated

with animal handling, whereas crop farming, on the other hand, has different types of activities and therefore different types of hazards. Furthermore, the type of crop produced on the farm also presents its own peculiar health and safety hazards. In South Africa there are farms where both animals and crops are farmed on the same land, which leads to a combination of health and safety hazards associated with both animal and crop farming. The problem includes frequency of exposure: in the maize industry, for example, there are certain times during the year that dust production is excessive because of certain activities. Occupational health and safety issues are therefore diverse and to address them all would entail extensive research. The present study thus concentrated on crop farms in the Mangaung municipal district, Free State Province (specifically those producing maize, corn and sunflowers) and set out to identify the different types of health and safety hazards in order to develop an applicable and practicable occupational health and safety programme to protect farm workers.

The first step in the control and elimination of occupational health and safety hazards is the recognition and identification of the hazards. The recognition and identification include both health and safety aspects.

1.2 Aim of the chapter

The aim of this chapter was to gain information regarding the activities of farm workers namely: the types of activity they are involved in during a working day, number of workers on a farm, the length of their working day, etc.

2. MATERIALS AND METHODS

In the present study, a checklist (Annexure A) was compiled that was completed during the walk-through survey of farms. The checklist covered aspects such as the activities that workers are routinely involved in and the machinery used for these activities, working hours, number of employees, how often during the year the activity takes place and during which season. The walk-through survey was conducted on selected crop farms in the Mangaung municipal district, Free State Province, South Africa. The activities that farm workers were involved in were

identified, together with the types of machinery used. Thereafter the number of workers involved in each activity and the time spent on each of these activities, were determined.

As the study focused on the Mangaung municipal district, a map of the area (Annexure B) showing all farms was obtained. The farms within this district were identified (897 farms). Cultivation farms as required for the study and farms identifiable by name were selected to be included in the study population. This was accomplished by means of a drive-by of farms in the Mangaung municipal district. The study population comprised of 204 farms. Fifty farms were systematically selected from the study population to be included in the study. Appointments were made telephonically with the farm owners / managers to visit these farms (the success rate of these appointments was 78%, i.e. some farmers did not want the study done on their farms, and some forgot the appointment). The total farms visited until a data saturation point (as suggested by a statistician) was reached were 25.

3. RESULTS

There were four main crop farming activities identified on each of the selected crop farms in the Mangaung municipal district. These activities were the preparation and ploughing of land, the planting of crops, the application of pesticides and the harvesting of crops. The machinery used during each of these activities was identified (Table 3.1). The workers involved in each crop farming activity (Table 3.2), as well as the hours that they spent on each activity (Table 3.3) were noted and tabled. The season in which each activity took place was also noted.

TABLE 3.1: Activities and machinery identified on crop farms in the Mangaung municipal district, South Africa

Activity	Machinery and / or equipment
Preparation of land	Tractors
	Disc harrow
	Fertiliser spreader
Ploughing of land	Tractors
	Ploughs
Planting of crops	Tractors
	Planters
Application of pesticides	Tractors
	Sprayers
Harvesting of crops	Harvesters
	Balers
	Trucks
	Trailers

Examples of the machinery used during activities on crop farms are indicated below. Figures 3.1 and 3.2 show different types of tractors used during the preparation and ploughing of land and the planting of crops.

FIGURE 3.1: Tractor fitted with a roll-over protective structure

FIGURE 3.2: Tractor without a roll-over protective structure

Figures 3.3 and 3.4 indicate the type of machinery used during the application of pesticides. There are different types of pesticide applicators / sprayers available on the market.

FIGURE 3.3: The application of pesticides using a sprayer (small scale)

FIGURE 3.4: The application of pesticides using a different type of sprayer

Figures 3.5 and 3.6 indicate different types of harvesters used during the harvesting of crops.

FIGURE 3.5: Harvester harvesting crops

FIGURE 3.6: A different type of harvester shown during the harvesting of crops

TABLE 3.2: The number of farm workers involved in the identified activities on crop farms in the Mangaung municipal district

	Number of workers involved in each activity				
Farm	**Preparation of land**	**Ploughing**	**Planting**	**Application of pesticides**	**Harvesting of crops**
1	8.0	8.0	8.0	1.0	6.0
2	5.0	3.0	4.0	2.0	4.0
3	6.0	5.0	5.0	3.0	3.0
4	2.0	6.0	6.0	4.0	4.0
5	1.0	2.0	3.0	1.0	3.0
6	3.0	2.0	3.0	2.0	2.0
7	2.0	3.0	3.0	3.0	3.0
8	2.0	2.0	3.0	1.0	2.0
9	6.0	6.0	4.0	2.0	2.0
10	5.0	5.0	4.0	3.0	3.0
11	2.0	2.0	4.0	2.0	2.0
12	2.0	3.0	3.0	3.0	3.0
13	4.0	4.0	4.0	4.0	4.0
14	3.0	3.0	3.0	3.0	3.0
15	2.0	2.0	4.0	2.0	3.0
16	5.0	6.0	3.0	3.0	3.0
17	6.0	2.0	4.0	2.0	2.0
18	3.0	3.0	3.0	3.0	4.0
19	4.0	6.0	4.0	2.0	2.0
20	2.0	4.0	3.0	3.0	3.0
21	4.0	3.0	2.0	2.0	6.0
22	2.0	3.0	3.0	3.0	3.0
23	2.0	2.0	4.0	2.0	2.0
24	6.0	3.0	3.0	3.0	3.0
25	2.0	2.0	2.0	2.0	6.0
	3.56 ± 1.8502	**3.60 ± 1.7078**	**3.68 ± 1.2490**	**2.44 ± 0.8206**	**3.24 ± 1.2342**

TABLE 3.3: The time spent (hours) by farm workers on each of the identified activities

	Hours spent on each activity				
Farm	**Preparation of land**	**Ploughing**	**Planting**	**Application of pesticides**	**Harvesting of crops**
1	8.0	8.0	8.0	8.0	10.0
2	8.0	9.0	9.0	8.0	10.0
3	9.0	10.0	10.0	8.0	11.0
4	8.0	11.0	11.0	9.0	10.0
5	8.0	12.0	11.0	8.0	10.0
6	9.0	9.0	12.0	8.0	9.0
7	10.0	10.0	11.0	9.0	9.0
8	8.0	11.0	10.0	8.0	8.0
9	8.0	12.0	11.0	9.0	11.0
10	9.0	10.0	12.0	8.0	10.0
11	8.0	8.0	10.0	9.0	10.0
12	9.0	8.0	9.0	8.0	8.0
13	8.0	9.0	10.0	10.0	8.0
14	9.0	9.0	11.0	11.0	8.0
15	10.0	10.0	12.0	8.0	9.0
16	10.0	11.0	11.0	9.0	8.0
17	8.0	9.0	10.0	9.0	9.0
18	9.0	8.0	9.0	10.0	8.0
19	10.0	9.0	10.0	9.0	8.0
20	8.0	8.0	8.0	9.0	10.0
21	9.0	10.0	9.0	8.0	10.0
22	8.0	8.0	10.0	8.0	11.0
23	9.0	9.0	11.0	10.0	12.0
24	10.0	8.0	10.0	8.0	8.0
25	8.0	9.0	9.0	8.0	9.0
	8.72 ± 0.7916	**9.40 ± 1.2583**	**10.16 ± 1.1431**	**8.68 ± 0.8524**	**9.36 ± 1.1860**

Table 3.4 summarises the results obtained from the walk-through survey of crop farms. During the preparation of fields an average of 3.56 ± 1.8502 workers worked an average of 8.72 ± 0.7916 hours each working day. The ploughing of the fields took an average of 3.60 ± 1.7078 workers an average time of 9.40 ± 1.2583 per working day. The planting of crops had the highest average of 3.68 ± 1.2490 workers involved for an average of 10.16 ± 1.1431 hours on each working day. The application of pesticides was done by an average of 2.44 ± 0.8206 workers during an average of 8.68 ± 0.8524 hours per working day. The last activity on crop farms namely, harvesting of the crops, took an average of 9.36 ±

0.7916 hours per working day and an average of 3.24 ± 1.2342 workers were involved.

TABLE 3.4: A summary of the information collected from the walk-through survey

Activity	Average number of workers	Average working hours (h)
Preparation of land	3.56 ± 1.8502	8.72 ± 0.7916
Plough	3.60 ± 1.7078	9.40 ± 1.2583
Plant	3.68 ± 1.2490	10.16 ± 1.1431
Application of pesticides	2.44 ± 0.8206	8.68 ± 0.8524
Harvest	3.24 ± 1.2342	9.36 ± 0.7916

Figure 3.7 illustrates the average number of farm workers involved in each of the identified activities on crop farms in the Mangaung municipal district. It is clear from Figure 3.7 that the number of farm workers involved in the different types of activities on crop farms is not high when compared to the normal number of employees in industry.

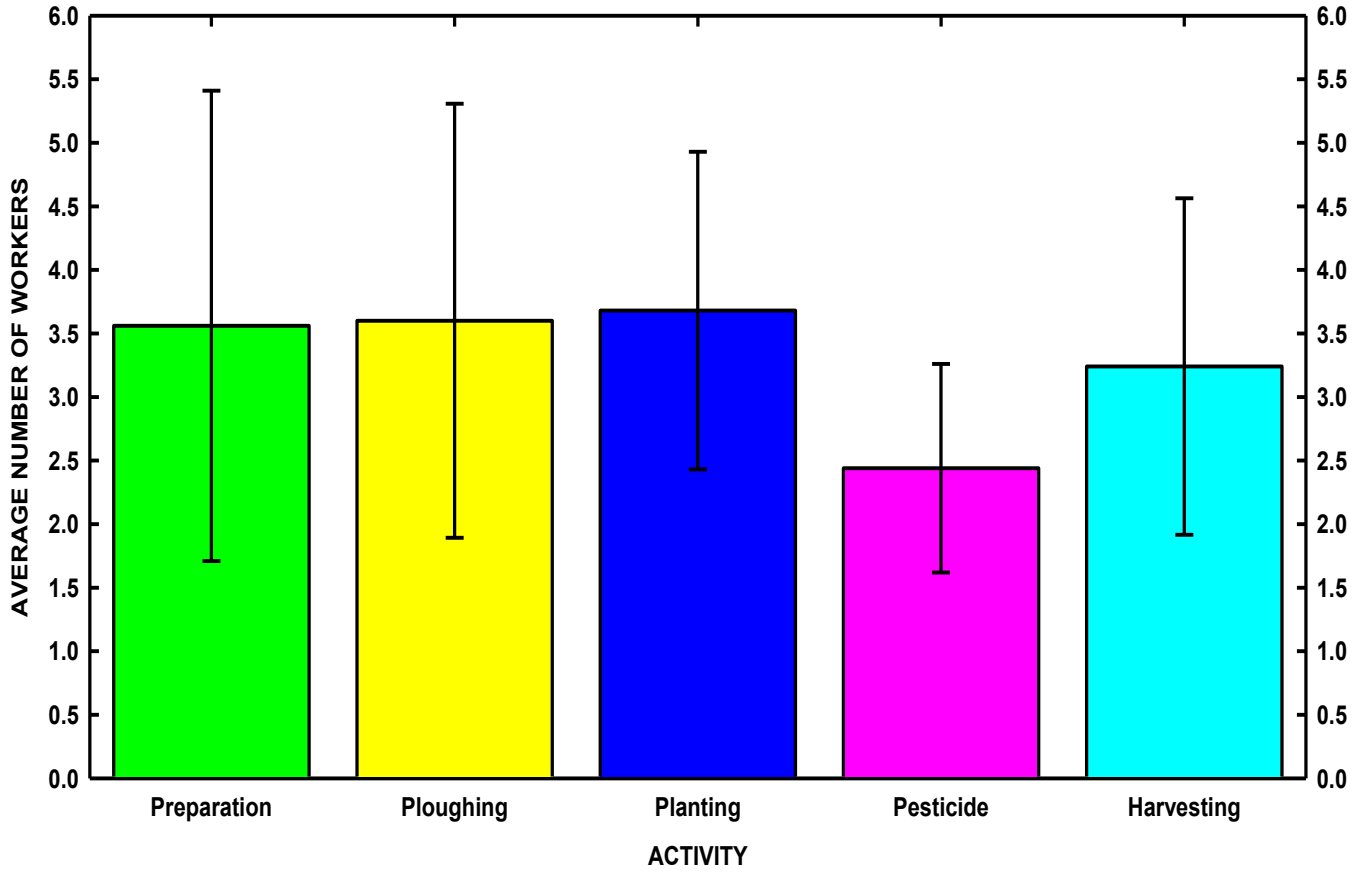


FIGURE 3.7: The average number of workers involved in different activities on crop farms

Figure 3.8 illustrates the average time that farm workers spend on each of the identified activities on crop farms in the Mangaung municipal district. It is clear from Figure 3.8 that the average time that farm workers spend on each of the activities exceeds the normal 8-hour working shift and therefore also the normal 40-hour working week.

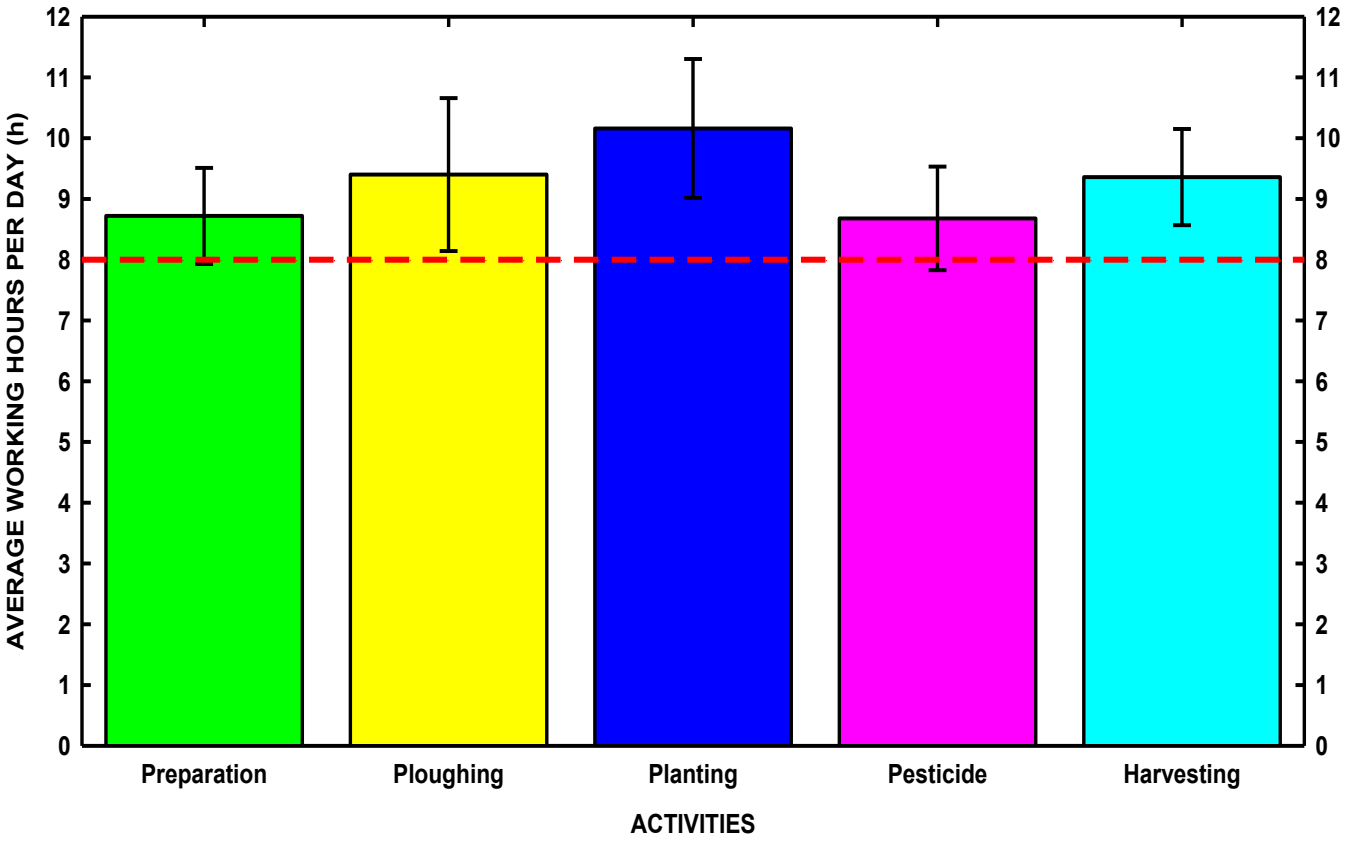
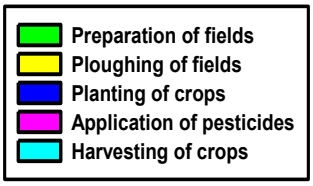


FIGURE 3.8: The average working hours (h) per day that the workers spend on each activity on crop farms



4. DISCUSSION

The farms in the Mangaung municipal district include both animal and crop farming. The number of farms in this region that could be identified from the map obtained included 897 farms. The farms selected for the purposes of this research project included certain types of crop farming activities (specifically those producing maize, corn and sunflowers). Farms that could be identified by name and that included crop farming were selected with the aid of a drive-by. Two-hundred-and-four farms fell into this category. Twenty-two point seven four percent (22.74%) of all the farms in the study area, were identified to be included in the study. The farms were visited until a data saturation point (suggested by a

statistician) was reached: thus until it became apparent that no new information could be collected.

The farms selected for the study were visited and a walk-through survey of each was conducted. During the walk-through survey a checklist was completed to list the main activities on the farms, to identify the machinery and/or equipment used during each activity, the number of workers involved as well as the working hours of each activity. The identification of the activities and machinery and/or equipment used is the first step in the reduction or prevention of occupational exposure.

The activities that crop farm workers in the Mangaung municipal district are involved in during the normal execution of their work were identified from observation as follows: the preparation of land for the planting of crops, the ploughing of land, the planting of crops, the application of pesticides and the harvesting of crops. The same activities were identified in a study conducted by Kundiev and Chernyuk (2001). It was also found in this study that the cultivation of the land was the most labour-intensive preliminary stage of crop production. These cultivation operations constitute 30% of planting and growing operations. As a rule, harvesting lasts from 25 to 40 days. Harvesting of grain is generally performed in the hottest season (Kundiev and Chernyuk, 2001). The machinery and/or equipment identified so being used during each of the activities includes tractors, disc harrows, fertiliser spreaders, ploughs, planters, sprayers, harvesters, balers, trucks and trailers. The equipment used during crop farming activities is essentially the same worldwide, although the design may differ from country to country (Agricultural Research Centre of Finland and The Tampere University of Technology, 2006).

The average number of farm workers involved in each activity (namely two and four workers) is lower than that encountered in the normal industrial work environment. This indicates that the normal crop farm worker's work involves different types of activities since each worker is involved in many or all of the activities. The farm workers are therefore not specialised workers and are expected to be able to complete a variety of different tasks. In addition, the farm

owner or manager may not regard occupational health and safety of the farm workers as a priority since only a few workers are involved. He/she may reason that since only two to four workers are involved the exposure is negligible, since in the industrial environment several hundred employees may be exposed to the same hazards.

According to the results the planting of crops had the highest average number of working hours with the highest average number of workers involved. The lowest average number of working hours was recorded in the application of pesticides, where the lowest average number of workers was involved. The ploughing of fields and the harvesting of crops also showed average working hours longer than the normal 8-hour work shift per day.

The results indicated that the average number of working hours for all four activities were longer than the normal 8-hour working shift. This may be as a result of the urgency of the work involved. Because farming depends upon biological processes, farm work is subject to biological needs and constraints (Pennsylvania State University, 1997). Certain types of farm work, such as ploughing, harvesting and application of pesticides, must be done within brief time periods or the entire year's harvest may be lost. When the weather does not cooperate it is even more important for farmers to perform certain tasks swiftly and to complete the work as soon as possible while conditions allow it. Such time constraints are the reason why farmers sometimes work longer shifts (Pennsylvania State University, 1997). Since the planting of crops is seasonally bound, the activities are not done through the whole year. This in turn means that the workers, although they work longer than the 8-hour work shift, do not work these hours every day throughout the whole year.

The working hours spent on each activity need to be taken into account when assessing health and safety risks as this will indicate the exposure of the farm workers to the health and safety risks involved. The normal threshold limit values (TLVs) used to limit the exposure of workers to stressors are expressed in 8-hour working day limits according to the Occupational Health and Safety Act, Act 85 of 1993 (South Africa, 1993) as well as in the Regulations promulgated under this

Act. Farm workers in general work longer hours than the prescribed 8-hour working day. Since occupational health and safety exposure limits are expressed in 8-hour limits the exposure time of farm workers must be taken into account when dealing with the occupational health and safety of these workers (South Africa, 1993). TLVs thus cannot be applied as precisely as they are indicated in legislation. TLVs must be converted to the length of the farm workers' workday. This means that the exposure limit for farm workers will be less than that of the normal industrial worker, but more than the exposure limit of the general public (i.e. environmental TLVs).

The season during which each activity is executed should be considered when a risk assessment is done. Farm workers indicated during the walk-through survey that the preparation of land, ploughing of land and the planting of corps is done during the spring or summer season, depending on the rainfall. The reason for this is that the Mangaung municipal district falls in the summer rainfall area of South Africa. These activities thus take place during the hottest times of the year in the general outdoor environment.

5. CONCLUSION

The walk-through survey is the first step in the recognition of occupational health and safety hazards. The data from the walk-through survey of crop farms in the Mangaung municipal district clearly indicate that farm workers are involved in different types of activities. The farm worker therefore should be able to do a variety of different types of work that involve different types of machinery and/or equipment. The working hours of farm workers are longer than the prescribed 8-hour shift per day.

In Chapter 4 an applicable hazard identification risk assessment was compiled and completed utilising the information gained in Chapter 3

6. REFERENCES

Arcury, T.A., Quandt, S.A., Russell, G.B. 2002. Pesticide safety among farm workers: perceived risk and perceived control as factors reflecting environmental justice. *Environmental Health perspect.* 2:233-240.

Agricultural Research Centre of Finland and the Tampere University of Technology. 2006. International Hazard Datasheets on Occupations: Field crop worker.

Bradley, K.R. 2002. Health hazards in agriculture - an emerging issue. Retrieved on January 21, 2005, from http://www.cdc/gov/nasd/docs/d001001-d001100/d001050/d001050.html

Center for Disease Control and Prevention. Office of Health and Safety. 1997. Personal protective equipment. Retrieved on January 18, 2005, from www.cbs.state.or.us/external/osha/educate/training

Engel, L.S. 1998. Neurophysiological function in farm workers exposed to organophosphate pesticides. *Archives of Environmental Health.* Retrieved on March 24, 2006 from http://www.findarticles.com/p/articles/mi_m0907/is_n1_v53/ai_20598439

Estill, C.F., Baron, S., Steege, A.L. 2002. Research and dissemination needs for ergonomics in agriculture. *Public Health.* 117(5): 440-445.

Hattingh, S., Acutt, J. 2003. Occupational health management and practice for health practitioners. South Africa: Juta & Co Ltd. 88-90, 198.

Kundiev, Y., Chernyuk, V.I. 2001. Planting and growing operations. *Encyclopedia of Occupational Health and Safety*. United States International Labour Organisation.

Manjabosco, C.W., Morata, T.C., Marques, J.M. 2004. Audiometric findings of agricultural workers. *Arquivos de Otorrinolaringologia*. 8(4):285-295.

Nisga'a Valley Health Board. 2004. Walk-through survey / workplace monitoring. Retrieved on March 16, 2005, from http://www.nisgaahealth.bc.ca/ohs/hazardousagents.asp#monitoring

Occupational Health and Safety Administration. 2003. Agricultural hazards. Retrieved on February 14, 2005, from http://www.osha.gov/Publications/osha3151.pdf

Occupational Health and Safety in Ontario. n.d. Health and safety hazards. Retrieved on April 25, 2003, from http://www.worksafesask.ca/files/ont_wsib/certmanual/ch_01.html

Rathinam, X., Kota, R., Thiyagar, N. 2005. Farmers and formulations - rural health perspective. *Medical Journal of Malaysia*. 60(1). Retrieved on May 6, 2005, from http://www.mma.org.my/info/6_rural_05.htm

Pennsylvania State University. 1997. Understanding Your Community's Agriculture. Retrieved on May 12, 2005, from http://pubs.cas.psu.edu/FreePubs/pdfs/ua317.pdf

Schenker, M.B., McCurdy, S.A., Farrar, J.A., Morrin, L.A. 1995. Hazard perceptions of California farmers. *Agricultural Health News*. 2(2):27-40.

Schenker, M.B. 1995. Schenker stresses need for agricultural health and safety awareness. *Agricultural Health News*. 3:2-3.

Schenker, M. 2004. Challenges in agricultural health and safety. *Agricultural Health News*. 3:2-5.

Schoeman, J.J., Schröder, H.H.E. 1994. Occupational hygiene. South Africa: Juta & Co, Ltd. 222.

South Africa. 1993. Occupational Health and Safety Act, Act 85 of 1993. Pretoria: State Press. Pretoria: Government Printer.

Western Center for Agricultural Health and Safety. 2004. California is the leading agricultural state. Department of Epidemiology and Preventive Medicine University of California. Retrieved on July 30, 2005, from http://agcenter.ucdavis.edu/

Zhao, W. 1993. Preventing cold-related illnesses in agricultural workers. Rutgers Cooperative Extension. New Jersey, New Brunswick: Rutgers, the State University of New Jersey, Publication.

CHAPTER 4

HAZARD IDENTIFICATION RISK ASSESSMENT ON CROP FARMS IN THE MANGAUNG MUNICIPAL DISTRICT

1. INTRODUCTION

A comprehensive occupational health and safety programme can only be developed when the physical and health hazards are first identified in the workplace (Nonprofit Risk Management Center, 2005). This is known as a hazard assessment. A hazard assessment determines the potential hazards in the workplace. Exposure assessment determines whether the identified hazard exists at levels that are dangerous to employees (NPS Risk Management Division, 2005). An assessment considers which workers, if any, are exposed or likely to be exposed to an identified workplace hazard and for how long (Occupational Health and Safety in Ontario, n.d.).

A comprehensive hazard assessment should identify all potential hazards and should include both physical and health-related hazards (NPS Risk Management Division, 2005). A list of the potential hazards should be developed during the walk-through survey (Nonprofit Risk Management Center, 2005). The data should be organised and analysed when the walk-through survey is completed to help determine the appropriate actions that need to be taken to minimise, reduce or eliminate the potential hazards (Nonprofit Risk Management Center, 2005). The periodic reassessment of the workplace should be conducted to determine any changes in conditions, equipment or operating procedures that could affect occupational hazards (Department of Consumer and Business Services, n.d.; Occupational Health and Safety Administration, 2003).

Recognition and assessment prepare the way for control or elimination of a hazard. Where an assessment indicates that a hazard is likely to adversely affect one or more workers, control or elimination, where possible, of the identified hazard is needed (Occupational Health and Safety in Ontario, n.d.). The maintain the health of the workforce it is essential that the different types of stressors

should be controlled or eliminated and in order to control or eliminate the stressors it is necessary firstly to determine the most critical exposures that may lead to death or serious illness. A hazard identification risk assessment (HIRA) is more useful since each hazard has specific risks associated with it. After initial identification of the associated risks, these risks are assessed in terms of probability and severity on a high, medium, low scale (Guild, Ehrlich, Johnston and Ross, 2001). The resulting risk rating is used to guide the course of action.

According to Hattingh and Acutt (2003) this HIRA should be conducted during the initial walk-through survey. The nature and effects of hazards can be deduced by identifying environmental factors or stressors, equipment and human errors that could occur within the work environment (Hattingh and Acutt, 2003). After the initial identification of the hazards the risks in connection with each hazard should be identified. The risk assessment is done in order to determine the measures that must be taken to eliminate or reduce the identified risks to an acceptable level. The assessment depends upon the nature of the work and the type and extent of the hazards and risks. An estimation of the incidence and severity of the adverse health effects (risk assessment) likely to occur due to actual or predicted exposure to a workplace hazard can be used to develop strategies to reduce, minimise or eliminate exposure (Hattingh and Acutt, 2003).

The following terms are relevant to a HIRA and should be understood before the commencement of the hazard identification risk assessment:

- A hazard is something with the potential to cause harm and this can include substances or machinery, methods of work and other aspects of work organisation.
- A risk means the likelihood that the harm from a particular hazard is realised.
- Extent of the risk covers the number of people who might be exposed and the consequences for them.
- Risk assessment is an evaluation of the above reflecting the likelihood that harm will occur, its severity and extent, reaching a conclusion on whether and how management of such factors need to be implemented to eliminate or lessen that likelihood (Guild, *et al*., 2001).

The location of the control is often used to describe the principles of hazard control: at the source of the hazard; along the path between the hazard and the worker; or at the worker (Occupational Health and Safety in Ontario, n.d.).

- Control at the source. The best control is the elimination of the hazard. If this is not feasible, the best alternative is substitution of a non-hazardous or less hazardous material or process. Where no acceptable substitute is available, enclosing or isolating the hazard can protect the worker against exposure (Schoeman and Schröder, 1994; Occupational Health and Safety in Ontario, n.d.).
- Control along the path. Some processes and the products resulting from the processes cannot be enclosed or isolated. This includes, for instance, the removal of a hazardous gas or dust with a local ventilation system; alternatively, a general ventilation system can reduce exposure by diluting the concentration of the hazardous substance in the air (Hattingh and Acutt, 2003; Occupational Health and Safety in Ontario, n.d.)
- Control at the worker. Where neither control at the source nor control along the path is effective, control at the worker may be necessary. Control at the worker often consists of special personal protective equipment or clothing that must be worn during the performance of certain work functions. Gloves for hand protection are the most common example. Ear muffs or ear plugs for noise protection and respirators for protection of the worker against airborne hazardous substances (Occupational Health and Safety in Ontario, n.d.) are further examples of protective gear.

There are no specific rules but well formulated guidelines in literature as to how risk assessments should be conducted but it is necessary that a risk assessment be carried out before one proceeds with the work activities. All hazards need to be considered. However, it is only necessary to record the significant findings of an assessment, including any group of employees and others identified as being especially at risk. It is not necessary to catalogue every potential hazard (Curtis, 2001).

According to literature, the individual health and safety hazards and associated risks must be identified before a risk rating can be done (Guild, *et al*., 2001). These health and safety risks are identified with the aid of literature as well as experience and knowledge in the field of occupational health and safety.

The first step in the risk assessment involves identifying the hazards which could reasonably be expected to result in significant harm to employees. Thereafter all the groups of employees and others who might be affected, as well as how they are affected should be determined (Hattingh and Acutt, 2003; Curtis, 2001).

Subsequently, the existing preventative or precautionary measures that are in place against risks should be identified. These may already reduce the risk sufficiently, although further action may be necessary to ensure that they are properly maintained. Following the identification of the hazards, risks, employees who may be affected, how they may be affected and the existing preventative measures, the risks must be rated, for example as high, moderate or low risk (Guild, *et al*., 2001; Curtis, 2001). Different methods of rating exist (Curtis, 2001): one method that is frequently applied establishes a risk rating for each hazard by multiplying a probable frequency rating by a severity rating. The results of the multiplication may then also be multiplied by the working hours of workers since longer work hours increase the risk to the workers (Guild, *et al*., 2001; Curtis, 2001). The process of establishing these individual ratings is thus a matter of judgement and foresight based on occupational health and safety knowledge and experience.

1.1 Problem statement

Worldwide, farm workers are exposed to a variety of different occupational health and safety hazards. These hazards include, for example, dust, fumes, noise, temperature, pesticides, insecticides, ergonomics, trip and slip and vibration (Zhao, 1993; Estill, Baron and Steege, 2002).

A HIRA should be compiled and completed to identify all possible hazards and risks to which farm workers may be exposed. The risks involved in each health and safety hazard are rated in the HIRA.

1.2 Aim of the chapter

The aim of this chapter was to identify the health and safety hazards associated with each crop farming activity in the Mangaung municipal district in order to determine the occupational health and safety hazards and associated risks that farm workers may be exposed to on these crop farms. The health and safety risks will be rated in a HIRA to indicate which risks should receive urgent attention to minimize, reduce or eliminate the exposure of farm workers.

2. MATERIALS AND METHODS

The activities on the crop farms selected in the Mangaung municipal district were observed to identify the health and safety hazards and the associated risks. The observed activities, machinery, health and safety hazards and the associated risks were listed in table form (see Chapter 3, Table 3.1).

After the initial identification of the hazards and risks, a HIRA was compiled and completed. During the risk assessment tables 4.1 and 4.2 were used as guides to determine the risk rating of the exposure to certain stressors to which farm workers may be exposed to during the execution of their normal working activities. The tables used in the risk rating were derived from the Australian Standards AS/NZS4360 and adapted for use in the present study for the farming industry in the Mangaung municipal district. According to the method prescribed by the Australian Standards AS/NZS4360, the risk rating should take the consequence of risks, the likelihood or probability of the risks as well as the work hours into account. The possible consequences of each health and/or safety risk was given a value according to Table 4.1 below, according to the method prescribed by the Australian Standards AS/NZS4360 (SAI Global, 2004).

TABLE 4.1: Possible consequences of each health or safety risk

Level	Descriptor	Example detail description
1	Insignificant	No injuries, low financial loss
2	Minor	First aid treatment, medium financial loss
3	Moderate	Medical treatment required, high financial loss
4	Major	Extensive injuries, loss of production, major financial loss
5	Catastrophic	Death, huge financial loss

The likelihood of each health or safety risk actually occurring was given a value according to Table 4.2 below.

TABLE 4.2: Likelihood of each health or safety risk actually happening

Level	Descriptor	Description
1	Rare	May occur only in exceptional circumstances
2	Unlikely	Could occur at some time
3	Possible	Might occur at some time
4	Likely	Will probably occur in most circumstances
5	Almost certain	Is expected to occur in most circumstances

Subsequently, the number of working hours that farm workers are exposed to each health or safety hazard was taken into account, since the longer they are exposed to a certain hazard the higher the risk involved. The working hours were given a value according to Table 4.3. If a worker works less than one hour, the health or safety risk to the worker is very low. If the workers spend half of the normal working day (8 hours) exposed to a certain health or safety hazard, the risk will be higher but still low. Occupational health and safety standards are normally expressed in maximum exposure over an 8-hour work shift. Thus longer working hours will have lower maximum exposure levels to ensure the health and safety of workers.

TABLE 4.3: Hours that the worker may possibly be exposed to a certain health or safety risk

Level	Description
1	Less than 1 hour of exposure to the specific stress per working day
2	Between 1 and 4 hours of exposure to the specific stress per working day
3	Between 5 and 8 hours of exposure to the specific stress per working day
4	Between 9 and 10 hours of exposure to the specific stress per working day
5	More than 10 hours of exposure to the specific stress per working day

A risk rating was used to prioritise the health and safety risks encountered on crop farms in the Mangaung municipal district. To determine the risk rating individual preference was used, as adapted from the method prescribed by the Occupational Health and Safety Policy Committee's document (Occupational Health and Safety Policy Committee's document, AS4360:1999). The allocated values (Tables 4.1, 4.2 and 4.3) were multiplied to calculate the individual health and safety risk ratings. For example, if the possible consequence of a risk is minor (value of 2) and the likelihood of the same risk is unlikely (value 2), even if the worker is exposed to the risk for long working hours (value 5), then the risk is regarded as low [maximum risk rating of 20 if the values are multiplied (2 X 2 X 5 = 20)]. If the possible consequence of the risk is moderate (value 3) and the likelihood of the risk occurring is possible (value 3) even if working for long hours (value 5), then the risk is regarded as moderate [maximum risk rating value of 45 (3 X 3 X 5 = 45)]. Any risk rating value higher than these values will be regarded as a high risk (any risk rating of above 45). A final risk rating of between 1 and 20 will be regarded as a **LOW** risk, between 21 and 45 as **MODERATE** risk and above 45 as a **HIGH** risk.

3. RESULTS

The health and safety hazards and associated risks during each activity and for the machinery used were identified during each activity. During the preparation of land for example, fertilisers are utilised to replenish the soil. This is done with

the aid of tractors in an outdoor environment (in some instances fertilisers may be added when planting the crops). During the ploughing of land the same types of health and safety hazards and associated risks were identified except that fertilisers are not used. The outdoor environment presents certain hazards while the use of the tractor presents others. Certain features of tractors make them more or less safe, and an example of this would be that a tractor fitted with a roll-over protective structure is safer than one without.

Table 4.4 indicates the different health and safety stresses that are relevant to each activity on crop farms. The table indicates the activity, the machinery used, the health and safety hazards and the risks involved with each health and safety hazard.

TABLE 4.4: The identified health and safety hazards associated with each activity on crop farms

No	Activity	Machinery / implements	No	Hazards	No	Risks	Health or safety risk
1.	Preparation of land	Tractors, disc harrow, fertiliser spreader	1	Outdoor environment	1	Exposure to high temperatures	Health
					2	Exposure to ultraviolet radiation	Health
					3	Inhalation of inorganic dust	Health
			2	Fertilisers	4	Inhalation of ammonium nitrate	Health
					5	Skin contact with fertilisers (contact dermatitis)	Health
					6	Skin burns	Health
			3	Tractors	7	Exposure to excessive noise	Health
					8	Exposure to whole body vibration	Health
					9	Inhalation of exhaust gases	Health
					10	Poor ergonomics	Health and safety
					11	Tractor roll-overs	Safety
					12	Trips and slips	Safety
					13	Caught in or between objects / loss	Safety

						of limbs	
2.	Ploughing of land	Tractors, ploughs	1	Outdoor environment	1	Exposure to high temperatures	Health
					2	Exposure to ultraviolet radiation	Health
					3	Inhalation of inorganic dust	Health
			2	Tractors	4	Exposure to excessive noise	Health
					5	Exposure to whole body vibration	Health
					6	Inhalation of exhaust gases	Health
					7	Poor ergonomics	Health and safety
					8	Tractor roll-overs	Safety
					9	Trips and slips	Safety
					10	Caught in or between objects / loss of limbs	Safety
3.	Planting of crops	Tractors, drill planters	1	Outdoor environment	1	Exposure to high temperatures	Health
					2	Exposure to ultraviolet radiation	Health
					3	Inhalation of inorganic dust	Health
			2	Tractors	4	Exposure to excessive noise	Health
					5	Exposure to whole body vibration	Health
					6	Inhalation of exhaust gases	Health
					7	Poor ergonomics	Health and safety

					8	Tractor roll-overs	Safety
					9	Trips and slips	Safety
					10	Caught in or between objects / loss of limbs	Safety
4.	Application of pesticides	Tractors, sprayers	1	Outdoor environment	1	Exposure to high temperatures	Health
					2	Inhalation of inorganic dust	Health
					3	Exposure to ultraviolet radiation	Health
			2	Tractors	4	Exposure to excessive noise	Health
					5	Exposure to whole body vibration	Health
					6	Inhalation of exhaust gases	Health
					7	Poor ergonomics	Health
					8	Tractor roll-overs	Safety
					9	Trips and slips	Safety
					10	Caught in or between objects/loss of limbs	Safety
			3	Pesticides	10	Inhalation of organophosphates	Health
					11	Ingestion of organophosphates	Health
					12	Skin absorption of organo-phosphates	Health
					13	Contact dermatitis	Health

					14	Skin burns	Health
5.	Harvesting of crops	Harvesters, balers, trucks and trailers	1	Outdoor environment	1	Exposure to high temperatures	Health
					2	Inhalation of inorganic dust	Health
					3	Inhalation of organic dust	Health
					4	Exposure to ultraviolet radiation	Health
			2	Harvesters	5	Exposure to excessive noise	Health
					6	Exposure to whole body vibration	Health
					7	Inhalation of exhaust gases	Health
					8	Poor ergonomics	Health and safety
					9	Roll-overs	Safety
					10	Trips and slips	Safety
					11	Caught in or between objects / loss of limbs	Safety

The health and safety hazards associated with crop farming in the Mangaung municipal district were identified as the outdoor environment, fertilisers, pesticides, tractors and harvesters. The risks associated with these hazards include exposure to variety of stressors: high temperature, ultraviolet radiation, inorganic dust, organic dust, ammonium nitrate, excessive noise, exhaust gases and whole body vibration. Safety risks were also identified, for instance tractor roll-overs, slips and trips and being caught in or between objects.

Table 4.5 shows the risk assessment for crop farm workers in the Mangaung municipal district. The risk assessment includes the risk rating value and risk of each health and safety risk, calculated according to the method described in materials and methods, P.52.

TABLE 4.5: Risk assessment of each health and safety risk and its associated risk rating

No	Hazard	Risk	Consequence					Likelihood					Work hours					Risk value	Risk rating
													<1	1-4	5-8	9-10	>10		
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
1	Outdoor environment	Exposure to high temperatures			X					X						X		36	M
		Exposure to ultraviolet radiation			X					X						X		36	M
		Inhalation of inorganic dust			X						X					X		48	H
		Inhalation of organic dust			X						X					X		48	H
2	Fertilisers	Inhalation of ammonium nitrate				X					X					X		64	H
		Skin contact with fertilisers (contact dermatitis)			X					X						X		36	M
		Skin burns		X						X						X		24	M

3	Tractors	Exposure to excessive noise				X					X					X		64	H
		Exposure to whole body vibration			X						X					X		48	H
		Inhalation of exhaust gases			X						X					X		48	H
		Poor ergonomic design (musculo-skeletal disorders)			X					X						X		36	M
		Roll-overs					X			X						X		60	H
		Trips and slips			X					X						X		36	M
		Caught in or between objects / loss of limbs				X				X						X		48	H
4	Pesticides	Inhalation of				X				X						X		48	H

		organophos-phates																	
		Ingestion of organophos-phates				**X**				**X**							**X**		**48**	**H**
		Skin absorption of organophos-phates				**X**				**X**							**X**		**48**	**H**
		Contact dermatitis			**X**					**X**							**X**		**36**	**M**
		Skin burns	**X**							**X**							**X**		**12**	**L**
5	Harvesters	Exposure to excessive noise				**X**					**X**						**X**		**64**	**H**
		Exposure to whole body vibration			**X**						**X**						**X**		**48**	**H**
		Inhalation of exhaust gases			**X**						**X**						**X**		**48**	**H**
		Poor ergonomic			**X**					**X**							**X**		**36**	**M**

		design (musculo-skeletal disorders)																
		Roll-overs				X			X						X		60	H
		Trips and slips			X				X						X		36	M
		Caught in or between objects / loss of limbs				X			X						X		48	H

Low risk (risk rating value of 1 – 20)

Moderate risk (risk rating value of 21 – 45)

High risk (risk rating value of > 45)

According to the completed risk assessment of each health and safety risk and its associated risk rating (Table 4.5), low, moderate and high risks were identified on crop farms in the Mangaung municipal district. The only low risk identified was skin burns from skin contact with fertilisers. There were seven moderate risks identified, for example exposure to high temperatures and ultraviolet radiation. Inhalation of inorganic dust, organic dust, organophosphates and ammonium nitrate were among the eleven identified high risks.

4. DISCUSSION

The different types of activities on crop farms in the Mangaung municipal district include the preparation of land, the ploughing of land, the planting of crops, the application of pesticides and the harvesting of crops (see Chapter 3, Table 3.1). These activities are associated with certain hazards and each of these hazards has its own health and safety risks. As previously mentioned, the activities relating to crop farming in this region are done in the outdoor environment. This exposes the farm workers not only to work-related hazards but also to environmental hazards, and additional hazards may be present depending on the type of material and machinery used in the activities.

The HIRA (Table 4.5) indicates the risk ratings of health and safety risks to which crop farm workers in the Mangaung municipal district were exposed to. The risk rating included low, moderate and high risks.

5.1 High health and safety risks of farm workers

The risks that were categorised as “high” risks should receive first priority when dealing with the minimisation, reduction or elimination of occupational exposures of farm workers. Eleven factors were identified as high risk factors to which farm workers are exposed during the normal execution of their farming activities:

- Inhalation of inorganic dust
- Inhalation of organic dust
- Inhalation of ammonium nitrate
- Exposure to excessive noise

- Exposure to whole body vibration
- Inhalation of exhaust gases
- Tractor roll-overs
- Caught in or between objects
- Inhalation of organophosphates
- Ingestion of organophosphates
- Skin absorption of organophosphates

A discussion of the health and safety effects of the above-mentioned identified risks follows. Some of the health and safety risks are discussed in conjunction with others, since the health effects resulting from exposure are similar in some cases.

5.1.1 Inhalation of inorganic and organic dust

Harrison's (2002) preliminary data suggests that workers in agricultural crop production comprise the major group with occupational respiratory diseases in terms of magnitude of respiratory disease (Harrison, 2002). The agricultural activities on crop farms expose farm workers to environmental dust. High personal dust exposure levels were measured in Sweden by Nieuwenhuijsen and Schenker during most operations on farms, and in particular during ground preparation operations (Nieuwenhuijsen and Schenker, 1998). According to Kundiev and Chernyuk (2001) the dust concentration in tractor cabs can vary from a few mg/m^3 to hundreds of mg/m^3, depending essentially on the cab enclosure. Approximately 60 to 65% of cases measured by Kundiev and Chernyuk (2001) exceeded the permissible total dust concentration of $10mg/m^3$ and the permissible respirable dust concentration ($5mg/m^3$) is exceeded 60 to 80% of the time.

Dust deposition is to a large degree dependent on the concentration and the physical nature of the specific dust particles in the air (DiNardi, 1997). Depending on the intrinsic chemical and physical nature of the inhaled particles and also the chemicals absorbed onto the dust surfaces, the biological response of the human body may be non-injurious, slight, serious or even fatal. The deposition of dust on the mucociliary apparatus normally stimulates a flow of mucus. If the

production of mucus is excessive or if it is not removed adequately, it can accumulate in the airways, thus reducing the lumen of the conducting tubes and elevating the resistance airflow (Clayton and Clayton, 1978). This is a reversible reaction following the inhalation of high concentrations of dust. In most people the reaction requires high concentrations of dust and it is not recognised to occur commonly. In hyper-reactive people, however, lower concentrations of dust may evoke a recognisable response. Furthermore, prolonged stimulation of the mucus-secreting glands and cells can lead to hypertrophy or enlargement of these structures (Clayton and Clayton, 1978). The inhalation of dust may also increase the incidence of Tuberculosis.

Inorganic dusts are primarily an issue in field activities associated with ploughing, tilling, hay-making and harvesting. Inorganic dust refers to dust from the environment. Those individuals with underlying chronic obstructive pulmonary diseases, including asthma and chronic bronchitis, may experience aggravation of the underlying condition. Persistent and repetitive exposure to high levels of inorganic dust could lead to restrictive lung disease (Kirkhorn, 2000).

Organic dust comes from hay, grain, fuel chips, straw and livestock. Organic dust includes moulds, pollens, bacteria, pesticides, chemicals, feed and bedding particles, as well as animal particles including hair, feathers, and droppings. Long-term exposure to organic dust can lead to congestion, coughing or wheezing, sensitivity to dust and frequent infections, such as colds, bronchitis and pneumonia. Over time, exposure to organic dust can result in serious respiratory illnesses, such as organic dust toxic syndrome (ODTS) and farmer's lung (United States Department of Labor, n.d.). It was reported in 1990 by the United States Department of Labor that approximately one in 10 people working in agriculture will have an episode of ODTS, a temporary flu-like illness (United States Department of Labor, n.d.). Repeated exposure to organic dust can cause Farmer's Lung, an allergic disease caused by mould spores which the body's immune system cannot counteract and which may cause lung damage and result in death (United States Department of Labour, n.d.).

5.1.2 Inhalation of ammonium nitrate

Fertilizers are materials that are introduced to the soil to obtain plentiful and stable harvest crops. Ammonium nitrate dust which is absorbed through inhalation is irritating to the respiratory tract and may lower the blood pressure. Exposure to ammonium nitrate fertilisers may cause skin, eye, mouth and nose burns and death by suffocation (Myers, 2001).

5.1.3 Exposure to excessive noise

Farming is a noisy industry: a large number of activities involve exposure to noise levels which can cause permanent hearing loss. The degree of hearing loss depends on the length of time one is exposed to the noise and the intensity of the noise. Noise levels greater than 85dB(A) averaged over an 8-hour period, places the human ear at risk of hearing loss (Australian Centre for Agricultural Health and Safety, 2003).

Sounds enter the ear and travel to the cochlea where about 30 000 tiny hair cells receive and transmit the sounds to the brain where it is interpreted. Exposure to excessive noise results in destruction of these hair cells. The damage is painless and often not noticed until a significant number of these hair cells have been destroyed. The degree of hearing loss depends on the exposure time to noise and the noise intensity (loudness). Noise levels greater than an average of 85dB(A) over an 8-hour period may cause hearing loss. The noise initially destroys the hair cells which distinguish the soft sounds of speech, such as t, f, v, s, sh, ch and p (Schoeman and Schröder, 1994). This results in a person being able to hear, but not always able to understand what is being said. In the presence of background noise, hearing and understanding becomes difficult. Tinnitus (ringing in the ears) can also be caused by exposure to loud noise. Tinnitus can be tolerated by some people, but can be quite annoying to others (Australian Centre for Agricultural Health and Safety, 2003).

According to the Australian Centre for Agricultural Health and Safety (2003), the average noise levels emitted from harvesters range from 75 to 91dB(A). Tractors without cabins emit noise levels of 90 to 93dB(A) and with cabins 75 to 78dB(A).

The noise levels emitted depend on the age of the machinery, since wear and tear in older machinery increases the noise level (Australian Centre for Agricultural Health and Safety, 2003). Since the dB-scale is a logarithmic curve, every increase of 3dB doubles the exposure level, i.e. if farm workers are exposed to 88dB(A), it is regarded as double the permissible noise level.

5.1.4 Exposure to whole body vibration

Whole body vibration energy enters the body through a seat or the floor. This type of vibration may affect the entire body or a number of organs in the body. When a worker sits or stands on a vibrating floor or seat, the exposure affects almost the entire body and is called whole body vibration exposure. Drivers of some mobile machines, including certain tractors, may be exposed to whole body vibration which is associated with lower back pain and increased tiredness (Joubert, 2001). Farm workers operate the machinery for example, tractors and harvesters, while sitting in a seat on the vehicle. The worker is thus exposed to whole body vibration. Whole body vibration as well as localised vibration is prevalent in farming activities. Technology which reduces whole body vibration is available on newer equipment (Occupational Health and Safety Administration, 2003): seats on newer equipment are specifically designed to reduce vibration, being made of vibration-absorbing material and mounted on springs. New equipment will have new shock absorbers that will also reduce whole body vibration of the operator (European Agency for Safety and Health at Work, 2004).

5.1.5 Inhalation of exhaust gases

Farmers may be exposed to several different substances that can cause acute pulmonary responses. Carbon monoxide (CO), generated by combustion sources including internal combustion engines, can cause the death of agricultural workers if they are exposed to high concentrations (Myers, 2001).

5.1.6 Tractor roll-overs

Farm vehicles account for approximately half of the fatal injuries on farms in the United States of America and the majority of these deaths are attributable to tractors (Western Center for Agricultural Health and Safety, 2004). Tractor-related accidents constitute the leading cause of agricultural deaths in the United States of America. Approximately 250 people die each year in overturns, run-overs, entanglements and highway collisions (Schenker, 2004). According to Schenker (2004) it is disturbing that tractor roll-overs consistently account for more than half of fatalities on farms in light of the fact that simple and effective means to prevent deaths from tractor roll-overs are readily available.

Evidence from Europe, specifically Sweden, shows that when tractor roll-over protective structures (ROPS) are mandated, deaths and serious injuries from roll-overs can be sharply reduced or even eliminated (Schenker, 2004). An example of the dramatic impact of ROPS on tractor-related fatality rates may be seen in Sweden, where annual fatality rates decreased from more than 15 to 0 per 100 000 tractors during the 30-year period in which mandatory ROPS were implemented. Attainment of the zero-fatality target coincided with enactment of the requirement for all tractors to be equipped with ROPS (Schenker, 2004).

5.1.8 Caught in or between objects

If a farm worker moves a tractor when someone is between the tractor and the equipment connected to it, the person may be caught in or between objects which can cause serious bodily harm to the individual. This safety hazard could easily be minimised if farm workers were educated and trained in safely dealing with machinery and equipment. For example, if farm workers know that they are not to wear items that could become entangled in moving machine parts, such as jewellery, drawstrings, ties or loose clothing, the safety risk is decreased (United States Department of Labor, n.d.).

5.1.9 Inhalation, ingestion and skin absorption of organophosphates

Pesticides are designed to be toxic to kill or harm weeds, insects and organisms that cause disease in plants and trees, but it can cause both acute and chronic health effects in human beings. These health effects include skin rashes, systemic poisoning, cancer, birth defects, infertility, damage to the brain and nervous system, and it can exacerbate conditions such as asthma, allergies and chemical sensitivities (Katten, 2004).

Poisoning due to pesticides is a notifiable condition in South Africa (South Africa, 2003) and between 100 and 150 cases are reported per year, with a case fatality rate in the order of 10% (London, 1995). Investigators know that these figures are a substantial underestimate of the true rates, because incidents often go unreported. Some workers fail to report for fear of loosing their jobs (London, 1995; Katten, 2004). Apart from acute morbidity, chronic effects of low-dose long term exposures to organic pesticides are attracting increasing concern. This is particularly important in South Africa for a number of reasons. Potential exposures are widespread and may be environmental in origin. Current agrochemical registration procedures rely almost exclusively on data of acute toxicity and toxicity grading is based on LD_{50}s, measures which do not take long term toxicity into account. Farm workers are particularly vulnerable to long term health effects, given their poor living and working conditions (London, 1995).

The skin is the most exposed organ while spraying pesticides on fields. If farm workers are unprotected during spraying of pesticides it may result in skin contact, especially on the hands and face, leading to hand dermatitis, pigmentation and thickening of the skin on hands and fungal infections of the skin (Rathinam, Kota and Thiyagar, 2005). Rathinam, Kota and Thiyagar (2005) stated that farmers are most sensitive to fungicides such as captofol, folpet and captan. According to these authors, farmers exposed to arsenic pesticides are at risk of skin cancer, multiple cell carcinomas and squamous cell carcinoma.

From 1997 to 2000, the California Environmental Protection Agency's Department of Pesticide Regulation reported 1899 cases of occupational poisoning by agricultural pesticides, an average of 475 cases per year. Many

workers in the United States of America are not provided with adequate pesticide hazard training to enable them to recognise symptoms of poisoning; therefore they are unaware that it is job-related (Katten, 2004).

5.2 Moderate health and safety risks of farm workers

The seven risks that were categorised as “moderate” risks for farm workers in the Mangaung municipal district should receive second priority when dealing with the reduction or elimination of occupational exposures of farm workers. These “moderate risks” include the following:

- Exposure to high temperatures
- Exposure to ultraviolet radiation
- Skin contact with fertilisers
- Skin burns from fertilisers
- Poor ergonomic design
- Trips and slips
- Contact dermatitis

An understanding of the health effects related to these identified health and safety risks may help in the reduction or elimination of exposure.

5.2.1 Exposure to high temperatures

Heat stress is the build-up in the body of heat generated by the muscles during work and of heat radiated from warm and hot environments (Rosenberg, 2006). The term heat illness is used to describe the failure of the human body to adjust to heat stress (Hattingh and Acutt, 2003). Various heat illnesses may develop as a result of excessive exposure to heat. These illnesses range from serious heat rash to heat collapse (Schoeman and Schröder, 1994).

Heat exhaustion and heat stroke result when the body is subjected to more heat than it can cope with (Rosenberg, 2006). When the body becomes overheated, less blood goes to the active muscles, the brain and other internal organs. During hot weather, heat illness may be an underlying cause of other types of

injuries, such as heart attacks on the job, falls and equipment accidents arising from poor judgment (Rosenberg, 2006). Heat stress causes increased sweating, depleting the body's fluid and causing heat intolerance. This reduces work capacity and efficiency and may increase the risk of accidents (Rosenberg, 2006). Workers get weaker, become tired sooner and may be less alert, less able to use good judgment and less able to do their jobs well (Rosenberg, 2006).

As strain from heat becomes more severe, there is a rapid rise in body temperature and heart rate. Workers may not realise that this is happening because there is no pain. The most serious illness is heat stroke. Its effects can include confusion, irrational behaviour, convulsions, coma and even death. Survivors from heat stroke may be very sensitive to heat for months afterwards and heat stroke may cause varying degrees of brain and kidney damage. More than 20% of people afflicted by heat stroke die, even young and healthy adults (Rosenberg, 2006).

5.2.2 Exposure to ultraviolet radiation

Skin cancer is the most common form of cancer. People with fair skin, blue eyes and red or blond hair are most likely to develop skin cancer. Skin cancers occur most frequently (90% of all cases) on parts of the body not usually covered by clothing (Bradley, 2002). There are three major types of skin cancer: basal cell carcinoma, squamous cell carcinoma, and malignant melanoma. Basal cell carcinoma is the most common form. It rarely spreads, but if left untreated, can spread to underlying tissues and destroy them. It usually occurs as a small, shiny, pearly nodule that may ulcerate and crust. Squamous cell carcinoma, although rarely life-threatening, is more dangerous than basal cell carcinoma because it spreads more rapidly. It may begin as a nodule or as a red, scaly, sharply outlined patch. Malignant melanoma is the least common, but most deadly, type of skin cancer. It starts as a small, mole-like growth that increases in size and forms irregular borders. It may change colour, ulcerate, or bleed from a slight injury. Melanoma is completely curable in its early stages, but if left untreated, spreads rapidly through the lymph system (Bradley, 2002).

Skin cancer is a concern on the farm because of the long hours farmers spend in the sun (Bernhardt and Langley, 1993). Of particular concern for farmers is the area at the back of the neck (Bradley, 2002).

5.2.3 Skin contact and skin burns from fertilisers and contact dermatitis

Skin contact with fertilisers may cause contact dermatitis. There are two general categories: irritant and allergic. Irritants act directly on the skin at the place of contact. Allergic sensitizers, however, cause changes in the immune system so that subsequent contact produces a reaction. Phototoxic or photo allergic reactions occur when light, in combination with certain substances, causes skin disease. Other types of agricultural dermatitis include heat rash, origin infections, and insect and plant irritants (United States Department of Labor, n.d.; College of Agricultural Sciences, n.d.).

A number of factors predispose an individual to dermatitis, such as age, sex, race, temperature and humidity, previous skin disorders, skin damage and personal hygiene. Work-related skin diseases are often easy to detect, but difficult to diagnose (Bradley, 2002). Contact dermatitis is a skin disorder that occurs among agricultural workers (United States Department of Labor, n.d.; College of Agricultural Sciences, n.d.).

5.2.4 Poor ergonomic design

Many characteristics of farm work are typical of ergonomic factors associated with an increased risk for musculoskeletal trauma and degenerative disorders. Poor ergonomic design is associated with increased traumatic injury in agriculture (Western Center for Agricultural Health and Safety, 2004). The National Health Interview Survey of California found an increased prevalence of arthritis among male farmers compared to other currently employed males (Western Center for Agricultural Health and Safety, 2004).

Improved human-tractor interface designs, such as well-accommodated operator enclosures (i.e. cabs and protection frames) can enhance operator productivity,

comfort and safety (Hsiao, Whitestone, Bradtmiller, Zweiner, Lafferty, Kau and Gross, 2005).

5.2.5 Trips, slips and caught in or between objects

Falls are the most common accident in agriculture (United States Department of Labor, n.d.). Falls often result in serious injuries or death. Many falls occur because of slips and trips and can be avoided by wearing proper shoes and following safe work procedures. Dust debris and mud on steps of machinery may cause falls (United States Department of Labor, n.d.).

5.3 Low health and safety risks of farm workers

The only identified “low” risk in crop farming was skin burns resulting from exposure to organophosphates.

Skin is the most exposed organ during the application of pesticides on fields. Without the proper protection, spraying of pesticides may result in frequent skin contact, especially on the hands and face, leading to hand dermatitis, pigmentation and thickening of the skin on hands and fungal infection of skin. Farmers exposed to arsenic pesticides are at risk of skin cancer, multiple cell carcinomas and squamous cell carcinoma (Rathinam, Kota and Thiyagar, 2005).

5. CONCLUSIONS

The results of the study indicate that crop farm workers in the Mangaung municipal district are exposed to a variety of health and safety hazards in their work environment. Each of the identified health and safety hazards has associated health and safety risks.

The identified health and safety risks expose the farm worker to a variety of environmental stressors. These include extreme temperatures, ultraviolet radiation and inorganic dust. Depending on the type of activity, the machinery

used, the working hours and whether additional chemicals are involved, the risks change with each activity.

Fertilisers and pesticides are of special importance since the farm worker is not only exposed to the environmental stressors but also to added hazards from inhalation, absorption through the skin or skin contact and ingestion of these chemicals.

An overall occupational health and safety programme as well as sub-programmes for the minimisation, reduction or elimination of each identified health and safety risk on crop farms were designed in Chapter 5

6. REFERENCES

Australian Centre for Agricultural Health and Safety. 2003. Rural Noise Injury Fact sheet. Australia. Retrieved on October 16, 2004, from www.farmsafe.org.au/mfs.htm

Bradley, K.R. 2002. Health hazards in agriculture - an emerging issue. Retrieved on January 21, 2005, from http://www.cdc/gov/nasd/docs/d001001-d001100/d001050/d001050.html

Bernhardt, J., Langley, R. 1993. Agricultural hazards in North Carolina. *North Carolina Medical Journal*. 54:512-515.

Clayton, G.D., Clayton, F.E. 1978. Patty's industrial hygiene and toxicology. Third revised edition. Volume 1. New York: John Wiley and Sons. 165, 175.

College of Agricultural Sciences. n.d. Health hazards in agriculture. Oregon State University. Retrieved on January 21, 2005, from http://agsci.oregonstate.edu/research/FST_manual/3-3.htm

Curtis. 2001. Risk assessment code of practice. Sydney Australia. Retrieved on May 3, 2005, from www.workcover.nsw.gov.au/NR/rdonlyres/EBAEAF8D-8F25-47F5-9CDE-F65FE7B1D712/0/cop_riskassessment_963.pdf

Department of Consumer and Business Services. n.d. Personal protective equipment. Oregon. Retrieved on March 24, 2005, from http://www.cbs.state.or.us/external/osha/educate/training/pages/203xm1.html

Dinardi, S.R. 1997. The industrial environment – its evaluation and control. Fairfax Virginia: American Industrial Hygiene Association. 404.

Estill, C.F., Baron, S., Steege, A.L. 2002. Research and dissemination needs for ergonomics in agriculture. *Public Health.* 117(5): 440-445.

European Agency for Safety and Health at Work. 2004. Safety and health for small and medium sized enterprises. Retrieved on May 30, 2005, from http://sme.osha.eu.int/publications/fs2002/2003/en/index_9.htm

Guild, R., Ehrlich, R.I., Johnston, J.R., Ross, M.H. 2001. *Handbook of Occupational Health Practice in the South African Mining Industry*. The Safety in Mines Research Advisory Committee.

Joubert, D. 2001. Hand - arm and whole body vibration. Australia: Queensland University. Retrieved on May 3, 2005, from http://www.scientifics.com/ Downloads/Vibration.pdf

Harrison, R.J. 2002. Agricultural surveillance of respiratory disease. *Agricultural Health News*. 4:3-4.

Hattingh, S., Acutt, J. 2003. Occupational health management and practice for health practitioners. South Africa: Juta & Co Ltd. 88-90, 198.

Hsiao, H., Whitestone, J., Bradtmiller, B., Zweiner, J., Lafferty, C., Kau, T.Y., Gross, M. 2005. Anthropometric criteria for the design of tractor cabs and protection frames. *Ergonomics*. 48(4):323-353

Katten, A. 2004. Industrial hygienist aims to protect farm workers. *Agricultural Health News*. 7:5-7.

Kirkhorn, S.R. 2000. A primer for Wisconsin practitioners and health/safety professionals. Partners in agricultural health. Agricultural respiratory hazards and disease. Minnesota: University of Minnesota.

Kundiev, Y., Chernyuk, V.I. 2001. Planting and growing operations. *Encyclopedia of Occupational Health and Safety*. United States International Labour Organisation.

London, L. 1995. The health hazards of organophosphate use in South Africa. Pesticides News. (27):6-7. Retrieved on February 14, 2005, from http://www.pan-uk.org/pestnews/pn27/pn27p6.htm

Myers, L.M. 2001. Health problems and disease patterns in agriculture. *Encyclopaedia of Occupational Health and Safety*. Retrieved on February 14, 2005, from turva.me.tut.fi/iloagri/natu/fh_main.htm

Nieuwenhuijsen, M.J., Schenker, M.B. 1998. Determinants of personal dust exposure during field crop operations in California agriculture. *American Industrial Hygiene Association Journal*. 59(1):9-13.

Nonprofit Risk Management Center. 2005. Workplace toolkit. Washington, DC. Retrieved on March 16, 2005, from http://www.nonprofitrisk.org/ws-ps/topics/PPE/dress-ps.htm

NPS Risk Management Division. 2005. Personal protective equipment. Washington, DC. Retrieved on March 16, 2005, from http://www.nps.gov/training/tel/Guides/ppe_pguide

Occupational Health and Safety Administration. 2003. Agricultural hazards. Retrieved on February 14, 2005, from http://www.osha.gov/Publications/osha3151.pdf

Occupational Health and Safety in Ontario. n.d. Health and safety hazards. Retrieved on April 25, 2003, from http://www.worksafesask.ca/files/ont_wsib/certmanual/ch_01.html

Rathinam, X., Kota, R., Thiyagar, N. 2005. Farmers and formulations - rural health perspective. *Medical Journal of Malaysia*. 60(1). Retrieved on February 14, 2005, from http://www.mma.org.my/info/6_rural_05.htm

Rosenberg, H. 2006. Department of Agriculture and Resource Economics. Retrieved on March 24, 2006, from are.berkeley.edu/heat

SAI Global. 2004. Risk Management. Australia Standards. Australia. Retrieved on February 14, 2005, from www.riskman.unsw.edu.au/ohs/RISK%20RATING%20SYSTEM%20V4.pdf

Schenker, M. 2004. Challenges in agricultural health and safety. *Agricultural Health News.* 3:2-5.

Schoeman, J.J., Schröder, H.H.E. 1994. Occupational hygiene. South Africa: Juta & Co, Ltd. 141.

South Africa. 2003. National health act. Pretoria: State Press. Pretoria: Government Printer.

United States Department of Labor. n.d. Occupational Safety and Health Administration (OSHA). Retrieved on January 21, 2005, from www.osha.gov/SLTC/youth/agriculture/

Western Center for Agricultural Health and Safety. 2004. California is the leading agricultural state. Department of Epidemiology and Preventive Medicine

University of California. Retrieved on July 30, 2005, from http://agcenter.ucdavis.edu/

Zhao, W. 1993. Preventing cold-related illnesses in agricultural workers. Rutgers Cooperative Extension. New Jersey, New Brunswick: Rutgers, the State University of New Jersey, Publication.

CHAPTER 5

AN OCCUPATIONAL HEALTH AND SAFETY PROGRAMME FOR CROP FARM WORKERS IN THE MANGAUNG MUNICIPAL DISTRICT, FREE STATE

1. INTRODUCTION

An occupational health and safety programme were specifically designed for implementation on crop farms in the Mangaung municipal district, Free State.

1.1 AN OCCUPATIONAL HEALTH AND SAFETY PROGRAMME

The definition of occupational health and safety is “the science and art devoted to the anticipation, identification, evaluation and control of those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and well-being or significant discomfort and inefficiency among workers or among the citizens of a community” (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994). It may be deduced from this definition that the basic principles included in an occupational health and safety programme are the anticipation, identification, evaluation and control of hazards in the workplace.

In a well-structured occupational health and safety programme all of the above-mentioned aspects must be included. The programme should also give an indication of how often and when inspection must be done.

1.1.1 Identification of health and safety hazards in the work environment

The anticipation of health and safety hazards in the work environment is normally done during the planning stage of a new industry. Health and safety hazards can also be anticipated if it is not possible to inspect all different processes in an industry or if a process is not fully operational.

The identification of health and safety hazards in the work environment involves the knowledge and understanding of the adverse effects that the hazards may cause. The identification process normally relies on some type of observation (Guild, Ehrlich, Johnston and Ross, 2001). It is recommended that a walk-through survey or an inspection of the work environment should be conducted initially by an occupational hygienist to recognise possible health and safety hazards (Hattingh and Acutt, 2003). Thereafter, regular inspections of the work environment should form an important part of the overall occupational health and safety programme (Miles, 1997). These inspections, according to Miles (1997), should include the entire workplace, even work areas where no work is done regularly.

During the workplace inspection a hazard identification risk assessment (HIRA) must be done to identify and prioritise health and safety risks. A HIRA is necessary before the evaluation phase of an occupational health and safety programme can commence, since the health and safety risks are identified and prioritised in the HIRA and will therefore indicate the order in which attention must be given to each identified health and safety risk. This order of importance is then used during the evaluation phase (Guild *et al.*, 2001).

1.1.2 Evaluation of health and safety hazards in the work environment

Evaluation of the occupational environment requires that the evaluator possess the necessary background knowledge of applicable occupational diseases, effects of exposure, sampling procedures and threshold limit values (TLVs) (Plog, 1988). Thus according to the Occupational Health and Safety Act (South Africa, 1993), an approved inspection authority (AIA) should execute these evaluations. During the evaluation of health and safety hazards the extent of exposure, the number of exposed employees and the effectiveness of possible control measures should be taken into account when analysing the collected data (Hattingh and Acutt, 2003). Sampling of occupational exposure includes both environmental and personal sampling.

Environmental sampling is normally conducted to evaluate a specific work area. This establishes the exposure level of all employees in the specific work area. Personal sampling is used to evaluate an individual's exposure to certain environmental stressors, whether the employee works in one or more areas (Plog, 1988; Schoeman and Schröder, 1994).

Evaluation of hazards should be done in accordance with the relevant legislation which prescribes sampling procedures (South Africa, 1993). According to the applicable legislation (Occupational Health and Safety Act (South Africa, 1993)) as well as all the relevant Regulations promulgated under this Act), standard procedures must be used during the evaluation of hazards to establish the actual exposure of employees.

1.1.3 Control measures to eliminate or reduce health and safety hazards in the work environment

Occupational health and safety control measures used in industry include, in order of importance, engineering control measures, administrative control measures and the use of personal protective equipment (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994).

Engineering control measures reduce or eliminate a hazard either by the initial design of equipment or by the processes of substitution, isolation or ventilation (Plog, 1988). For example, highly toxic substances can be replaced by less toxic substances, or by isolation of the worker, or a process that will reduce exposure. In addition, ventilation can be used to dilute certain air contaminants (Hattingh and Acutt, 2003).

Administrative control measures reduce the time that the worker is exposed to a certain hazard (Plog, 1988). Rotation of workers as an example of an administrative control measure will reduce the hours spent in a certain area and

thus reduce the exposure time. Education and training of workers in addition to the above-mentioned is also often used in industry as part of administrative control measures (Plog, 1988).

Personal protective equipment (PPE) is used as a last resort if engineering and administrative control measures do not reduce the hazard successfully (Plog, 1988). Examples of PPE include gloves, foot protection, eye protection, hearing protective devices, hard hats, respirators and protective clothing (Occupational Health and Safety Administration, 2003). PPE is available in different sizes and therefore employers should consider comfort and fit when selecting the appropriate PPE. It is important to ensure that when different items of PPE are worn together, that they are compatible (Occupational Health and Safety Administration, 2003). Furthermore, education and training of employees in the use, maintenance and necessity of PPE is essential in the reduction of exposure.

2. PROBLEM STATEMENT

During the execution of their work, farm workers are exposed to different occupational health and safety hazards, including dust, fumes, noise, temperature, pesticides, insecticides, ergonomics and trips and slips (Zhao, 1993; Estill, Baron and Steege, 2002), amongst other things.

In the United States of America, Clayton and Clayton suggested in 1978 that occupational health and safety, as it is practised in industry, should be adapted to differences encountered in the agricultural work environment (Clayton and Clayton, 1978). The differences between normal industry and the agricultural work environment include the fact that farm workers often work long hours with few breaks, and they often work alone in all weather conditions (Zenz, 1994).

Occupational health and safety exposures of South African farm workers have not been studied extensively. Although some studies have been done on pesticide exposure, occupational health and safety exposures have not been

researched as a whole (Arcury, Quandt, Russell, 2002; Engel, 1998). There is a need in South Africa for an adapted and applicable occupational health and safety programme to protect farm workers from all health and safety risks inherent to this specific work environment.

3. AIM AND OBJECTIVES OF THE CHAPTER

The aim of this part of the study was to compile an applicable occupational health and safety programme based on the information gathered as part of identification (see Chapter 3) and the HIRA (see Chapter 4) for crop farm workers in the Mangaung municipal district of Southern Africa. The objectives included the following aspects:

- the development of an overall occupational health and safety programme for crop farm workers in the Manguang municipal district, Free State; and
- the development of an individual sub-programme for each of the identified health and safety risks of crop farm workers in the Mangaung municipal district, Free State.

4. AN OCCUPATIONAL HEALTH AND SAFETY PROGRAMME FOR CROP FARM WORKERS IN THE MANGAUNG MUNICIPAL DISTRICT, FREE STATE

Health has been acknowledged as one of the most critical elements related to quality of life; it is thus vital to protect the health of farm workers. The protection of farm workers' health will also enhance their quality of life (College of Agricultural Sciences, n.d.).

To achieve the above-mentioned, an occupational health and safety programme should ideally be designed and executed to protect farm workers in their occupational environment. This programme must be applicable to the circumstances and to the specific health and safety risks inherent in the agricultural work environment. The basic elements that should be included in this programme are the same as those for programmes in other industries, although the elements must be applicable to the agricultural work environment. A basic

occupational health and safety programme includes the principles of anticipation, identification, evaluation and control to achieve a healthier environment for the workforce (Schoeman and Schröder, 1994). Although the above-mentioned principles should form the basis of any occupational health and safety programme, it was necessary to adapt these to suit the uniqueness of the agricultural industry in South Africa.

Figure 5.1 depicts the overall occupational health and safety programme for crop farm workers in the Mangaung municipal district, Free State.

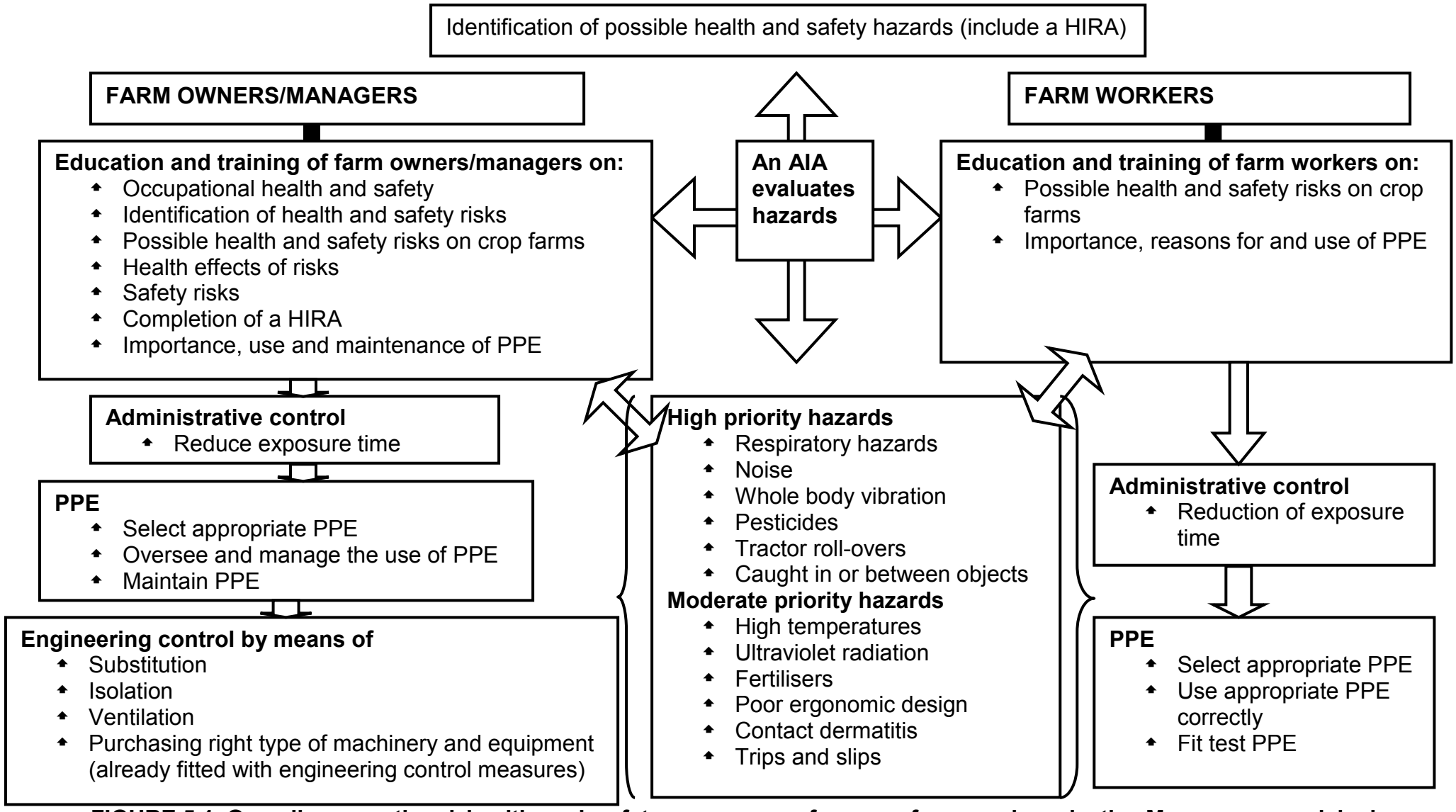


FIGURE 5.1: Overall occupational health and safety programme for crop farm workers in the Mangaung municipal district, Free State

4.1 Identification of activities on crop farms and the hazard identification risk assessment

In order to design an occupational health and safety programme for agricultural workers it is necessary to recognise the problems related to the health and safety of the workers (Schenker, 1995). Hazard recognition means the identifying of potential hazards in the workplace, identifying the adverse effects that may be associated with these hazards and determining whether there is a possibility of people being exposed or affected. Health and safety hazards are not always obvious, however. A comprehensive hazard assessment should include scrutinization of all potential hazards (i.e. both physical and health-related hazards) (United States Department of Labor, n.d) before the development of a programme.

Thus, the first step in developing an occupational health and safety programme was the identification of the various activities on crop farms in the Mangaung municipal district (see Chapter 3). This was necessary as the identification of health and safety hazards is dependant upon the processes and the machinery used in the processes, as well as on an understanding of the environment in which these processes are executed.

Subsequently, a HIRA was compiled and completed to prioritise the identified health and safety hazards and the associated risks of each hazard present on crop farms in this region (see Chapter 4). The priorities (high, moderate and low) given to the different health and safety risks signify the course and order of actions that need to be taken in order to reduce or eliminate the hazards.

In executing the programme the risks that were categorised as “high risks” (Figure 4.1) should receive first priority when dealing with the reduction or elimination of occupational exposures of farm workers (Guild, Ehrlich, Johnston and Ross, 2001). The health hazards rated as “high” included inhalation of inorganic and organic dust, exhaust gases, organophosphates and ammonium nitrate, exposure to excessive noise and whole body vibration and skin

absorption of organophosphates. The safety hazards that were given high priority were tractor roll-overs and being caught in or between objects.

Seven risks were categorised as “moderate”, and these should receive second highest priority when dealing with the elimination or reduction of occupational exposures of farm workers. These risks included the following: exposure to high temperatures, ultraviolet radiation, skin contact and skin burns from fertilisers, poor ergonomic design of equipment, trips and slips of farm workers and contact dermatitis.

The only identified “low” risk in crop farming was skin burns resulting from exposure to organophosphates.

4.2 Evaluation of the health and safety risks on crop farms

According the Occupational Health and Safety Act (South Africa, 1993), the evaluation of health and safety risks must be conducted by an AIA. This also applies to crop farms in the Mangaung municipal district. The sampling procedure should be done according to standard methods prescribed, if available, to ensure reliable and valid results. In the suggested occupational health and safety programme for crop farm workers, deviations from the normal occupational health and safety sampling procedure applied in industry were made to accommodate the uniqueness of farms.

The results from environmental and/or personal sampling should then be evaluated against standards set in relevant South African legislation. This includes the Occupational Health and Safety Act (South Africa, 1993) as well as all relevant Regulations promulgated under this Act. The results from the evaluation are then used in the implementation of the correct control measures to ensure the health and safety of farm workers.

4.3 Control of the health and safety risks on crop farms

In an occupational health and safety programme in industry a certain route is prescribed for the control measures applied in the reduction or elimination of hazards (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994). Engineering control measures must first be applied. If these do not reduce or eliminate hazards sufficiently, then administrative control measures should also be utilised. When both the engineering and administrative control measures still do not sufficiently reduce or eliminate hazards, personal protective equipment is used as a last resort (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994).

The control measures proposed to reduce or eliminate the hazards present on crop farms in the Mangaung municipal district include all types of measures (engineering and administrative control measures as well as personal protective equipment) utilised in industry, yet applicable to this particular work environment. However, the proposed order of control measures differs from that of normal industry, since the agricultural environment is a unique work environment and the financial implications for farm owners must be taken into account (Figure 5.1).

The farm owner or manager may be able to identify the health and safety hazards and risks on their farms and complete an applicable HIRA with the appropriate education and training. The education and training of farm owners and/or managers must also include the basic principles of occupational health and safety, the health effects of exposure to hazards, safety risks and the importance, use and maintenance of PPE. The farm worker also needs education and training on possible health and safety risks in the agricultural environment and on the importance and use of PPE. In a study conducted in 1995, London found that the majority of farm workers in South Africa were illiterate (London, 1995). Therefore, in order to counteract possible illiteracy, it is recommended that education and training of farm workers be done with the aid of sketches, diagrams and/or illustrations. The farm owner and/or manager also needs general knowledge on administrative and engineering control measures.

5. Individual health and safety hazard control sub-programmes

It was recognised that individual health and safety hazard control sub-programmes are essential in the application of an occupational health and safety programme for farm workers in order to establish individual actions that should be taken to apply the general programme successfully.

Some of the health and safety risks identified on farms were grouped together, since the hazard involved and the control measures that need to be applied to reduce or eliminate them are essentially the same. The health and safety hazard control sub-programmes were grouped together as follows and were dealt with separately (Figure 5.1):

- High priority health and safety hazards
    - Respiratory hazards
    - Noise
    - Whole body vibration
    - Pesticides
    - Tractor roll-overs
    - Caught in or between objects
- Moderate priority health and safety hazards
    - High temperatures
    - Ultraviolet radiation
    - Fertilisers
    - Poor ergonomic design
    - Contact dermatitis
    - Trips and slips

The only low priority health and safety risk identified was skin burns from exposure to organophosphates (which is part of the pesticide exposure hazard). Therefore, this was included in the discussion of pesticides.

5.1 Respiratory hazards

5.1.1 Introduction: Respiratory hazards present in the agricultural environment

Farming situations present several respiratory hazards to farm workers. Exposure to these hazards has been linked to excessive coughing and congestion in 20 to 90% of farm workers and families (Bradley, 2002). Agricultural workers are subject to several pulmonary diseases related to exposures at work and an excess of these diseases has been found amongst farm workers in several countries (Bradley, 2002). Many respiratory conditions may initially present as a viral-like syndrome and may be misdiagnosed and treated inappropriately with antibiotics as bacterial sinusitis and bronchitis (Kirkhorn, 2000). The respiratory hazards identified in this study included, among others, inorganic dust, organic dust and exhaust gases.

Inorganic dust exposure

In the agricultural work environment inorganic dust may be emitted by a variety of processes; the loosening of the soil results in the formation of dust for example (Kundiev and Chernyuk, 2001). The nature of the dust in the air varies and depends on meteorological conditions, season, kind of work and type of soil (Kundiev and Chernyuk, 2001). Inorganic dusts are primarily an issue in field activities associated with ploughing, tilling, hay-making and harvesting (Schenker, 1995). Grain handling can also cause high exposure to inorganic dust (Schenker, 1995; Kundiev and Chernyuk, 2001). Silicates, including primarily the noncrystalline diatomite silica and crystalline silica or quartz, make up the bulk of inorganic dust (Nieuwenhuijsen and Schenker, 1998). Inorganic dust is not as significant as organic dust or as toxic as industrial sources of quartz dust (Kirkhorn, 2000).

Persistent and repetitive exposure to high levels of dust could lead to restrictive lung disease. Furthermore, those individuals with underlying chronic obstructive pulmonary disease, including asthma and chronic bronchitis, may experience

aggravation of the underlying disease if they are additionally exposed to dust in the work environment (Kirkhorn, 2000).

Organic dust

There are many hazards associated with the inhalation of organic dust during agricultural operations. Dust is released into the air when hay and straw are handled in the course of harvesting and storage of hay and straw (Swedish National Board of Occupational Safety and Health on Organic Dust in Agriculture, 1994). Extremely high concentrations of dust may occur in the threshing, harvesting and storage of grain. The contents of grain dust include particles from grain, fungi and bacteria, as well as inorganic material (Swedish National Board of Occupational Safety and Health on Organic Dust in Agriculture, 1994).

Long-term exposure to organic dust can lead to congestion, coughing or wheezing, sensitivity to dust and frequent infections, such as colds, bronchitis, and pneumonia. Particles with an aerodynamic diameter of 5 µm or less accompany the inhaled air into the alveoli and may cause inflammatory changes in the lungs (Swedish National Board of Occupational Safety and Health on Organic Dust in Agriculture, 1994). Approximately one in 10 people working in agriculture will have a temporary flu-like illness during the course of their employment (United States Department of Labor, n.d.). Over time, exposure to organic dust can result in serious respiratory illnesses, such as Organic Dust Toxic Syndrome (ODTS) and Farmer's Lung (Swedish National Board of Occupational Safety and Health on Organic Dust in Agriculture, 1994). The allergic disease known as Farmer’s Lung is caused by mould spores which the body's immune system cannot counteract: this may cause lung damage and could even result in death (United States Department of Labor, n.d.).

Symptoms of ODTS include coughing, fever, chills, body aches and pains, shortness of breath and fatigue. These symptoms occur 4 to 12 hours after exposure to high levels of organic dust from mouldy hay, silage or grain and can last up to seven days (United States Department of Labor, n.d.).

Farmer's Lung Disease or Farmer's Hypersensitivity Pneumonitis (FHP) is a form of hypersensitivity pneumonitis or allergic alveolitis that is specific to the sensitization to thermophillic actinomycetes or *Aspergillus* fungal species found in organic dust in agricultural operations. It is an allergic reaction caused by the inhalation of dust from mouldy hay, straw and grain. The most dangerous months for contracting FHP are when mouldy crops are handled indoors, thus the time during storage, after harvesting. In susceptible individuals, repeated exposure damages the lung tissue, which causes shortness of breath and an inability to perform strenuous work (Bradley, 2002).

Exhaust gas exposure:

A variety of disabling gases, including nitrogen dioxide (NO_2), hydrogen sulphide (H_2S), ammonia (NH_3), carbon dioxide (CO_2) and methane (CH_4), are produced during many routine operations on farms. Farm workers may be exposed to several different gases, including nitrogen dioxide (NO_2), hydrogen sulphide (H_2S), ammonia (NH_3), carbon dioxide (CO_2) and methane (CH_4) that can cause acute pulmonary responses. Exposure to low levels of NO_2, H_2S, or NH_3 may produce lung and eye irritations, dizziness, drowsiness and headaches. High levels of H_2S and NO_2 may cause unconsciousness and death may follow. Nitrogen dioxide (NO_2) generated in silos can cause death among silo workers (Bradley, 2002).

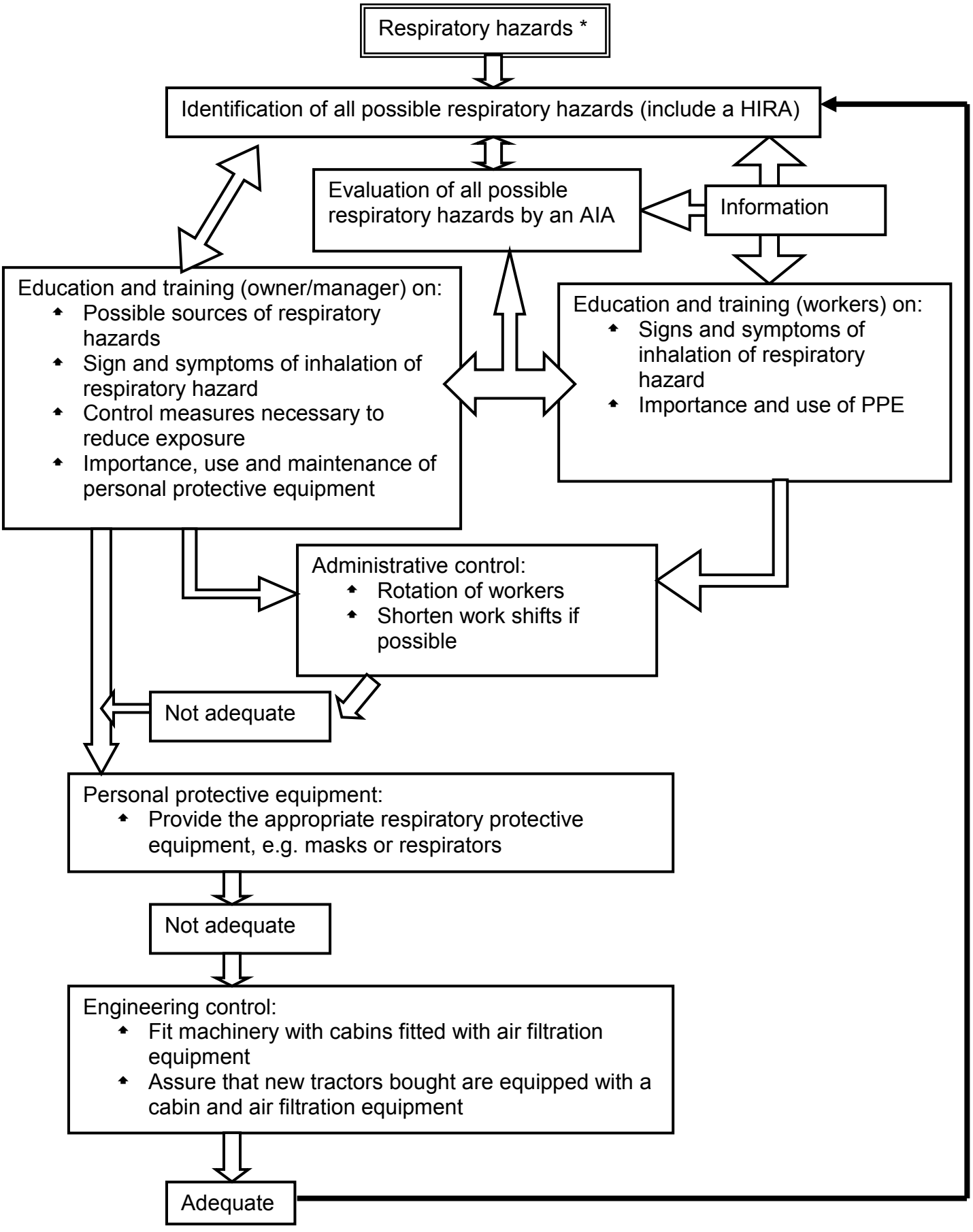
Carbon monoxide (CO) is a toxic odourless and colourless gas that may lead to death by asphyxiation. It is generated by combustion sources such as internal combustion engines. Extremely toxic concentrations can accumulate rapidly in poorly ventilated buildings, as quickly as within 3-5 minutes (Dinardi, 1997). Agricultural exposures can also occur from kerosene heaters and running engines in workshops or barns.

Symptoms of exposure to CO may initially consist of headache, fatigue, difficulty in concentrating and dizziness progressing to chest pain, shortness of breath, visual abnormalities and eventually confusion, weakness and coma at higher levels or prolonged exposure. Loss of consciousness can develop rapidly without

warning signs in environments with high concentrations. Pulmonary oedema and respiratory arrest may occur (Seger and Welch, 2001). Carbon monoxide can cause death of agricultural workers exposed to high concentrations inside buildings (Dinardi, 1997).

5.1.2 Individual respiratory hazard control sub-programme

The suggested individual respiratory hazard control sub-programme (Figure 5.2) proposes procedures that should be followed to minimise the exposure of farm workers. It includes the identification, evaluation and control measures necessary to accomplish the above-mentioned reduction of exposure.



* Inhalation of inorganic dust, organic dust and exhaust gas

FIGURE 5.2: Individual respiratory hazard control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment, PPE - personal protective equipment)

The identification of respiratory hazards and the completion of an applicable HIRA regarding these hazards may be done by the farm owner and/or manager. It is however, essential that they receive adequate education and training to be able to complete a HIRA. They need the appropriate knowledge on applicable occupational diseases as well as the sources of hazards that may increase the likelihood of the development of illnesses to enable them to identify and prioritise the hazards adequately. After the hazards have been prioritised in the HIRA, they should, according to legislation, be monitored or evaluated by an AIA (South Africa, 1993).

The control measures that should be implemented in the agricultural work environment to reduce respiratory hazards entail education and training of both farm owner and/or managers and farm workers. Thereafter, administrative control measures, the use of PPE and engineering control measures (Figure 5.2).

The results from and information on the evaluation must be shared with both the farm owner and/or manager as well as with farm workers. According to the Regulations for Hazardous Chemical Substances promulgated under the Occupational Health and Safety Act (South Africa, 1993; South Africa, 1995), hazardous chemical substances should be monitored at least once every two years. Since farm workers are involved in different types of activities during the normal execution of their tasks it is suggested that an initial evaluation of hazardous chemical substances be conducted at least once a year during each agricultural activity. Control measures should be implemented after the initial evaluation of respiratory hazards to reduce exposure of farm workers. Thereafter the evaluation may be conducted once every two years during the activities identified that could present respiratory hazards as stated in the abovementioned Regulations.

Education and training of farm owners and/or managers is essential to provide them with the appropriate knowledge, skills and ability to identify respiratory hazards. The type of education and training for farm owners and/or manager will differ from that of farm workers. Farm owners and/or managers need education and training in the identification of possible respiratory hazards that may be

present on the farm, the signs and symptoms of inhalation hazards and the control measures necessary to reduce the exposure of farm workers to these respiratory hazards. The farm worker's education and training should be conducted, if possible, with the aid of sketches, diagrams and/or illustrations to demonstrate the signs and symptoms of inhalation of respiratory hazards. They should also receive education and training in the importance and use of PPE.

Administrative control measures should limit the time spent in areas where over-exposure to respiratory hazards could occur. This includes rotation of workers or shortening of the work shift. If the administrative control measures do not adequately reduce the exposure of farm workers, the farm owner should provide the appropriate PPE.

In case of respiratory hazards PPE includes respiratory protection ranging from masks to respirators. Prevention against respiratory hazards involves adequate respiratory protection (United States Department of Labor, n.d.). The best prevention of respiratory disease is to wear an approved respirator (United States Department of Labor, n.d.). Air-purifying respirators remove contaminants from the air, but can only be used in environments where there is enough oxygen to sustain life. Supplied-air respirators must be used in oxygen-limited environments or in environments with acute toxic gas levels (Bradley, 2002).

The selection and proper fit of respiratory protective equipment is important, since the fit of PPE to the worker will determine the effectiveness of the protection (United States Department of Labor, n.d.). Education and training is of the utmost importance when PPE is used, since the correct use and maintenance will have an impact on its effectiveness (Schoeman and Schröder, 1994). The worker should also be trained in the importance of the use of PPE.

Engineering control measures should always be selected whenever this is financially possible, since in this way overall exposure of farm workers will be reduced without the use of administrative control measures or PPE. Engineering control measures to control respiratory hazards on farms include tractors being fitted with cabins that include air filtration equipment. Newer tractors and

combines generally provide adequate respiratory protection because an air filtration system is already installed in enclosed cabins. The effectiveness of air filtration protection also depends on the regular changing of the air filters (Occupational Health and Safety Administration, 2003).

5.2 Excessive noise

5.2.1. Introduction: Excessive noise present in agricultural activities

Agricultural noise is a common health hazard on farms and a third of farm workers are exposed to a time-weighted average (TWA) noise level of above 85dB(A) (Bradley, 2002). Noise from farm tools and machinery can cause permanent hearing loss. Several categories of noise sources emit levels of between 100 and 110dB(A). Prolonged exposure to excessive noise produced by tractors, combines, choppers, grain dryers and chainsaws, for example, can cause permanent hearing loss unless noise control measures are taken. Due to the natural deterioration of the machine engine, the gearbox and other components of the machine (tyres, exhaust), old and worn tractors emit high noise levels (Pessina and Guerretti, 2000).

If someone has to shout above noise in order to be heard by someone else a metre away, his/her hearing could be at risk. Hearing provide two warning signs for overexposure: temporary threshold shift (TTF) and ringing in the ears (tinnitus) (College of Agricultural Sciences, n.d.). Hearing loss may be temporary at first, but repeated exposure will lead to permanent hearing damage. The damage can occur gradually over a number of years and remain unnoticed until it is too late. Noise induced hearing loss is very common among farmers (Occupational Health and Safety Administration, 2003). If a worker is continually exposed to loud noises, he/she should undergo periodic hearing tests. This test, called an audiogram, will reveal signs of hearing loss. If hearing loss is noted steps should be taken to reduce exposure and further damage to the ears may be eliminated (Bradley, 2002).

5.2.2 Individual noise control sub-programme

The suggested individual noise control sub-programme (Figure 5.3) proposes the identification, evaluation and control measures necessary to minimise the risk of hearing loss.

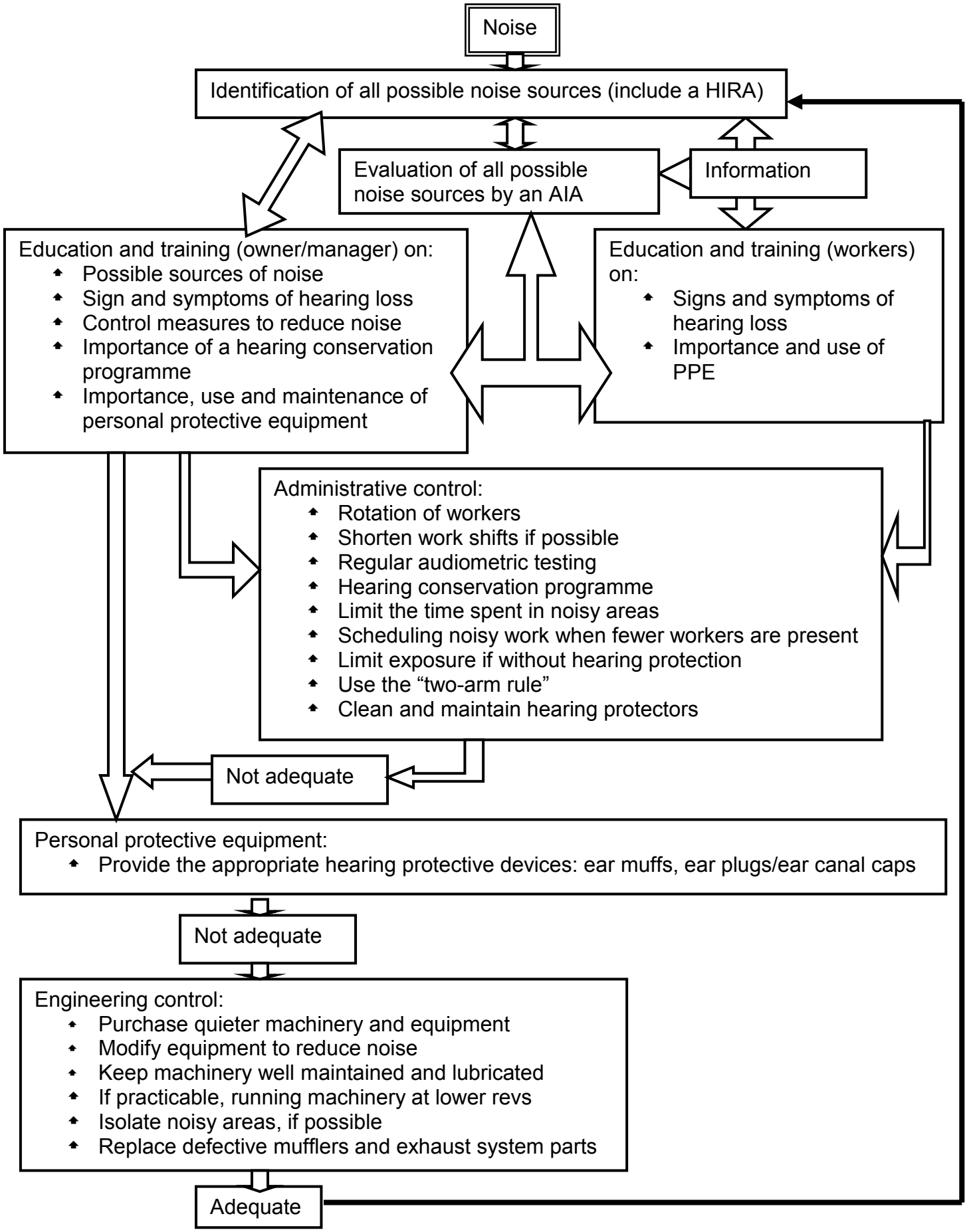


FIGURE 5.3: Individual noise control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment, PPE - personal protective equipment)

According to the Noise Induced Hearing Loss Regulations (2003) promulgated under the Occupational Health and Safety Act, Act 85 of 1993, an employer shall ensure that no employee is exposed to noise levels equal to or exceeding 85 dB(A). If the measured noise level exceeds this prescribed level (i.e. a noise zone), all possible precautions must be taken to reduce the noise level and protect the employee's hearing (South Africa, 1993; South Africa, 2003).

The education and training of farm owners and workers are an important step in preventing hearing loss. The recognition of a noise zone (≥ 85dB(A)), i.e. an area where the worker must shout to be heard, is the first step (South Africa, 2003). Education and training on the importance, use and maintenance of hearing protection devices is also essential.

The noise exposure level must be evaluated according to legislation at least once a year and hearing tests must be done at least annually on employees exposed to noise levels exceeding the prescribed limit. A hearing conservation programme must be implemented in such cases (South Africa, 2003).

Farm workers may be protected from noise exposure by following certain administrative control measures. One of the first administrative control measures that can be applied is to limit the time of exposure to noise, for example, limiting the time workers spend in a noisy environment, job rotation to alternate noisy jobs with quiet ones and scheduling noisy work when fewer workers are around. The use of the "two arm rule" should also be applied, i.e. if the voice needs to be raised to be heard when the person is two arm lengths from the other person, the noise level is probably high enough that he/she needs to protect their hearing. If ringing in the ears is experienced a hearing test should be conducted to establish hearing levels and possible signs of hearing loss (College of Agricultural Sciences, n.d.). If noise exposure is not sufficiently lowered with the use of the administrative control measures hearing protective devices should be worn.

There are different types of hearing protective devices available, including earmuffs, ear plugs and ear canal caps. Ear muffs can be classified according to

the composition of the headband and muff cushions, their weight and their special features such as noise reduction rating (NRR), communication headset and foldable headband (Pessina and Guerretti, 2000; Bradley, 2002). Earplugs are normally characterised by the style (pre-moulded, user-formed, custom-moulded, expandable), the composition of the device (silicon, vinyl, foam-vinyl, foam urethane, mineral wool, thermoplastic elastomer, waxed cotton, hard acrylic) and other distinguishing features, such as availability of safety cord and compatibility of wear with other safety devices (Pessina and Guerretti, 2000; Bradley, 2002). Ear canal caps are sometimes preferred to both earplugs and earmuffs, especially in situations where earplugs have to be removed frequently, in some environments where earmuffs feel too hot to wear. The main features indicate the style, the composition of the canal piece (silicon, vinyl, foam vinyl, foam urethane) and the compatibility of wear with other safety devices (Pessina and Guerretti, 2000).

Hearing protection devices such as earplugs or ear muffs to prevent hearing loss should be used around noisy machinery and should be used from the minute noise begins (College of Agricultural Sciences, n.d.). These protection devices should always be worn on open tractors and when shooting. It should be cleaned and maintained regularly and worn or damaged parts should be replaced. The following should be kept in mind when hearing protection devices are worn to reduce exposure to noise: a combination of ear muffs and ear plugs should be worn when shooting (College of Agricultural Sciences, n.d.); ear muffs should be tried on before purchase to ensure comfort and a sound-proof fit; ear plugs may be more comfortable for some people, and must always be inserted with clean hands; re-usable plugs must be cleaned regularly; and hearing protection devices should be kept near the area of a noisy activity, e.g. in the tractor cab (Health and Safety Manual for Field Activities, n.d.).

Noise can also be reduced at the source by engineering control measures. Purchasing of quieter machinery and equipment will reduce the noise level emitted. Equipment should also be well lubricated, maintained and/or modified to reduce the noise level. All the components should regularly be tightened. If possible, machinery should be run at lower revolutions (College of Agricultural

Sciences, n.d.). Isolating work areas from noisy machinery using distance or insulation will reduce the exposure of farm workers to noise. Defective mufflers and exhaust system parts should be replaced. The noise level from stationary equipment can also be reduced by enclosing components or building acoustic barriers or heavy partitions (College of Agricultural Sciences, n.d.).

5.3 Whole body vibration

5.3.1 Introduction: Whole body vibration present in agricultural activities

"Vibration is oscillatory motion occurring when there is an alternating movement or velocity in one direction and then a velocity in the opposite direction" (Hattingh and Acutt, 2003). Vibration is divided into two types, either localised or whole body vibration (Zenz, 1994; Schoeman and Schröder, 1994). Localised vibration occurs when the vibration is passed through the hands, wrists and arms of the worker (Zenz, 1994). When a human body is supported on a surface which is vibrating and which causes the body to vibrate, whole body vibration occurs (Hattingh and Acutt, 2003).

Whole body vibration occurs when driving any type of vehicle (Occupational Health and Safety Administration, 2003). Agricultural vehicle operators are thus exposed to low frequency whole body vibration. Vibration in the frequency range of 8-20 Hz is the most prevalent when driving vehicles (Hattingh and Acutt, 2003). Symptoms of exposure to low frequency vibration that have been reported include motion sickness, a general feeling of discomfort and possible visual impairment (Hattingh and Acutt, 2003; International Labour Organisation, 2000; Schoeman and Schröder, 1994). One study reported the prevalence of lower back pain to be 10% greater among tractor drivers (Occupational Health and Safety Administration, 2003).

5.3.2 Individual whole body vibration control sub-programme

The suggested individual vibration control sub-programme was designed to be implemented on farms to limit whole body vibration of farm workers (Figure 5.4).

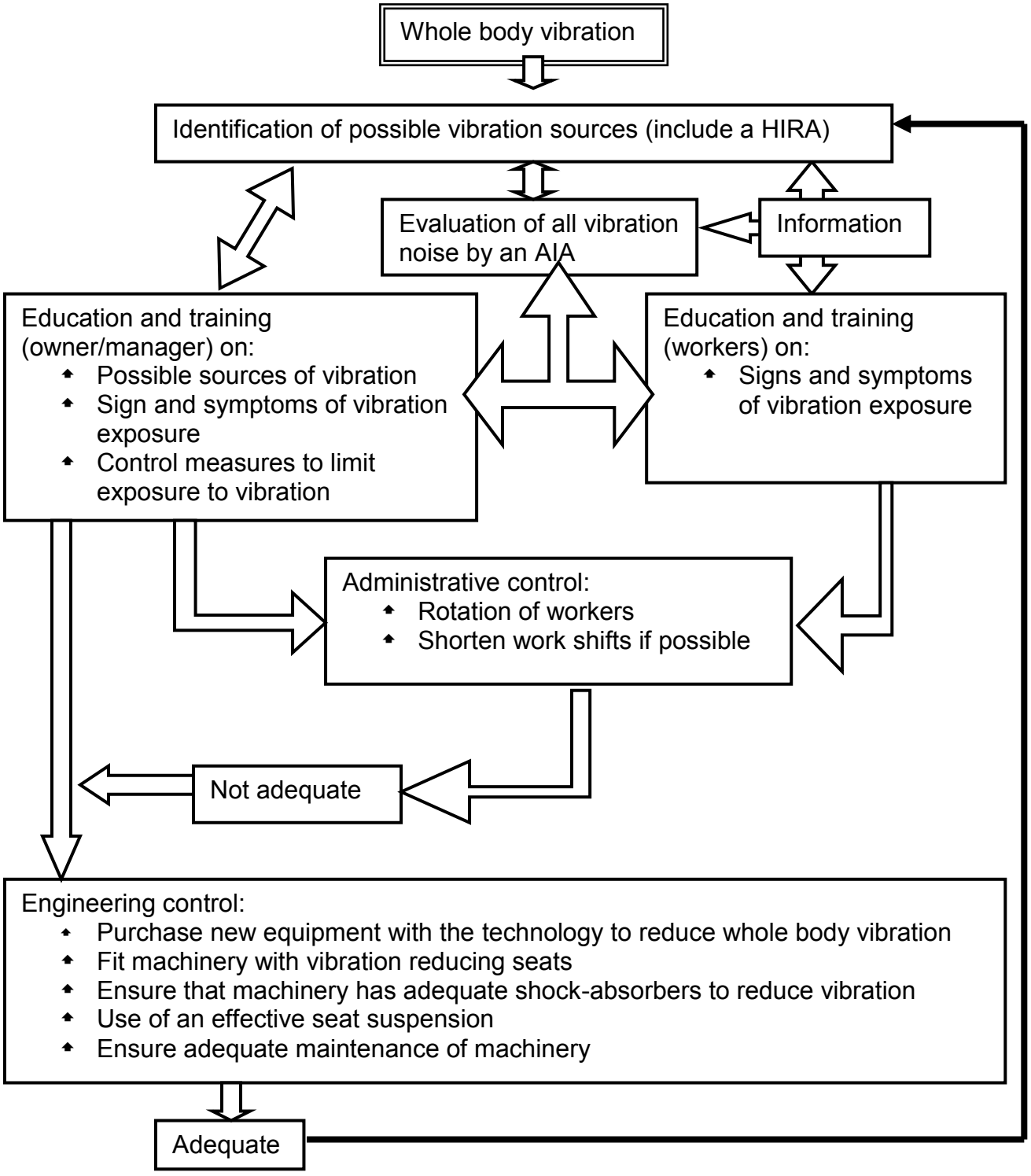


FIGURE 5.4: Individual whole body vibration control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment)

There are no vibration standards available in South Africa (Hattingh and Acutt, 2003; Schoeman and Schröder, 1994). The United States of America as well as Europe each have their one vibration standards (Wasserman, 2003). However, the signs and symptoms of vibration exposure are known and therefore the exposure of farm workers to vibration should be limited. The identification of whole body vibration should be considered wherever vehicles are used during the execution of the farm worker's normal duties.

Education and training of farm owners and/or managers should be conducted on the signs and symptoms of vibration exposure as well as on the appropriate control measures that could be implemented to limit exposure of farm workers. Farm workers also need education and training on the signs and symptoms of vibration exposure.

Administrative control measures could limit the exposure of farm workers. These measures include the rotation of workers, as well as shorter work shifts.

Engineering control measures however, are the most effective way to control vibration exposure of farm workers. When purchasing new equipment the farm owner should ensure that it is fitted with the technology to reduce whole body vibration (Occupational Health and Safety Administration, 2003). Machinery should be fitted with vibration-reducing seats and the machinery should have adequate shock-absorbers to reduce whole body vibration (Farmsafe Queensland, 2002). Use of an effective seat suspension will dampen low-frequency vibration in the cabin of tractors (Kundiev and Chernyuk, 2001). Adequate maintenance and lubrication of machinery may also effectively reduce the exposure of farm workers to whole body vibration.

5.4 Pesticide exposure

5.4.1 Introduction: Pesticide exposure present in the agricultural environment

Pesticides present significant occupational and environmental risks throughout the world, and are suspected to be mutagenic, carcinogenic or teratogenic (Ngowi, 2002). The organophosphate pesticides are chemically related esters of phosphoric acid or certain of its derivatives. Their physical and chemical properties have rendered them useful for agricultural purposes (Myers, 2001). Organic phosphates have the ability to inhibit the action of the cholinesterase enzymes (Myers, 2001).

Pesticides can enter the body by a number of routes (Bradley, 2002): they may enter the body through ingestion, inhalation or absorption. The inhalation hazard is determined by the physical form and solubility of the chemical. The possibility and degree of absorption varies with the chemical. Some chemicals may cause dermatitis (Myers, 2001), while serious and even fatal poisoning may occur by ingesting even small amounts while eating or smoking. Organophosphates may be inhaled when dusts or volatile compounds are handled. The ability to penetrate the skin in fatal quantities without the warning of irritation may make organophosphates especially difficult to handle (Myers, 2001).

Inhalation. Inhalation of pesticides is likely to occur when the pesticide is in the form of gas, fine spray droplets, dust, fumes or smoke (Hattingh and Acutt, 2003). Users of fumigants and gases are therefore particularly at risk of poisoning by inhalation.

Skin absorption. This is one of the most common routes of poisoning by pesticides. Pesticides can easily pass unnoticed through work clothing and intact human skin. Some pesticide formulations are especially hazardous if they are toxic or contain penetrative solvents (Schoeman and Schröder, 1994).

Ingestion. The hands, lips and mouth may become contaminated by a pesticide during work and therefore it is important to wash properly before eating or smoking. Good personal hygiene practices could limit the ingestion hazard of pesticides (DiNardi, 1997).

Organophosphates cause neurotoxic effects with specific signs and symptoms. These signs and symptoms range from dizziness, headache, nausea, vomiting, miosis, excessive sweating, lachrimation, muscular fasciculations, shortness of breath, coma, pulmonary oedema and respiratory depression (Ngowi, 2002).

It is widely recognised that agricultural workers are the largest occupational group at risk of adverse health effects from pesticides (Ngowi, 2002). Pesticides can present a hazard to applicators and to harvesters re-entering a sprayed field (Occupational Health and Safety Administration, 2003). If farm workers do not follow proper precautions, illness or even death may ensue (Bradley, 2002).

5.4.2 Pesticide exposure control sub-programme

Pesticides are used on all farms and therefore the identification of pesticide exposure is not essential, since it is already determined to be present. However, the route of entry must be determined to ensure that the correct control measures are implemented to minimise exposure of farm workers.

The suggested individual pesticide exposure control sub-programme includes inhalation, ingestion and absorption of pesticides. The control measures necessary to minimise each route of entry is indicated in Figure 5.5.

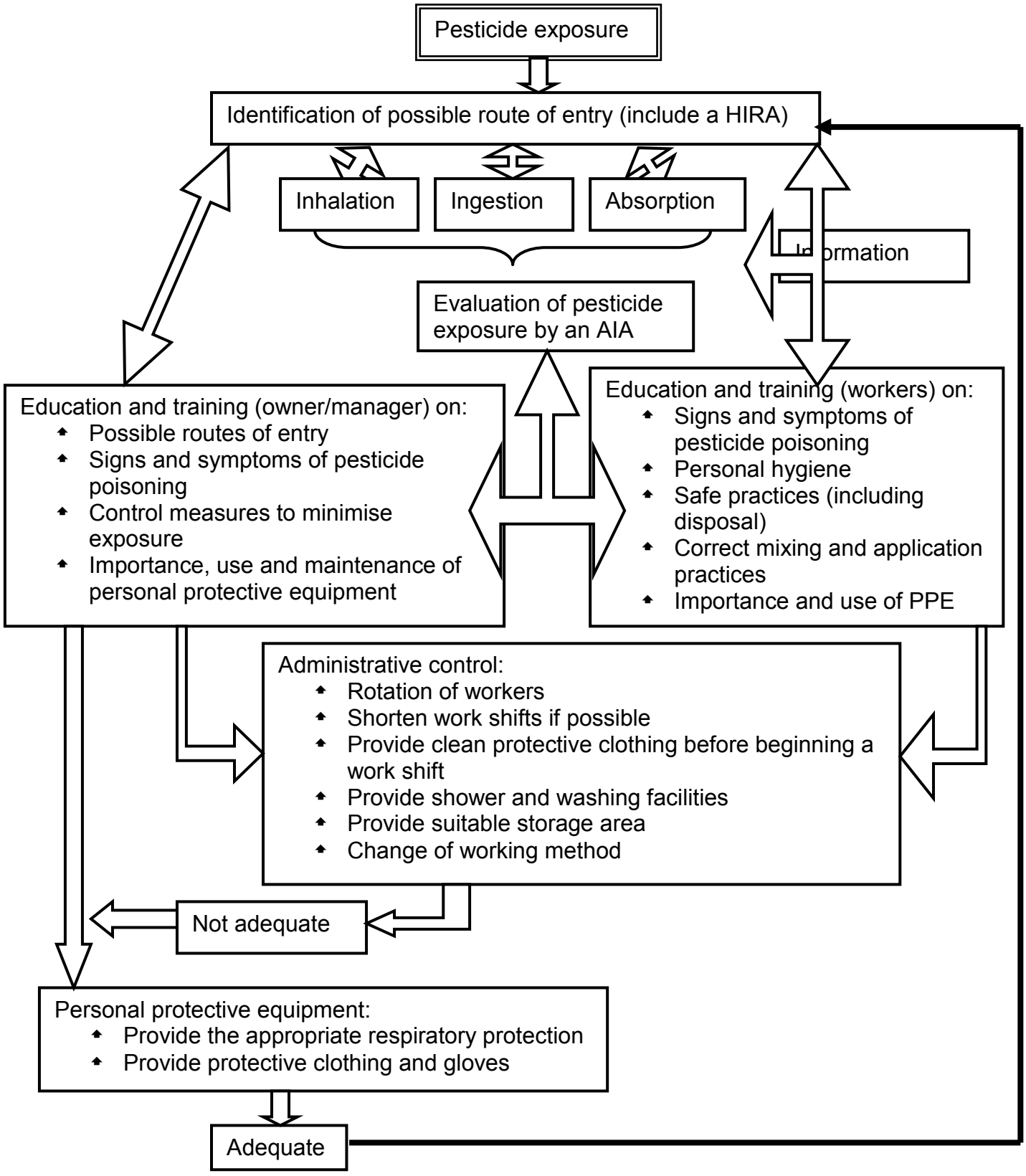


FIGURE 5.5: Individual pesticide exposure control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment, PPE - personal protective equipment)

The identification of possible routes of entry of pesticides into the human body is the first step in controlling the hazard (Bradley, 2002). After the identification of the route of exposure an AIA should evaluate the exposure of farm workers to pesticides. Before control measures can be implemented education and training of farm owners/managers and farm workers is essential.

The education and training of farm owners and/or managers should include the identification of the route of exposure, since this is important in the application of appropriate control measures. The farm owner and/or manager and farm worker should also be able to recognise the signs and symptoms of pesticide poisoning to ensure that a farm worker suffering from these symptoms is immediately removed from the area. All possible control measures should be explained to the farm owner and/or manager. The importance, use and maintenance of personal protective equipment should be included in the education and training of both groups. The correct handling, mixing, application and storage of pesticides could reduce or minimise the exposure to pesticides, simply by educating and training farm workers about the procedure. Personal hygiene of farm workers could reduce the absorption and ingestion hazards of pesticides (Myers, 2001). Smoking, eating and drinking before washing should be absolutely prohibited when any pesticide of moderate or higher toxicity is being handled or used (Myers, 2001). There are also general precautions that should be included in the education and training of farm workers: for example, during the application of pesticides, these chemicals should not be applied without adequate training; pesticides should only be used for the purpose for which they were intended and used at the correct application/dilution rate (Myers, 2001).

The administrative control measures that could be implemented in the agricultural work environment include the rotation of workers or limited work hours which would decrease the exposure time to pesticides. The provision of clean protective equipment at the beginning of each shift could prevent the absorption and ingestion of pesticides (South Africa, 1996). Pesticides should be stored in a suitable area that complies with the applicable legislation. Washing and shower facilities should also be provided by the employer (South Africa, 1996).

Personal protective equipment includes respirators and protective clothing and gloves. If provided to farm workers inhalation and absorption of pesticides will be reduced accordingly (Occupational Health and Safety Administration, 2003).

5.5 Tractor roll-overs

Injuries associated with modern harvesting operations typically relate to tractors, machinery, grain handling equipment and grain storage structures. Farming equipment, specifically tractors, are the predominant cause of fatal injuries in agriculture (Western Center for Agricultural Health and Safety, 2004). Since the 1950s, tractors have contributed to approximately half of all farm-related fatalities, with roll-overs being the single most important contributing factor. The utilisation of roll-over protective structures (ROPS) has proven to be the single most important intervention strategy in reducing the number of tractor-related fatalities (Myers, 2001). Other design features that have improved the safety and health of tractor operators include wider wheel bases and designs that lower the centre of gravity to improve stability (Field, n.d.).

Most tractor fatalities are the result of a roll-over. Therefore the use of ROPS in conjunction with a seat belt could save lives (Higgins, Parker and Wahl, 2001). A ROPS or a protective cab is the only sure protection against death or serious injury should a tractor roll sideways or back-flip (Higgins, Parker and Wahl, 2001). A ROPS works by limiting the roll to 90 degrees and protecting the driver's station from being crushed under the weight of the machine. However ROPS are useless unless the seatbelt is used. If tractors are not equipped with ROPS, it is strongly recommended that approved ROPS is retrofitted to the machine (Farmsafe Queensland, 2002).

Every tractor with a ROPS or cabin should also be fitted with a seat belt and/or an appropriate combination of operator protection devices in case of a roll-over or back-flip. Passengers should have a separate seat and seatbelt and be positioned within the zone of protection of the ROPS or cabin (Higgins, Parker and Wahl, 2001).

5.6 Being caught in or between objects during agricultural activities

Crushing injuries or deaths are also caused by getting caught under the loader bucket or between the loader and the tractor frame (United States Department of Labor, n.d.). The risk of getting caught in or between objects (Farmsafe Queensland, 2002) could be limited if the following precautions are followed:

- Items that could become entangled in moving machine parts such as jewellery, drawstrings, ties or loose clothing should not be worn.
- Loose hair should be tied back, but be aware that even short or tied-back hair may become entangled in moving equipment.
- Workers should not attempt to un-jam machinery while it is running.
- Workers should never insert any part of the body into machinery to un-jam equipment.
- Workers should never step over a rotating shaft, lean over a conveyer or hand-feed materials into machines with moving parts or blades.
- Workers should stay safely away from unshielded moving parts.
- Employees should be warned not to wear loose-fitting clothing or jewellery near operating farm machinery.
- Safe practices should be used when hitching and unhitching wagons. Hitching wagons is often overlooked as a cause of injury or death (Farmsafe Queensland, 2002).
- A tractor should not be moved if a worker is between it and the wagon (United States Department of Labor, n.d.).

5.7 Heat stress

5.7.1 Introduction: Exposure to heat stress in the agricultural environment

Heat stress occurs when the body builds up more heat than it can handle. High temperatures, high humidity, sunlight, and heavy workloads increase the likelihood of heat stress. There are numerous precautions that employers can take to prevent their workers getting heat stress (United States Environmental Protection Agency (EPA), 2005). It is however important to distinguish between

the different types of heat illnesses in order to take the proper precautions and/or implement the correct treatment. The different types of heat illnesses that could occur when a worker is exposed to extremely high temperatures range from heat cramps to heat stroke.

Heat cramps are muscle pains and spasms in the abdomen and legs caused by loss of electrolytes. The symptoms of heat cramps include painful muscle cramping and spasms, heavy sweating, vomiting and convulsions. A person suffering from heat cramps may be alert and well-oriented with a normal pulse and blood pressure. Treatment of heat cramps may range from resting in a cool location to getting medical help if the symptoms persist (Health and Safety Manual for Field Activities, n.d.).

Heat exhaustion causes inadequate blood flow and dehydration. The symptoms of heat exhaustion are as follows: pale and clammy skin, profuse perspiration, extreme fatigue and weakness, a normal body temperature, headache and vomiting. Emergency treatment of heat exhaustion includes moving the victim to a cooler location, having the person lie down with the feet 20-30 cm elevated, loosening clothing, having the person drink electrolyte replacement solution or juice if possible (every 15 minutes for one hour) and getting medical attention if the condition does not improve (Health and Safety Manual for Field Activities, n.d.).

Heat stroke is life threatening. The sweating mechanism of the human body shuts down and the body overheats. During heat stroke the skin is red, flushed, hot and dry, the body temperature is very high (41°C) with a rapid strong pulse. Dizziness, nausea, headache and unconsciousness may also occur. The emergency treatment of heat stroke requires that the person should be cooled rapidly – water, fan, air-conditioning, immediate medical attention and allowing the person to sip water if conscious (Health and Safety Manual for Field Activities, n.d.).

In the agricultural work environment heat stress may be experienced where work is done outdoors without shade and in direct sunlight. Harvesting of grain is

generally performed in the hottest season. Temperature in the cab can rise as high as 36 to 40°C. Tinted glass lowers the temperature of air in the cab by 1 to 1.6°C. A mechanically forced ventilation system with a flow rate of 350 $m^3.h^{-1}$ can create a temperature difference between inside and outside air of 5 to 7°C. If the combine is equipped with adjustable louvers, this difference drops to 4 to 6°C (Kundiev and Chernyuk, 2001). The time spent in this environment must also be taken into account since farm workers on average work longer than the normal 8-hour work shift.

5.7.2 Individual heat stress control sub-programme

The suggested heat stress control sub-programme (Figure 5.6) proposes procedures that should be followed to minimise the exposure of farm workers to heat stress. It includes the identification, evaluation and control measures necessary to accomplish the above-mentioned reduction of exposure.

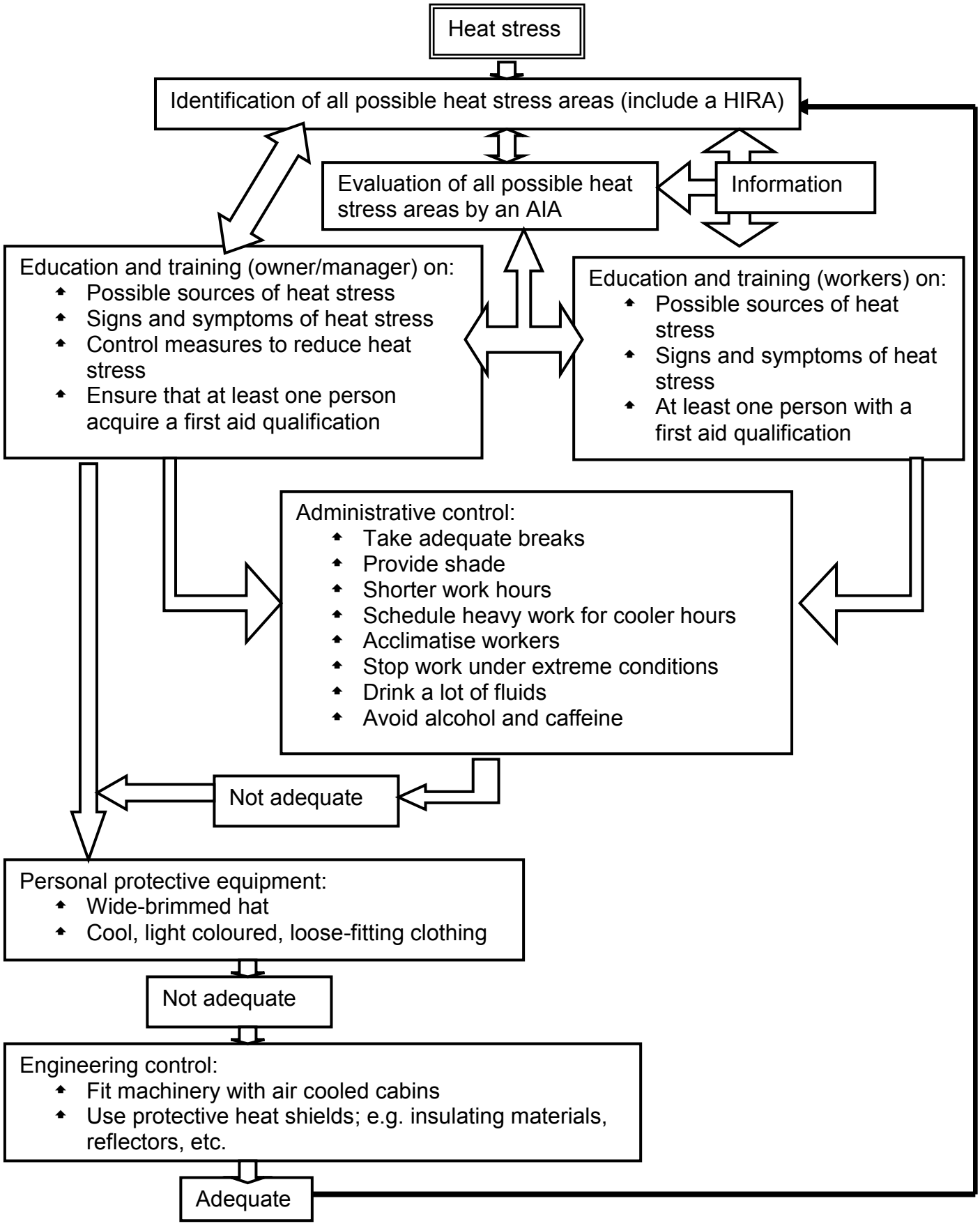


FIGURE 5.6: Individual heat stress control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment, PPE - personal protective equipment)

According to the Environmental Regulations for Workplaces, 1987, promulgated under the Occupational Health and Safety Act (South Africa, 1993, South Africa, 1987) an area may be referred to as a heat stress area if the measured wet bulb globe temperature (WBGT) index exceeds 30. Where the time-weighted average WBGT index, determined over a period of one hour, exceeds 30 in the environment in which an employee works, the employer of such employee shall if practicable, take steps to reduce the said index to below 30 (South Africa, 1987).

The standard method for evaluating high temperatures in industry should be applied to the agricultural environment. Both environmental and personal sampling of heat exposure is recommended for agricultural workers. Personal sampling is recommended since the farm worker moves around in the outdoor environment during the normal execution of his tasks. The evaluation should be done at least once during spring and summer of each year. Farm workers working in a heat stress area must also be medically examined at least once a year and declared fit for working in such conditions (South Africa, 1987).

In the hot season, daily routine ought to provide for working mainly in the morning and evening hours, reserving the hottest time for rest. Special attention should be paid to the balanced nourishment of workers with special note given to the energy requirements of tasks. Drinking regularly during exposure to heat is of great importance, and the availability of sufficient amounts of wholesome liquids of high quality is essential (Kundiev and Chernyuk, 2001).

The following control measures are recommended and adapted for use in the agricultural work environment to prevent heat stress of farm workers. Education and training of farm owners and/or managers should include possible sources of heat stress, the signs and symptoms of heat stress, and the control measures to reduce heat stress; there should be at least one person on the farm with a first aid qualification. At least one person should be certified in first aid (with knowledge of the symptoms and treatment of heat stroke) on every field work team. If it is suspected that the farm worker is developing heat stress the person certified in first aid may be able to treat him/her. The farm worker must be

educated and trained on the signs and symptoms of heat related illnesses. If they are adequately trained the risk of farm workers developing heat related disorders decreases. Medical attention will be given sooner if workers themselves are able to identify the signs and symptoms of heat illnesses.

Training and education is necessary in conjunction with administrative control since education and training only provides the worker with knowledge of heat illnesses and does not reduce the risk involved. Administrative control will reduce the exposure of farm workers to heat stress in the work environment.

Farm workers need adequate breaks when they are involved in work that may expose them to heat stress (Health and Safety Manual for Field Activities, n.d.). This may reduce the exposure time of the farm worker (Alvarez, 2002). Workers should be provided with shade or cooling during breaks (EPA, 2005). This will reduce the body temperature before the worker is exposed to further heat stress. The length of work periods should be decreased and rest periods increased (EPA, 2005). This will decrease the exposure time of farm workers to heat stress. Heavy work and PPE-related tasks should be scheduled for the cooler hours of the day (EPA, 2005).

Workers should be gradually acclimatised to high temperatures (EPA, 2005), as acclimatised workers are less likely to suffer heat stress. The acclimatisation process includes about 2 hours of light work per day in the heat for several days in a row. The work period should then be gradually increased over the next several days. An adjustment period of at least 7 days is recommended. If the weather warms up gradually, workers may adjust naturally. Vitamin C also helps with the acclimatisation of workers to high temperatures (Schoeman and Schröder, 1994). Work should be stopped when extreme conditions occur (EPA, 2005). This may reduce the chances of farm workers developing heat illnesses. Appropriate amounts and types of fluids should be ingested: 250 ml (1 cup) water every 15 minutes (Health and Safety Manual for Field Activities, n.d.; EPA, 2005). The appropriate amount of fluid ingested during the exposure to heat stress will rehydrate the body and prevent heat illnesses. Alcohol and caffeine should be

avoided. The use of alcohol and caffeine causes the body to dehydrate and increases the risk of heat illnesses.

If farm workers are not adequately protected with the use of only the administrative control measures, the use of personal protective equipment is recommended. The appropriate protective clothing should be worn (cool, loose, and light-coloured), including a wide-brimmed hat. Head coverings and clothing should be light in colour, absorbent and loose-fitting (Health and Safety Manual for Field Activities, n.d.)

When the administrative control measures and the use of personal protective equipment is still not adequate to reduce the exposure to high temperatures, engineering control measures must be implemented. The use of engineering control measures however will have a financial impact on the farm owner. Machinery (tractors, harvesters) with cabins or at least a roof is recommended since it keeps the worker in the shade during labour. When machinery is fitted with a cabin, the air inside the cabin might need to be cooled, since a closed cabin without ventilation may cause increases in temperature. Protective heat shields, insulating materials and reflectors should be used (Health and Safety Manual for Field Activities, n.d.)

5.8 Ultraviolet radiation

5.8.1 Introduction: Ultraviolet radiation exposure during agricultural activities

Exposure to ultraviolet radiation from the sun may cause skin cancer. Skin damage from the sun is cumulative - the longer the skin is exposed to the sun, the greater the risk of skin cancers. Rural workers have a high risk of getting skin cancers, as their work can expose them to long periods of ultraviolet radiation (Reynolds, n.d.).

Short term effects of exposure to ultraviolet radiation include reddened skin, blistering, swelling and later peeling of the skin, photosensitisation - acute skin reaction to UV with certain drugs, ointments, creams and chemicals, resulting in increased sunburn and skin damage and photo conjunctivitis and photokeratitis - sore, red, gritty swollen eyes, with sensitivity to strong lights (Reynolds, n.d.).

Long term effects of exposure to ultraviolet radiation include premature ageing - wrinkling, wasting skin tissues, excessive pigmentation, spots marked by clusters of tiny blood vessels and cataracts of the eye (Reynolds, n.d.).

Due to the fact that farm workers spend long work hours in the sun they could develop skin cancer. People at high risk include those with fair skin, blue eyes, and red or blond hair. Ninety percent of all skin cancers occur on parts of the body not usually covered by clothing. A place of particular concern for farmers is the back of the neck (Bradley, 2002).

5.8.2 Individual ultraviolet radiation control sub-programme

The suggested ultraviolet radiation stress control sub-programme (Figure 5.7) proposes procedures that should be followed to minimise the exposure of farm workers.

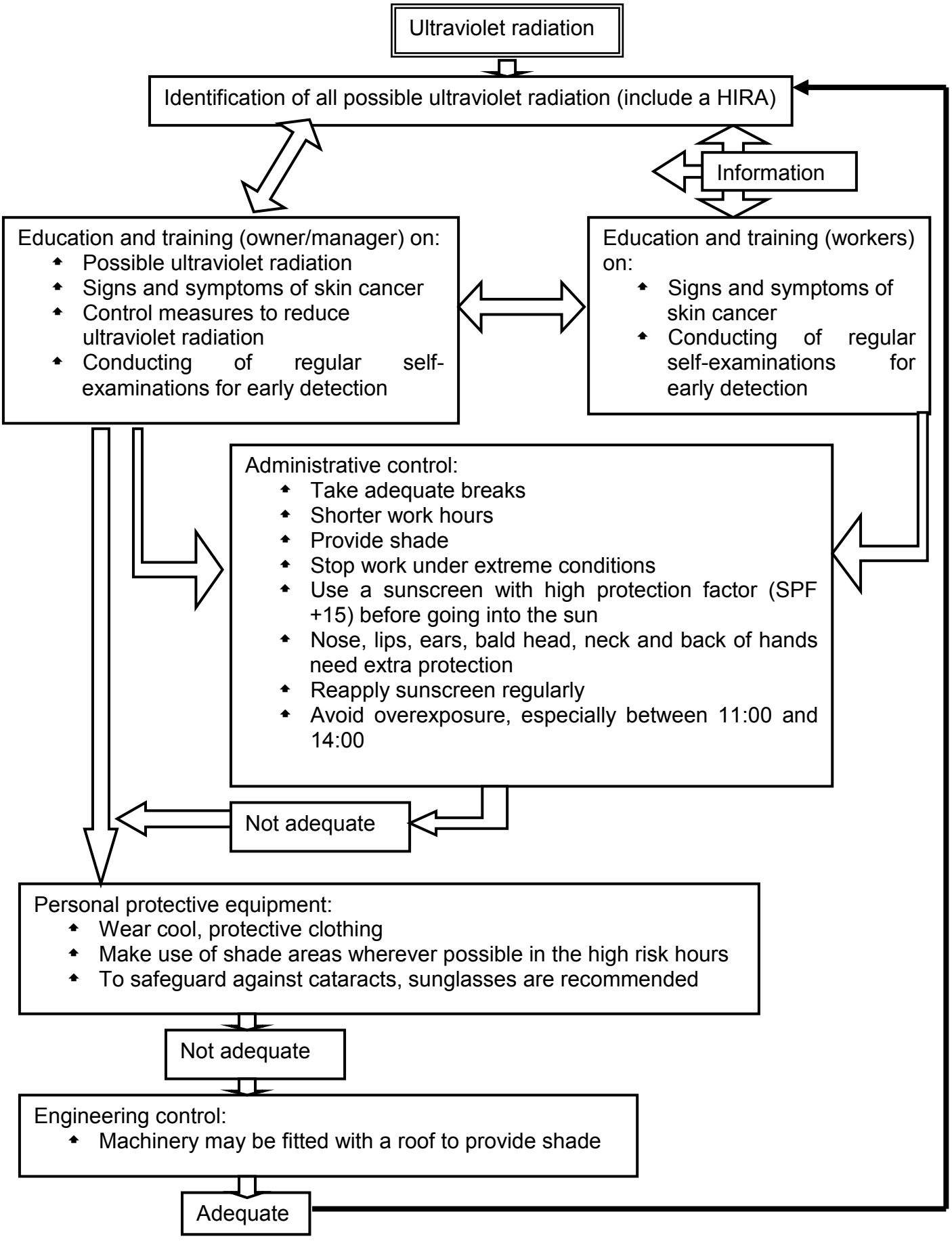


FIGURE 5.7: Individual ultraviolet radiation exposure sub-programme (HIRA - hazard identification risk assessment, PPE - personal protective equipment)

The following considerations will help identify exposure to ultraviolet radiation: lack of shade in outdoor work areas, reflective surfaces, e.g. water, cement, shiny metal or white-painted sheds and silos, cement surfaces, jobs done in sunlight and time spent on each job. Peak sun hours, the day's ultraviolet exposure forecast, if available, what body surfaces are exposed to sunlight, whether sun block-out is provided or used and whether protective clothing is available and worn should also be considered.

Ultraviolet radiation is not normally measured as an occupational health and safety stress. However, it is recommended that control measures be implemented when this form of stress is identified. Prevention is better than cure, since the development of skin cancer requires medical treatment and the cost involved may have considerable financial implications for farm owners.

The administrative control measures that are recommended to reduce or eliminate farm workers' exposure to ultraviolet radiation include either reducing the time spent in direct sunlight or protecting the skin against ultraviolet radiation from the sun. Cool, protective clothing, i.e. a shady hat, shirt with collar and long sleeves, and long trousers should be worn. A sunscreen with a high sun protection factor (SPF +15) should be used before the worker goes into the sun (Bradley, 2002). Workers noses, lips, ears, bald heads, necks and backs of hands need extra protection. Sunscreen should be reapplied regularly, especially if the worker is sweating. Shaded areas should be used wherever possible in the high risk hours. Sunglasses that conform to applicable standards are recommended to safeguard against cataracts. Overexposure should be avoided, especially between 11:00 and 14:00. Regular self-examinations for early detection of signs of skin cancer should be conducted (Bradley, 2002).

The engineering control measure that could be implemented to reduce the exposure of farm workers to ultraviolet radiation is the installation of shade protection on machinery.

5.9 Fertilisers

5.9.1 Introduction: Fertiliser exposure in the agricultural environment

Fertilisers are materials that are introduced to the soil to obtain plentiful and stable harvest crops. The principal elements required are nitrogen, phosphorus and potassium. Other elements relevant to growth but which are needed in smaller quantities, includes trace elements such as calcium, magnesium, sulphur, iron, zinc, manganese, copper, molybdenum, boron and iodine (Page, n.d.).

Ammonia forms the base of most fertilisers. The major fertilisers are ammonia itself, ammonium nitrate, urea, ammonium sulphate and ammonium phosphate. Ammonium nitrate is an oxidizer that is explosive when heated. Anhydrous ammonia is a moderately toxic gas at room temperature and must be kept under pressure or refrigeration during storage and use. It is a skin, eye and respiratory irritant, can cause burns and is flammable (DiNardi, 1997; Page, n.d.).

Ammonium nitrate is very soluble in water. One part of water dissolves about two parts of the nitrate by weight. Ammonium nitrate is not sensitive to friction or impact in conditions encountered in normal handling of limited quantities, but may explode if heated in confined spaces or upon severe shock. Impurities, specifically organic matter, increase the risk of detonation. Ammonium nitrate gives off toxic and corrosive nitrogen oxides which may colour the fumes from yellow to brown when heated to decomposition. Mixtures of ammonium nitrate and several substances may lead to decomposition or explosion. Ammonium nitrate dust is irritating to the respiratory tract and may lower the blood pressure (Baker, Ballenger and Lee, 1993; ILO, 1997; Page, n.d.).

5.9.2 Individual fertiliser exposure control sub-programme

The suggested fertiliser exposure control sub-programme (Figure 5.8) proposes procedures that should be followed to minimise the exposure of farm workers to

fertiliser exposure. It includes the identification, evaluation and control measures necessary to accomplish the above-mentioned reduction of exposure.

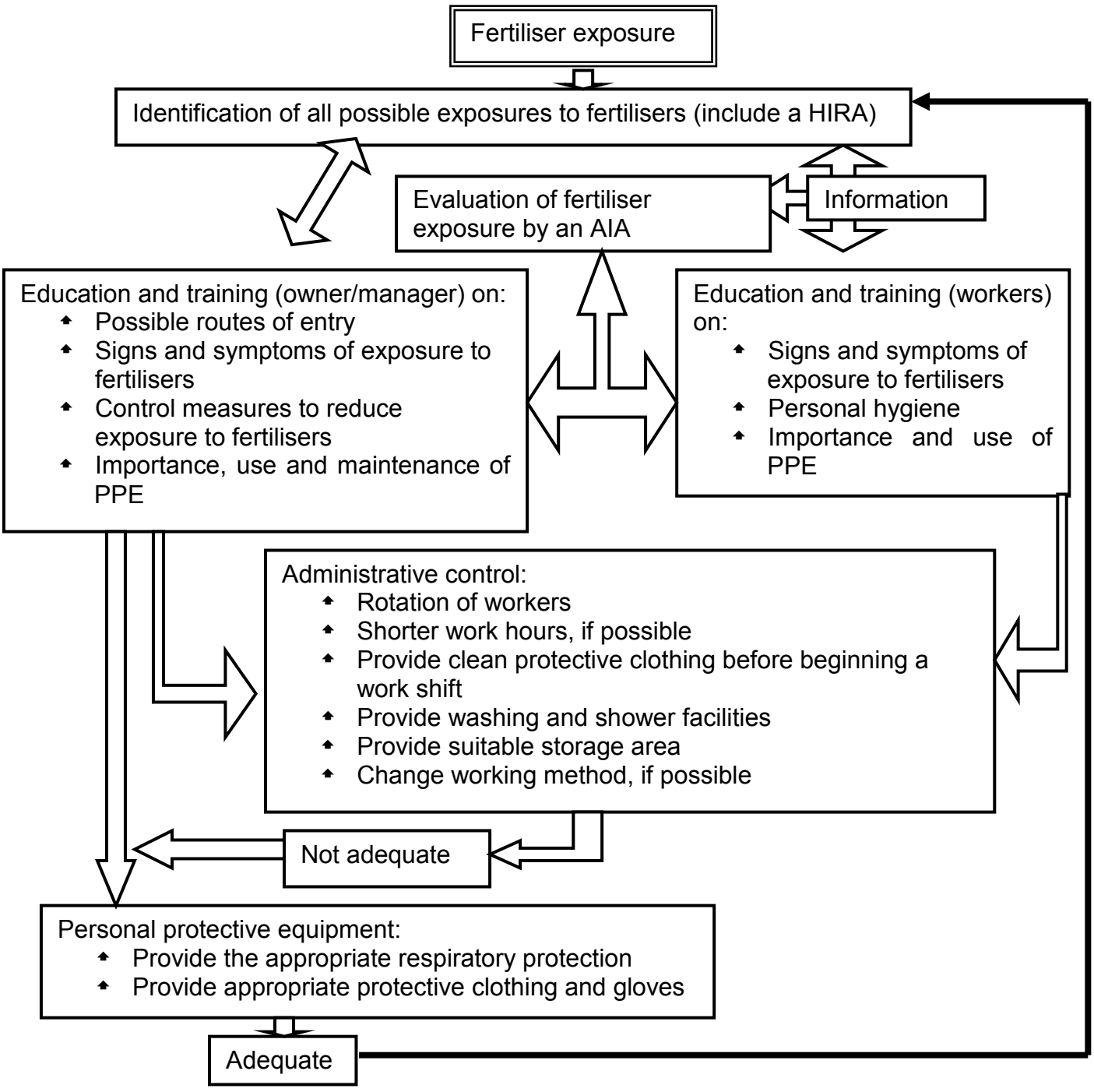


FIGURE 5.8: Individual fertiliser exposure control sub-programme (AIA - approved inspection authority, HIRA - hazard identification risk assessment, PPE - personal protective equipment)

The identification of possible fertiliser exposure of farm workers should be the first step in controlling the exposure. After the identification of the route of exposure an AIA should evaluate fertiliser exposure of farm workers. Before control measures can be implemented education and training of farm owners/manager and farm workers are essential.

The education and training of farm owners and/or managers should include the identification of the route of exposure. The farm owner and/or manager and farm worker should also be able to recognise the signs and symptoms of exposure to fertiliser to ensure the safety of farm workers working with fertilisers. All possible control measures should be explained to the farm owner and/or manager. The importance, use and maintenance of personal protective equipment should be included in the education and training of both groups. Personal hygiene of farm workers could reduce the exposure risk of farm workers to fertilisers (Myers, 2001).

The results from and information on the evaluation of fertiliser exposure must be shared with both the farm owner and/or manager as well as with the farm workers. According to the Regulations for Hazardous Chemical Substances promulgated under the Occupational Health and Safety Act (South Africa, 1993) hazardous chemical substances should be monitored at least once every two years. Control measures should be implemented after the initial evaluation to reduce fertiliser exposure of farm workers.

Administrative control measures should limit the time spent in areas where over-exposure to fertilisers could occur. This includes rotation of workers or shortening of the work shift. The provision of clean protective equipment at the beginning of each shift could prevent skin contact with fertilisers. Fertilisers should be stored in a suitable area that complies with the applicable legislation. Washing and shower facilities should also be provided by the employer. If the administrative control measures do not adequately reduce the exposure of farm workers, the farm owner should provide the appropriate PPE.

Personal protective equipment, including respirators and protective clothing and gloves provided to farm workers, should reduce exposure to fertilisers (Occupational Health and Safety Administration, 2003). Personal protective equipment (PPE) should always be worn. Standard PPE should be non-vented goggles, rubber gloves with thermal lining, face shield or an approved respirator. A lightweight rubber suit or (at the very least) a long sleeved shirt and overalls should be worn (Petrea, 2002).

5.10 Ergonomics

5.10.1 Introduction: Poor ergonomic design (musculoskeletal disorders)

Ergonomics is the study of human capabilities and the interaction of workers and job demands (Schoeman and Schröder, 1994). Ergonomics attempts to reduce the physical and mental stress of the job by optimising the work environment and the design of the work to fit the individual (Hattingh and Acutt, 2003). Poor ergonomic design may lead to musculoskeletal disorders (Schoeman and Schröder, 1994).

Sprains and strains are a significant problem among agricultural workers. Many of these problems result from handling heavy loads, repetitive motion, poor posture and dynamic motion (Myers, 2001).

5.10.2 Individual ergonomic sub-programme

The suggested ergonomic sub-programme (Figure 5.9) should reduce the risk of farm workers developing musculoskeletal disorders because of poor ergonomic design.

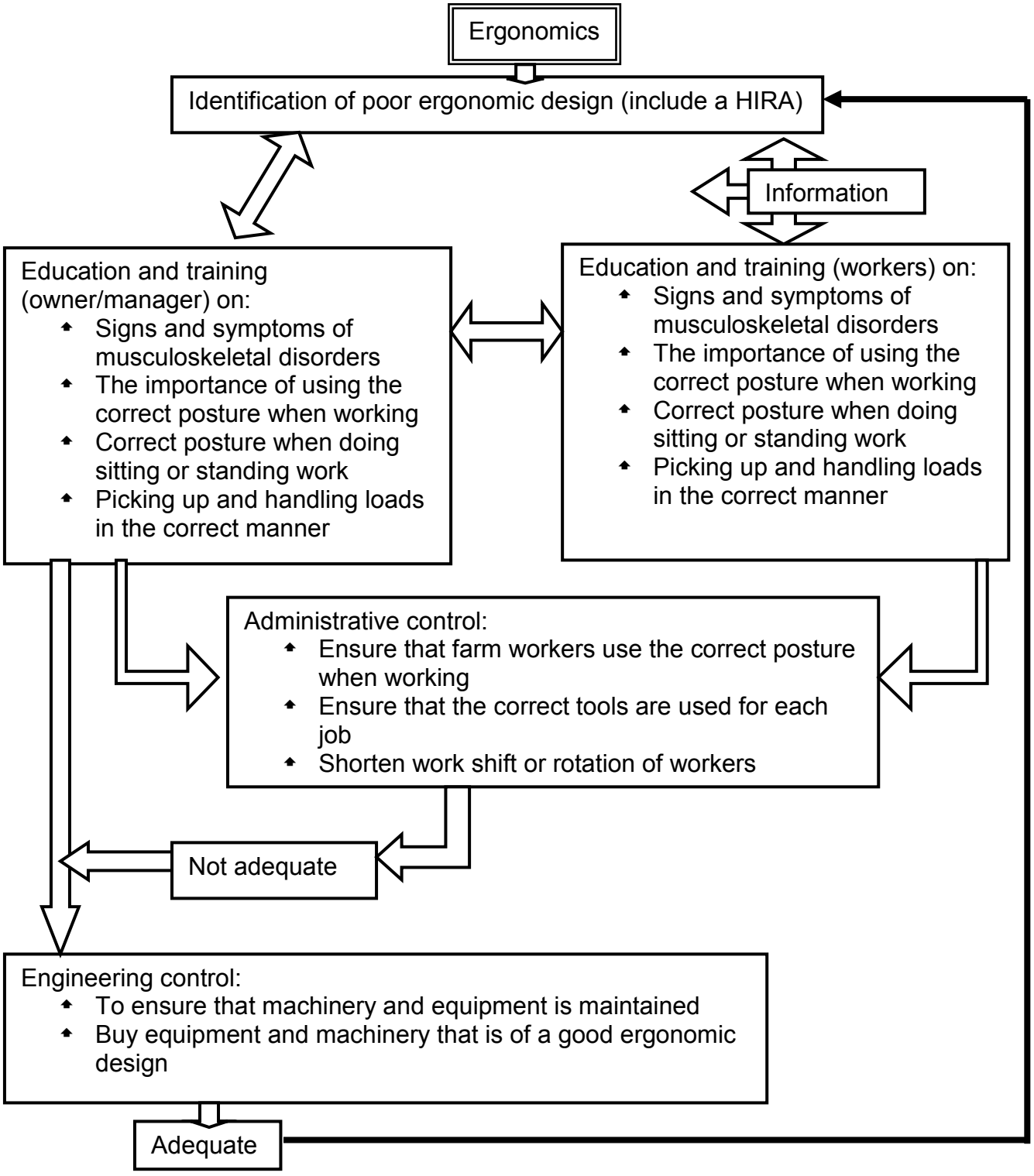


FIGURE 5.9: Individual ergonomic sub-programme (HIRA - hazard identification risk assessment)

Education and training of the farm owner and/or manager and the farm workers is essential to minimise the occurrence of musculoskeletal disorders caused by poor ergonomic design. The signs and symptoms of musculoskeletal disorders

should be known and understood by farm owners and/or managers and farm workers. The importance of correct posture during working, whether sitting or standing, should be highlighted during the education and training of farm owners and workers. The correct manner of picking up and handling loads could also minimise musculoskeletal disorders.

Certain administrative control measures could minimise the exposure of farm workers to poor ergonomic design and could therefore reduce the occurrence of musculoskeletal disorders. These include ensuring that farm workers use the correct posture when working and shortening of the work shift or rotation of workers.

Ensuring that machinery and equipment is properly maintained and buying equipment and machinery that is ergonomically well-designed is part of the engineering control measures that could be implemented. The operator's seat must be designed to guarantee a comfortable position and effective driving of the machine and tractor assembly. Design of modern tractor seats takes into account anthropometric data of the human body. Seats have adjustable back and arms and can be adjusted according to the operator's size, in both horizontal and vertical dimensions (Kundiev and Chernyuk, 2001).

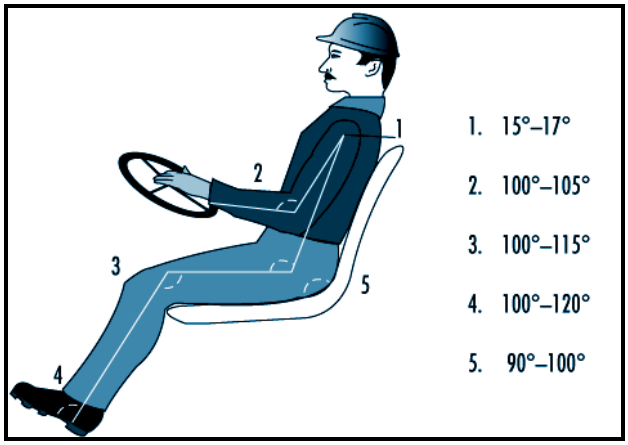


FIGURE 5.10: Angle parameters of optimal work posture of a tractor driver (Kundiev and Chernyuk, 2001)

5.11 Dermatitis

5.11.1 Introduction: Dermatitis in the agricultural environment

A number of factors predispose an individual to dermatitis, such as age, sex, race, temperature and humidity, previous skin disorders, skin damage and personal hygiene. Work-related skin diseases are often easy to detect, although difficult to diagnose (Centre for Occupational and Environmental Health, 2005). Wearing proper protective clothing and washing frequently are the most effective means of prevention (Bradley, 2002).

Contact dermatitis is a skin disorder that can occur among agricultural workers (Bradley, 2002). There are two general categories: irritant and allergic. Irritants act directly on the skin at the place of contact. Allergic sensitizers, however, cause changes in the immune system so that subsequent contact even to small amounts produces a reaction. Phototoxic or photo allergic reactions occur when light, in combination with certain substances, causes skin disease. Other types of agricultural dermatitis include heat rash and insect and plant irritants (Rathinam, Kota and Thiyagar, 2005; Centre for Occupational and Environmental Health, 2005; Bradley, 2002).

5.11.2 Individual dermatitis prevention sub-programme

The suggested dermatitis prevention sub-programme (Figure 5.11) proposes procedures that should be followed to minimise the development of dermatitis in farm workers.

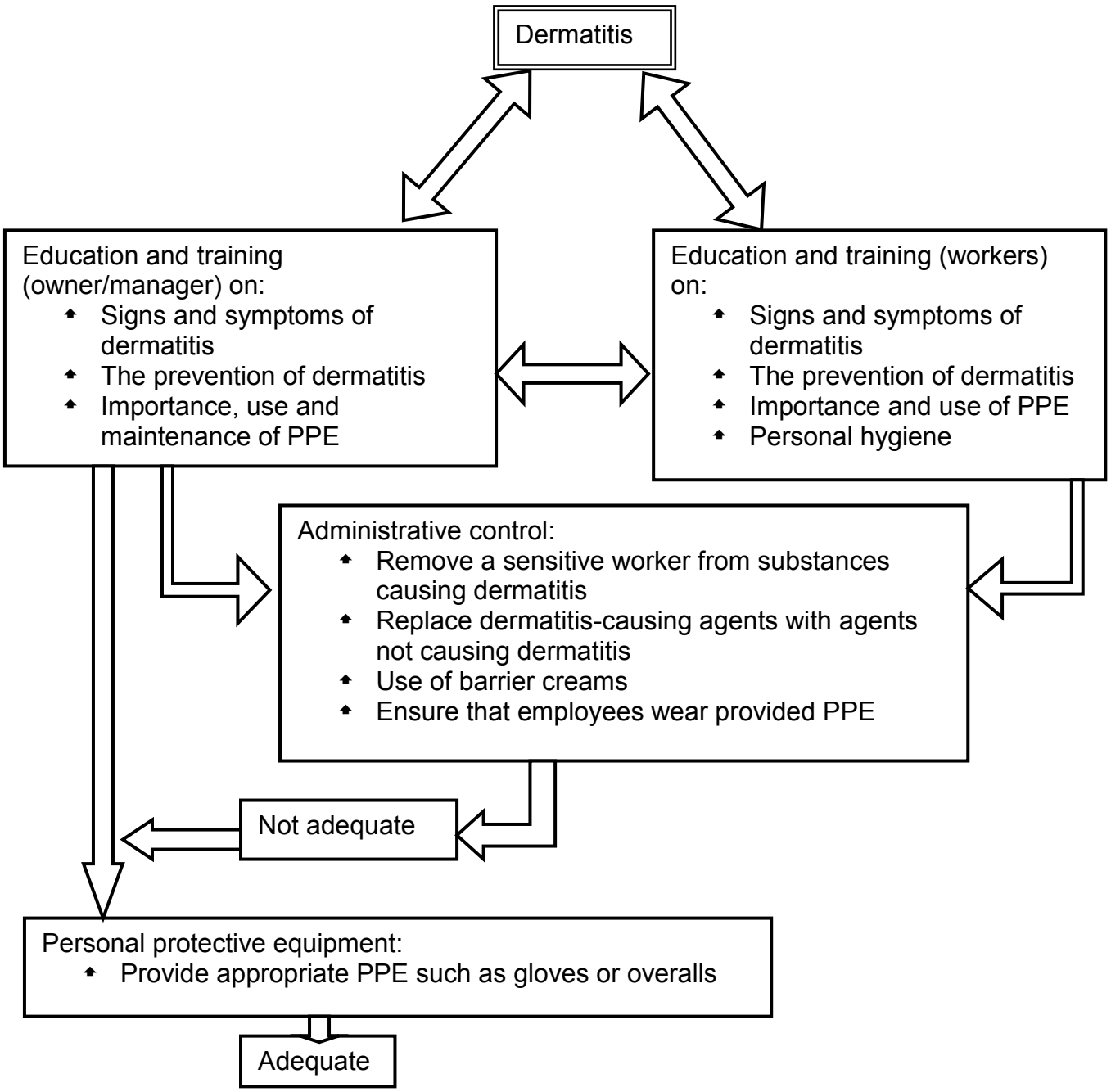


FIGURE 5.11: Individual dermatitis prevention sub-programme (PPE - personal protective equipment)

The occurrence of dermatitis can be reduced or minimised with the use of the correct education and training and the implementation of control measures. The farm owner and/or manager and the farm worker should receive education and training on the signs and symptoms of dermatitis as well as on the prevention thereof.

The administrative control measures require that farm workers who are sensitive to certain substances be removed from the work environment when these substances are used and given alternative work. If possible, the agents causing dermatitis should be replaced by agents that will not cause dermatitis. Barrier creams may be used as an alternative if the agents cannot be removed, but these creams are not always effective. Dermatitis can be prevented by ensuring that farm workers wear the appropriate PPE that is provided. The farm worker should also receive education and training on personal hygiene since this could reduce the possibility of developing dermatitis. The PPE that could be used includes clothing that ensures a barrier between the skin and the substances or agents used, such as gloves and/or overalls.

5.12 Trips, slips and falls in the agricultural environment

Trips, slips and falls could occur during the execution of normal agricultural activities. The following precautions should keep the occurrence of these injuries to a minimum:

- Tractor steps should be kept free of mud to help avoid slips and falls.
- Tools or other items that could cause a tripping hazard from equipment should be removed.
- Platforms, foot-plates and steps should be kept clear of mud, manure or other debris.
- The worker should not try to dismount machinery such as a tractor before it has completely stopped and the brakes are set. Thereafter, he/she should step down using handholds or rails. Worker should never jump off a tractor (moving or not) except in cases when the tractor comes into contact with energised power lines, and then he/she should jump as far away as possible.
- Preventative maintenance should be performed on equipment in the off-season. Trips and falls occur more frequently when the worker is in a hurry.
- Workers should be encouraged to practise safety by cleaning dust and debris from steps and/or platforms.

- Workers should be encouraged to wear shoes with a solid, slip-resistant tread; good traction should reduce the chance of slipping and falling (United States Department of Labor, n.d.)

6. CONCLUSION

An occupational health and safety programme should be implemented in all industries to minimise the exposure of workers to health hazards and the risk of injury, and should include the anticipation, identification, evaluation and control all environmental factors that could cause diseases, discomfort or injury. There is currently no existing occupational health and safety programme for agricultural activities in South Africa: the occupational health and safety programme proposed in this study was therefore compiled specifically for the agricultural environment. The general principles for occupational health and safety are all applied although adjusted and adapted to suit the specific agricultural environment.

Chapter 6 indicates the feasibility and acceptability of the suggested programmes to farm owners/managers.

7. REFERENCES

Alvarez, M. 2002. Excessive heat could cause a disaster for you. United States of America. Retrieved on February 5, 2003, from www.gpick.net/wea/Notices/ Excessive%20Heat%20Could%20Cause% 20A%20Disaster%20For%20You.htm

Arcury, T.A., Quandt, S.A., Russell, G.B. 2002. Pesticide safety among farm workers: perceived risk and perceived control as factors reflecting environmental justice. *Environmental Health perspect.* 2:233-240.

Baker, D.E., Ballenger, B., Lee, R. 1993. How to protect yourself from respiratory hazards. Columbia. Retrieved on March 20, 2005, from muextension.missouri.edu/xplor/agguides/agengin/g01935.htm

Bradley, K.R. 2002. Health hazards in agriculture - an emerging issue. Retrieved on January 21, 2005, from http://www.cdc/gov/nasd/docs/d001001-d001100/d001050/d001050.html

Centre for Occupational and Environmental Health. 2005. Health and risk. Resources for health-care professionals. Retrieved on February 14, 2005, from www.coeh.man.ac.uk/teaching_learning/resources/farms.php

Clayton, G.D., Clayton, F.E. 1978. Patty's industrial hygiene and toxicology. Third revised edition. Volume 1. New York: John Wiley and Sons. 165, 175.

College of Agricultural Sciences. n.d. Health hazards in agriculture. Oregon State University. Retrieved on January 21, 2005, from http://agsci.oregonstate.edu/research/FST_manual/3-3.htm

Dinardi, S.R. 1997. The industrial environment – its evaluation and control. Fairfax Virginia: American Industrial Hygiene Association. 404.

Engel, L.S. 1998. Neurophysiological function in farm workers exposed to organophosphate pesticides. *Archives of Environmental Health.* Retrieved on March 24, 2006 from http://www.findarticles.com/p/articles/mi_m0907/is_n1_v53/ai_20598439

Estill, C.F., Baron, S., Steege, A.L. 2002. Research and dissemination needs for ergonomics in agriculture. *Public Health.* 117(5): 440-445.

Farmsafe Queensland. 2002. Sugar industry risk assessment matrix. Western Australia. Retrieved on January 11, 2005, from http://www.safetyline.wa.gov.au/pagebin/farmhazd0036.pdf

Field, E.F. n.d. Harvesting operations. Encyclopeadia of Occupational Health and Safety. International Labour Organisation.

Guild, R., Ehrlich, R.I., Johnston, J.R., Ross, M.H. 2001. *Handbook of Occupational Health Practice in the South African Mining Industry*. The Safety in Mines Research Advisory Committee. 68.

Hattingh, S., Acutt, J. 2003. Occupational health management & practice for health practitioners. South Africa: Juta & Co Ltd. 88-90, 198.

Health and Safety Manual for Field Activities, n.d. United States of America. Retrieved on September 6, 2005, from http://www.inece.org/mmcourse/sect2.pdf

Higgins, D., Parker, D.L., Wahl, G. 2001. Hazards associated with using farm tractors to move large bales. Division of Safety Research, NIOSH, and Minnesota Department of Health. Retrieved on February 5, 2003, from http://www.safetyline.wa.gov.au /imagebin/trac_

International Labour Organisation. 1997. United States of America. Retrieved on March 20, 2005, from www.ilo.rog/public/english/bureau/inf/pr/1997/23.htm

International Labour Organisation. 2000. Occupational Safety and Health in Agriculture. Retrieved on May 13, 2005, from http://www.ilo.org/public/english/ protection/safework/agriculture/intro.htm

Kirkhorn, S.R. 2000. A primer for Wisconsin practitioners and health/safety professionals. Partners in agricultural health. Agricultural respiratory hazards and disease. Minnesota: University of Minnesota.

Kundiev, Y., Chernyuk, V.I. 2001. Planting and growing operations. *Encyclopedia of Occupational Health and Safety*. United States International Labor Organisation.

London, L. 1995. The health hazards of organophosphate use in South Africa. Pesticides News. (27):6-7. Retrieved on February 14, 2005, from http://www.pan-uk.org/pestnews/pn27/pn27p6.htm

Miles, K.H.R. 1997. Rural workplace human resource management guide. Retrieved on February 14, 2005, from TFGA Industrial Association. www.wsa.tas.gov.au

Myers, L.M. 2001. Health problems and disease patterns in agriculture. *Encyclopaedia of Occupational Health and Safety*. Retrieved on February 14, 2005, from turva.me.tut.fi/iloagri/natu/fh_main.htm

Nieuwenhuijsen, M.J., Schenker, M.B. 1998. Determinants of personal dust exposure during field crop operations in California agriculture. *American Industrial Hygiene Association Journal*. 59(1): 9-13.

Ngowi, A.V.F. 2002. Health impact to pesticide exposure in Tanzania. *African Newsletter on Occupational Health and Safety*. 12(3):71-74.

Occupational Health and Safety Administration. 2003. Agricultural hazards. United States of America. Retrieved on February 14, 2005, from http://www.osha.gov/Publications/ osha3151.pdf

Page, G.A. n.d. Agricultural chemicals. *Encyclopaedia of Occupational Health and Safety.* United States of America: International Labour Organization. Part IX, chemicals.

Pessina, D., Guerretti, M. 2000. Electiveness of Hearing Protection Devices in the Hazard Reduction of Noise from Used Tractors. *J. agric. Engng Res*. 75, 73, 80.

Petrea, C. 2002. Farm Safety & Health: Farm Electrical Safety. *National Safety Council's Agricultural Division, University of Illinois.*

Plog, B.A. 1988. Fundamentals of Industrial Hygiene. Third edition. United States of America: National Safety Council. 25, 27, 457, 461, 467, 473.

Rathinam, X., Kota, R., Thiyagar, N. 2005. Farmers and formulations - rural health perspective. *Medical Journal of Malaysia*. 60(1). Retrieved on February 14, 2005, from http://www.mma.org.my/info/6_rural_05.htm

Reynolds, D. n.d. Safety on the farm. United States of America. Retrieved on August 13, 2004, from http://www.saftek.net/ worksafe/farm_09.htm

Schenker, M.B. 1995. Schenker stresses need for agricultural health and safety awareness. *Agricultural Health News*. Volume 3.

Schoeman, J.J., Schröder, H.H.E. 1994. *Occupational hygiene*. South Africa: Juta & Co, Ltd. 222, 450.

Seger, D.L., Welch, L. 2001. Carbon monoxide poisoning from use of gasoline-fueled power washers in an underground parking garage. Columbia. Retrieved on September 7, 2005, from http://wonder.cdc.gov/wonder/prevguid/m0037050/ m0037050.asp

South Africa. 1987. Environmental Regulations for Workplaces. Pretoria: State Press. Pretoria: Government Printer.

South Africa. 1993. Occupational Health and Safety Act, Act 85 of 1993. Pretoria: State Press. Pretoria: Government Printer.

South Africa. 1995. Regulations for Hazardous Chemical Substances. Pretoria: State Press. Pretoria: Government Printer.

South Africa. 1996. General Safety Regulations. Pretoria: State Press. Pretoria: Government Printer.

South Africa. 2003. The noise induced hearing loss regulations. Pretoria: State Press. Pretoria: Government Printer.

Swedish National Board of Occupational Safety and Health on organic Dust in Agriculture. 1994. Organic dust in agriculture. Retrieved on September 7, 2005, from http://www.av.se/dokument/inenglish/legislations/eng9411.pdf

Tixier, J., Dusserre, G., Salvi, O., Gaston, D. 2002. Review of 62 risk analysis methodologies of industrial plants. *Journal of Loss Prevention in the Process Industries.* 15(4):291-303.

United States Department of Labor. n.d. Occupational Safety and Health Administration (OSHA). Agricultural Hazards. Retrieved on January 21, 2005, from www.osha.gov/SLTC/youth/agriculture/

United States environmental protection agency (EPA). 2005. Pesticides: Health and Safety. Retrieved on May 30, 2005, from http://www.epa.gov/pesticides/safety/workers/heatstre.htm

Wasserman, D.E. 2003. Occupational exposure: are you at risk? United States of America. Retrieved on August 10, 2006 from www.quest-technologies.com/APPNotes/Vibration_Paper.pdf

Western Center for Agricultural Health and Safety. 2004. California is the leading agricultural state. Department of Epidemiology and Preventive Medicine University of California. Retrieved on July 30, 2005, from http://agcenter.ucdavis.edu/

Zenz, C. 1994. Occupational Medicine. Third edition. United States of America: Mosby. 619, 828, 883,1049, 1196.

Zhao, W. 1993. Preventing cold-related illnesses in agricultural workers. Rutgers Cooperative Extension. New Jersey: Rutgers, the State University of New Jersey, Publication.

CHAPTER 6

FEEDBACK FROM A FOCUS GROUP OF CROP FARMERS OF THE MANGAUNG MUNICIPAL DISTRICT ON THE SUGGESTED OCCUPATIONAL HEALTH AND SAFETY PROGRAMME

1. INTRODUCTION

The attitude of farm owners/managers were tested towards the feasibility and acceptability of the suggested programmes.

1.1 Occupational Health and Safety programme for crop farm workers

The practice of occupational health and safety includes the development of remedial actions to control health hazards either by reducing or eliminating exposure to hazardous substances or conditions (The Hartford Loss Control Department, 2002). It may be deduced from the definition of occupational health and safety that the basic principles included in an occupational health and safety programme are the anticipation, identification, evaluation and control of hazards in the workplace (Schoeman and Schröder, 1994).

To achieve the above-mentioned for farm workers, an occupational health and safety programme should be designed and executed to protect farm workers in their occupational environment. This programme should ideally be applicable to the circumstances and specific health and safety risks inherent to the agricultural work environment. The basic elements that should be included in such a programme are the same as those for programmes in other industries, although the elements should be specifically applicable to the agricultural work environment.

1.2 Focus groups discussions

Focus groups can be defined as structured interviews, where 6-10 people are interviewed simultaneously (McNamara, 1999; Nielsen, 1997). Focus groups are

ideal for exploring studies, testing ideas about new programmes, solving specific programme problems, evaluating programmes and solving staff or management problems (Dawson, Manderson and Tallo, 1993). Ideally the people included in the focus group should be selected from the same study area as the original study area (McNamara, 1999; Nielsen, 1997). According to Evmorfopoulou (n.d.) some of the advantages of focus groups include the rapid and efficient acquisition of data, with fewer financial implications than is the case with individual interviews. The researcher is able to interact with respondents in focus groups to clarify questions and follow-up questions can be answered. Focus groups are flexible and can be used to examine a wide range of topics. The limitations of this manner of data collection include the following: it could limit generalisation to a larger population, the interaction of respondents may result in responses not being independent and the facilitator may intentionally bias results by not providing or by providing the desired answers (Evmorfopoulou, n.d.; Gibbs, 1997).

The design of the study included feedback from a focus group to explore the attitude of farm owners and/or managers from the Mangaung municipal district. This entails feedback regarding the feasibility and acceptability of the proposed occupational health and safety control programme.

1.3 Problem statement

Currently, there exists no comprehensive occupational health and safety programme for agricultural workers in South Africa. To effectively control, minimise, reduce or eliminate health and safety hazards associated with agricultural work on crop farms, a comprehensive occupational health and safety control programme for agricultural workers was compiled (see Chapter 5).

Before the suggested programme can be implemented it was necessary to ensure that the programme is both feasible and acceptable to the farm owners and/or managers who will implement the programme.

1.4 Aim and objectives of the chapter

The aim of this part of the study was to determine whether the suggested Occupational Health and Safety Control Programme (Chapter 5) is feasible and acceptable to the Mangaung municipal district crop farm owners and/or managers by means of feedback from a focus group selected from farmers in this area.

The objectives of this part of the study included:

- The determination of whether the suggested occupational health and safety programme would be feasible to the Mangaung municipal district crop farm owners and/or managers, and
- the determination of whether the suggested occupational health and safety programme would be acceptable to the Mangaung municipal district crop farm owners and/or managers.

2. MATERIALS AND METHODS

Ten Mangaung municipal district crop farm owners and/or managers were identified (a pre-existing study group of crop farm owners and/or managers from the study area) and selected to be included in the focus group discussion (McNamara, 1999). The members of the focus group thus came from the same area as the original study population.

A presentation was made by the researcher to the farmers, which included the overall occupational health and safety programme, and the sub-programmes for each identified health and safety hazard (Chapter 5) present on crop farms in this area. Subsequently the farmers were requested to complete a questionnaire.

The questionnaire (Annexure C) was compiled to include questions on all the different health and safety hazards covered in the proposed occupational health and safety programme, with two questions asked regarding each of the presented programmes. These questions were firstly, whether the selected farmers regarded the presented programme as feasible and secondly, whether the programme was acceptable to them. Responses from the selected farmers were

recorded as a yes or no. They could also include open comments on each of the suggested health and safety programmes.

The farm owners and/or managers were asked to complete the questionnaire regarding each of the presented programmes. The questionnaire was designed in Afrikaans since it is the language of preference for these farmers.

3. RESULTS AND DISCUSSION

The results are indicated as a percentage of the total sample size. Most of the farmers responded that the programme would be both feasible and acceptable (see Tables 6.1 and 6.2 for detail).

3.1 Overall suggested Occupational health and safety programme

The overall suggested occupational health and safety programme includes all the different health and safety hazards that crop farm workers are exposed to as well as the general control measures that could be implemented to minimise, reduce or eliminate these hazards and risks. Table 6.1 indicates the responses of the farmers to the question of feasibility and acceptability of the suggested programme.

TABLE 6.1: Responses from the selected farmers recorded for the suggested overall Occupational health and safety programme

	Feasible		Acceptable	
Responses	**Yes (%)**	**No (%)**	**Yes (%)**	**No (%)**
Recorded answers	**66.67**	**33.33**	**100**	**0**

Sixty-six point six-seven percent (66.67%) of the farm owners and/or managers responded that the suggested occupational health and safety programme would be feasible to implement on their farms, while 33.33% responded that it would not be feasible. All respondents agreed that the suggested programme was acceptable to be implemented on their farms.

The results showed that most of the farm owners and/or managers found the programme both feasible and acceptable. The combined positive responses to both questions were recorded as 83.34%.

According to some of the farm owners and/or managers the programme seemed to be too complicated to be implemented on their farms (13.33%). However, they also agreed that with the proper training it would be feasible since many do not understand the basic principles of occupational health and safety. The farmers (20%) also indicated that the administrative load of the farm owner and/or manager would increase with the implementation of this programme. One of their main concerns was the financial implication that the implementation of the programme would have on the farm owner. It was also indicated that in order to implement such a programme, legislation would be necessary to force the farm owners and/or managers to comply with the legislative requirements.

The Occupational Health and Safety Act (South Africa, 1993) stipulates that it is the responsibility of the employer to ensure that the work environment is as safe and as healthy as practically possible. Two of the respondents commented that it is the responsibility of the farm owner to minimise, reduce or eliminate hazards and risks to farm workers on their farms.

3.2 Individual sub-programmes for the control of health hazards on crop farms

Table 6.2 shows the responses recorded from the farm owners and/or managers regarding the individual health control programmes.

TABLE 6.2: Responses from the selected farmers recorded for the suggested sub-programmes for the control of individual health hazards

	Feasible			Acceptable		
Hazard	**Yes (%)**	**No (%)**	**Yes and No (%) ***	**Yes (%)**	**No (%)**	**Yes and No (%)****
Respiratory hazards	88.89	11.11	0	88.89	11.11	0
Noise	66.67	33.33	0	66.67	11.11	22.22
Whole-body vibration	55.56	44.44	0	55.56	44.44	0
Pesticide exposure	100	0	0	88.89	11.11	0
Heat stress	66.67	22.22	11.11	77.78	22.22	0
Ultraviolet radiation	66.67	33.33	0	66.67	33.33	0
Fertilisers	88.89	11.11	0	100	0	0
Ergonomics	77.78	11.11	11.11	77.78	22.22	0
Dermatitis	88.89	11.11	0	77.78	22.22	0
Average	**77.78**	**19.75**	**2.47**	**77.78**	**19.75**	**2.47**

* Respondents who felt that 50% of the programme was not feasible and 50% was feasible

** Respondents who felt that 50% of the programme was not acceptable and 50% was acceptable

The majority of respondents found the proposed sub-programmes for the control of health hazards present on crop farms both feasible and acceptable (77.78%) to be implemented on their farms. A few indicated that the sub-programmes are not feasible or acceptable (19.75%). In their comments they responded that the implementation of such a programme would have financial implications on the farm owner and that legislation would be needed to force them to implement these control measures. The additional administration involved in the

implementation of these programmes was also listed as a concern of farm owners and/or managers.

The rotation of workers and/or shortening of work shifts were indicated as possible by the respondents. They, however, emphasised that this implied that additional workers during certain times (i.e. planting of crops and harvesting) would be required, with concomitant financial expenses.

It was also suggested by the focus group that the implementation of these control measures would require adequate training of both farm owners and farm workers. They also voiced their concern about non-occupational exposures to certain hazards (e.g. workers who make fires inside their homes in winter) and they questioned whether the control measures implemented during work hours would have an effect on their overall exposure levels. This further indicates that education and training of farm workers is essential in the implementation of control programmes to reduce not only occupational exposure, but also non-occupational exposure.

The responses of the farm owners and/or managers of crop farms in the Mangaung municipal district to the safety control sub-programmes are presented in Table 6.3.

TABLE 6.3: Responses from selected farmers recorded for the suggested sub-programmes for the control of individual safety hazards

		Feasible		Acceptable	
No	**Hazard**	**Yes (%)**	**No (%)**	**Yes (%)**	**No (%)**
1	Tractor roll-overs	100	0	100	0
2	Caught in or between objects / loss of limbs	100	0	100	0
3	Slips, trips and falls	100	0	100	0
Average		**100**	**0**	**100**	**0**

The respondents all agreed that the sub-programmes for the control of safety hazards on crop farms are feasible and acceptable. Their responses furthermore indicate that farm owners and/or managers are aware of the safety hazards present on crop farms.

The farm owners and/or managers suggested that the proposed programmes should be presented to all farm owners and/or managers in the Free State. It was suggested that training of farm owners and/or managers on the health and safety hazards and the risks involved on crop farms should be conducted.

Other countries have additional/specific agricultural health and safety legislation designed for this work environment even though their occupational health and safety legislation as stated is not applied exactly in the agricultural environment. Under the United Kingdom Health and Safety at Work Act (Professional Health and Safety Consultants Ltd., 1974) specific agricultural health and safety regulations were promulgated. Australians are assisted by the Australian Centre for Agricultural Health and Safety to attain improved levels of health and well-being by action to reduce the incidence and severity of injury and illness associated with life and work in agriculture (Australian Centre for Agricultural Health and Safety, 2006). In 2001 the United States of America the National Institute of Occupational Safety and Health (NIOSH) developed nine regional centres with other regional and national agricultural organisations (NIOSH, 2001).

In June 2005, the Canadian government compiled a new regulation that would extend their Occupational Health and Safety Act to farming operations with paid workers. It will come into effect on June 30, 2006. This means that the rights and duties of workers and employers outlined in the Occupational Health and Safety Act of Canada regarding inspection and enforcement will be applicable and both workers and employers have to participate in workplace health and safety matters (OMAFRA Staff, 2005).

Under the Canadian Occupational Health and Safety Act the duties of employers include providing information, instruction and supervision to workers; advising workers about hazards in the workplace and notification of workplace fatalities

and critical injuries. Employers with six or more regularly employed workers also have to develop an occupational health and safety policy and programme (OMAFRA Staff, 2005).

However, countries like Canada are regarded as developed countries and the implementation of their Occupational Health and Safety Act in the agricultural community would therefore be easier. South Africa is regarded as a developing country and therefore the Occupational Health and Safety Act (South Africa, 1993) may be very difficult to implement in farming operations without certain adaptations for this specific work environment. The proposed Occupational Health and Safety Programme (see Chapter 5) is applicable to the specific circumstances found in South Africa. These circumstances relate to the specific work situations, machinery and/or equipment used and work hours on South African farms.

4. CONCLUSION

The results of this part of the study indicate that the suggested overall occupational health and safety programme, as well as the sub-programmes for the reduction, elimination or minimisation of health and safety hazards on crop farms in the Mangaung municipal district, is acceptable to the farm owners and/or managers.

5. REFERENCES

Australian Centre for Agricultural Health and Safety. 2006. National Farm Injury Data Centre. Australia. Retrieved on April 19, 2006, from http://www.acahs.med.usyd.edu.au/

Dawson, S., Manderson, L., Tallo, V.L. 1993. Focus group discussion. Boston. Retrieved on March 15, 2006, from http://www.unu.edu/Unupress/food2/UIN03E/uin03e00.htm

Evmorfopoulou, K. n.d. Focus groups methodology for the MADAME project. Retrieved on April 18, 2006, from http://www.shef.ac.uk/~scgisa/MADAMENew/Deliverables/FGEnd1.htm

Gibbs, A. 1997. Focus groups. England. Retrieved on April 18, 2006, from http://www.soc.survey.ac.uk/sru/SRU19.html

McNamara, C. 1999. Basics of conducting focus groups. Retrieved on March 14, 2006, from www.managementhelp.org/evaluatn/focusgrp.htm

National Institute of Occupational Safety and Health (NIOSH). 2001. Agricultural Centers Program. United States of America. Retrieved on April 19, 2006, from http://www.cdc.gov/niosh/about.html

Nielsen, J. 1997. The use and misuse of focus groups. Retrieved on March 16, 2006, from http://www.useit.com/papers/focusgroups.html

OMAFRA Staff. 2005. Farming Operations to come under the Occupational Health and Safety Act. Retrieved on March 3, 2006, from http://www.omafra.gov.on.ca/english/busdev/facts/ohsa.htm

Professional Health and Safety Consultants Ltd. 1974. United Kingdom Retrieved on April 19, 2006, from www.healthandsafety.co.uk/haswa.htm - 356k -

Schoeman, J.J., Schröder, H.H.E. 1994. *Occupational hygiene*. South Africa: Juta & Co, Ltd. 222, 450.

South Africa. 1993. Occupational Health and Safety Act, Act 85 of 1993. Pretoria: State Press. Pretoria: Government Printer.

The Hartford Loss Control Department. 2002. Loss control tips. Technical information paper series. Innovative safety and health solutions. Retrieved on March 24, 2005, from http://mb.thehartford.com/insurance_info/pdfs/820-001.pdf

CHAPTER 7

CONCLUSIONS AND REFLECTIONS

1. BACKGROUND

Agricultural workers are exposed to a wide variety of environmental hazards that are potentially harmful to their health and well-being. Occupational health and safety exposures of South African farm workers have thus far not been studied extensively. A need for the development of an occupational health and safety programme specifically designed for the protection of farm workers in South Africa thus exists.

Farms were selected from the Mangaung municipal district and a walk-through survey was conducted on each of the farms to determine the activities on crop farms, the number of employees and their working hours. The possible health and safety hazards and risks associated with each of these activities and machinery and/or equipment were anticipated and identified.

An occupational health and safety control programme with regard to occupational health and safety hazards and risks on crop farms was compiled, with the specific circumstances kept in mind of crop farms in the study area. An overall programme that included all the different health and safety hazards was designed. Thereafter each individual health and safety hazard was dealt with in separate sub-programmes. These sub-programmes included the control measures for each health and safety hazards in more detail. All the programmes included the basic principles of occupational health and safety namely: anticipation, identification, evaluation and control of the health and safety hazards.

Before the proposed occupational health and safety programme could be implemented on crop farms in this region, it was necessary to ensure the feasibility and acceptability of the programme by the farm owners and/or managers who would implement it. A focus group in this particular region was

selected to answer questions about the feasibility and acceptability as well as to give inputs regarding each of the programmes. The overall responses was positive regarding the feasibility and the acceptability of the suggested programme.

2. CONCLUSIONS

The following conclusions were drawn from the study:

- Farm workers in the Mangaung municipal district are involved in different types of activities using different types of machinery and/or equipment.
- The farm worker is required to do a variety of different types of work that involve different types of machinery and/or equipment.
- The main activities executed on the crop farms were the preparation of land, ploughing of land, planting of crops, application of pesticides and the harvesting of crops.
- The working hours of farm workers are longer than the normal industrial 8-hour work shift per day.
- The identified health and safety risks include extreme temperatures, ultraviolet radiation and inorganic dust.
- The applicable Hazard Identification Risk Assessment (HIRA) that was compiled and completed to indicate the risk rating of each of the identified health and safety risks on crop farms in the study area indicated eleven “high” risks, seven “moderate” risks and only one “low” risk.
- The occupational health and safety programme that was designed for these farm workers as a result of the study was judged to be both feasible and acceptable by the majority of a selected focus group of farm owners/managers from the Mangaung municipal district. The results from the focus group on the feasibility and acceptability of the proposed occupational health and safety programme indicated positive answers from the selected farmers.

3. RECOMMENDATIONS

The recommendations arising from the findings of the research are as follows:

- The proposed occupational health and safety programme should be implemented on crop farms in the Mangaung municipal district.
- The suggested occupational health and safety programme should be presented to as many crop farm owners and/or managers in the Free State as possible.
- It is suggested that the normal time-weighted average threshold limit value that is applicable to industry should be converted to relate to the longer work hours and therefore longer periods that farm workers are exposed to certain hazards.
- The education and training of farm owners and/or managers as well as farm workers is of the utmost importance. The implementation of the proposed occupational health and safety programme begins with the ability of farm owners and/or managers to identify health and safety hazards. Farm owners and/or managers should be able to complete a HIRA and to implement the appropriate control measures. It is suggested that the education and training programmes for farm workers should include sketches, diagrams or flow charts to accommodate illiterate workers. The education and training should include training in the identification of and signs and symptoms of over-exposure, as well as in the application of the appropriate control measures.
- The suggested occupational health and safety programme should be implemented in South Africa, with the necessary adjustments made to suit the different environments and climates. The programme is meant to be utilised in third world countries, although certain aspects are already being implemented in various first world countries.
- The government might consider the institution of incentives to encourage the application of the appropriate occupational health and safety programme to protect farm workers from the health and safety hazards present on farms.
- Legislation should be implemented which is specifically designed for the agricultural work environment.

4. REFLECTIONS OF THE STUDY

The research experience broadened the horizons of the researcher with reference to occupational health and safety. The application of the principles of occupational health and safety in a different work environment than the normal industrial set-up indicated that certain basic principles will always remain the same. However, the application of control measures could be adjusted to ensure an effective and applicable occupational health and safety programme for this unique work environment. Instead of concentrating on one type of exposure, the researcher was able to integrate all occupational health and safety stressors in an effective programme. Experience was gained in the anticipation and identification of occupational hazards. This enabled the researcher to compile an occupational health and safety programme including all possible hazards.

Although the study population was relatively small in relation to all crop farming activities in the Free State Province, it suggested that the types of activities will remain the same regardless of the sample size. Financial and time constraints made it impossible to include the monitoring of occupational health and safety hazards present in the agricultural work environment.

The study reached the goal of compiling an applicable HIRA and occupational health and safety programme for crop farms in the Mangaung municipal district. Even though the study area was small in comparison with the whole of the Free State, the study was designed to include as many health and safety hazards on crop farms as possible. Therefore, the programme could possibly be implemented on all crop farms in the Free State. The study served as a platform for additional research to be conducted on different types of farms.

5. FUTURE RESEARCH

Further research will entail the implementation and testing of the proposed occupational health and safety programme. An awareness campaign on the occupational health and safety hazards present on crop farms will be launched, starting in the Mangaung municipal district and thereafter the Free State province to facilitate and research the effective implementation of the programme.

Future research could furthermore include the actual determination of exposure levels of crop farm workers in their work environment. The evaluation of health hazards against the established occupational health and safety standards could indicate whether new exposure standards are needed for farm workers. Education and training programmes should be developed to suit the unique employer and employee in this work environment.

Annexure A

Farm name: _____ (Number:_____)
Farmer / contact person name and surname:_____
Contact number: _____

No	Activity	Number of employees	Hours	When / how long	Additional

Annexure B

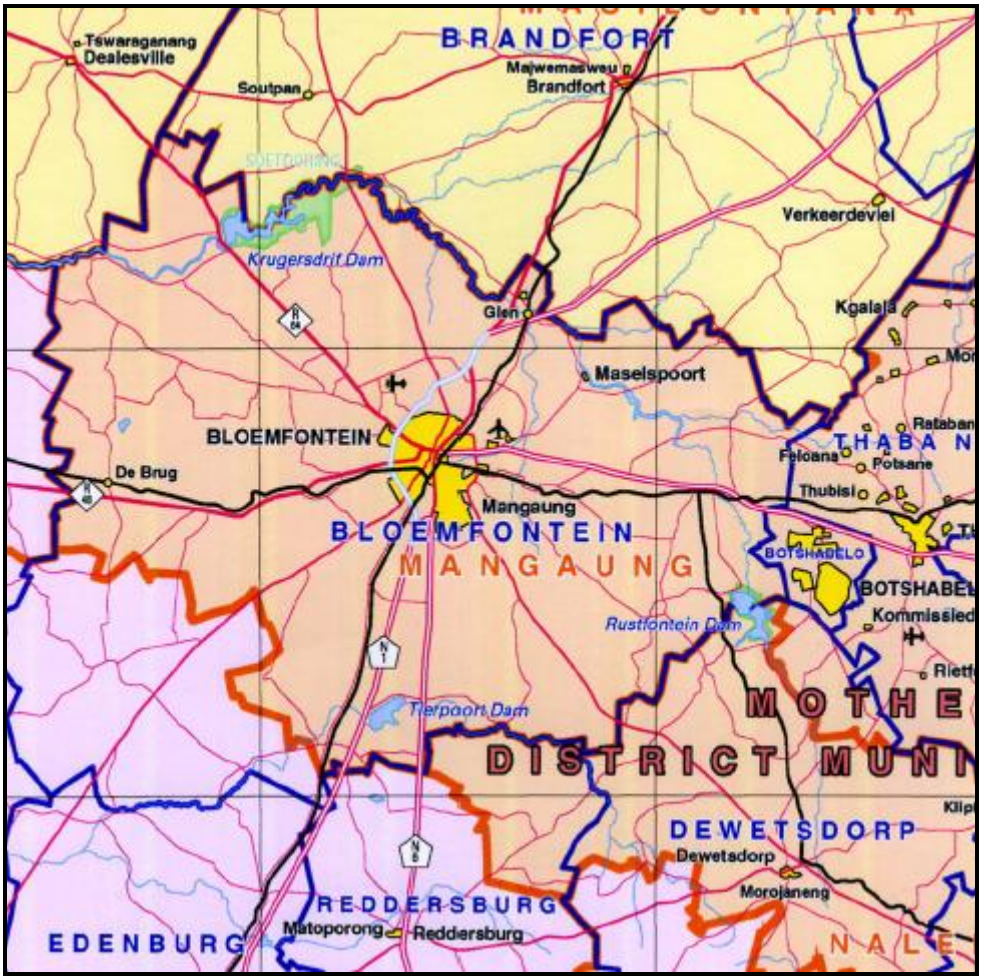


Figure A1: A map of the Mangaung municipal district, Free State

Annexure C

OCCUPATIONAL HEALTH AND SAFETY PROGRAMME QUESTIONNAIRE

Mark (X) the block that is applicable

1. Overall occupational health and safety programme

1.1 Is the proposed programme regarding the overall occupational health and safety for the control of hazards in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

1.2 Is the proposed programme regarding the overall occupational health and safety for the control of hazards in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

2. Respiratory hazards

2.1 Is the proposed programme for the control of respiratory hazards in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

2.2 Is the programme for the control of respiratory hazards in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

3. Noise

3.1 Is the proposed programme for the control of noise in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

3.2 Is the proposed programme for the control of noise in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

4. Whole body vibration

4.1. Is the proposed programme for the control of whole body vibration in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

4.2 Is the programme for the control of whole body vibration in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

5. Pesticide exposure

5.1 Is the proposed programme for the control of pesticide exposure in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

5.2 Is the proposed programme for the control of pesticide exposure in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

6. High temperature

6.1. Is the proposed programme for the control of exposure to high temperatures in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

6.2 Is the proposed programme for the control of exposure to high temperatures in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

7. Ultraviolet radiation

7.1 Is the proposed programme for the control of ultraviolet radiation exposure in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

7.2 Is the proposed programme for the control of ultraviolet radiation exposure in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

8. Fertilisers

8.1 Is the proposed programme for the control of exposure to fertilisers in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

8.2 Is the proposed programme for the control of exposure to fertilisers in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

9. Dermatitis

9.1 Is the proposed programme for the control of dermatitis in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

9.2 Is the proposed programme for the control of dermatitis in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

10. Ergonomics

10.1 Is the proposed programme for the control of poor ergonomic design in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

10.2 Is the proposed programme for the control of poor ergonomic design in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

11. Tractor roll-overs

11.1 Are the proposed control measures for the prevention of tractor roll-overs in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

11.2 Are the proposed control measures for the prevention of tractor roll-overs in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

12. Caught in or between objects

12.1 Are the proposed control measures for the prevention of this safety hazard in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

12.2 Are the proposed control measures for the prevention of this safety hazard in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

13. Trips, slips and falls

13.1 Are the proposed control measures for the prevention of this safety hazard in your opinion feasible?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____

13.2 Are the proposed control measures for the prevention of this safety hazard in your opinion acceptable?

YES **NO**

☐ ☐

Comments

_____

_____

_____

_____