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INTRODUCTION TO THE COURSE FOR THE TRAINER

The WHO Modules in occupational health, hygiene and safety are designed to provide education for professionals who are charged with the responsibility of protecting the health of workers: public health officers, physicians, nurses, policy makers, labor inspectors, and worker health and safety advocates. These materials were developed to implement the Forty-ninth World Health Assembly global strategy for occupational health (WHA49.12). Where relevant, the materials complement the effort of the International Programme on Chemical Safety (IPCS) Global Implementation Strategy on occupational risk management.

The materials are organized into three 16-hour, case based modules for a multidisciplinary audience, by economic sector: agriculture, manufacturing, and service. Occupational health encompasses many disciplines— toxicology, epidemiology, industrial hygiene, and safety. It employs the methods of hazard/risk identification, characterization, and evaluation and touches on issues related to policy and ethics. We have used the “economic sector” as an organizing format; classroom exercises are built around cases related to each sector and cover each of the occupational health disciplines in one classroom. The instructor may choose to re-organize the content to fit a different student group. For example, the hygiene-related exercises may be pulled out and re-assembled to educate a group of physicians in exposure assessment.

Each module has an instructor manual, a student manual, and a resources section that contains files with presentations and student exercises. The materials are in Microsoft Word (training manuals), PowerPoint (photos and lecture materials), Adobe Acrobat (pdf), and jpg files. They may be copied, altered, and re-arranged to fit the needs of the student audience. Instructors are encouraged to enhance the content by providing specific examples—readings and presentations—from the country in which they are taught.

**The Aim**

The aim of this course is to provide a basic but comprehensive introduction to hazards in the workplace and how to deal with them. The course is designed around the following principles:

- Workers are entitled to a healthy and safe work environment
- Risk evaluation requires a systematic approach that is essential for control and prevention of work related injuries and illnesses
- Sentinel health events have been traditionally used as an indicator of exposure to an occupational hazard. However, currently there is enough knowledge of workplace hazards to intervene prior to an adverse health outcome.

**Using the Materials**

This educational program is designed for implementation by experienced trainers (facilitators, tutors, and teachers) familiar with occupational health and safety, public health principles and the principles of participatory, student centered educational methods. The trainer should assess the needs of the participants and select those portions of the materials that best meet their needs. The Course Overview (section 1) introduces objectives, format and materials. The Introduction to Occupational Safety and Health (section 2) describes a framework for addressing occupational health and safety issues demonstrated throughout this curriculum. All trainers should read this material as the basis for the course. The material in section 2 may also be assigned to students; however, the curriculum is not dependent on students having read the material, only that the trainer is comfortable with the background information contained in this section. The rest of manual systematically addresses occupational health and safety issues.
Each manual contains about 16 hours worth of material. The three manuals offer about 48 hours of material which together offer a comprehensive introduction to occupational health and safety. The materials have been organized to cover recognition, assessment, and intervention in three economic sectors. For an introductory course, it is best to use all of the educational material in one of the manuals. Some of the exercises can stand alone, although it is intended as an integrated curriculum. In order to assist in the process, approximate time requirements are given for the exercises.

**Educational Methods**

The materials in this manual are designed to be delivered using a variety of teaching methods that will create an interactive learning environment tailored to the needs of a particular student group. The term “trainer” will be used to describe the facilitator, teacher, or tutor and “participant” to describe the people attending. Although some of the material is designed for a presentation-discussion format, much is designed so that the participants will become self-sufficient in learning more about Occupational Health. The goal is to give the participants knowledge, skills and tools to continue working in this area after the course has ended.

In almost every training situation, there will be a diverse group of people with different educational needs. The training materials should be chosen keeping in mind some basic facts about learning processes.

- Concrete experience- problem solving, discussing and researching real life problems
- Reflective observation – discussing problems and developing strategies for solutions
- Abstract conceptualization - applying principles to other situations
- Active experimentation - hands-on problem solving, implementing ideas

**Constructing a Program**

The exercises that appear in the manual will cover most of the basic training needs for the target audience. Educators should look for opportunities to supplement the material in the manual with other relevant information. Issues, such as legal protections, are covered generally and provide training on a process. Local information on standards and worker rights will need to be assembled and introduced by the instructor.

Films and videos are not used in this curriculum, but may be useful supplementary materials to introduce topics and provide for local relevance. However, care should be taken to select material that reflects the basic principles of the manual.

**Skills Training**

A major aim of this curriculum is to provide the participants with skills to address workplace health and safety problems in their communities. In addition to increasing their knowledge of the content material, participants will develop skills in using a framework for approaching workplace health and safety problems including hazard/risk identification and characterization, qualitative risk assessment, control strategies development, and risk communication.

**Resources**

The provision of information resources is an essential part of this program. Many of the exercises will be enhanced by the use of documents, texts, factsheets, and the world wide web. Each module has a resources section that contains these documents, as well as slide shows in MS Power Point to be used in the course.
Overall Course Outline

1. Course Overview
   a. Introduction to Course Objectives, Format, and Materials
   b. Introduction to Occupational Safety and Health (Presentation #1)

2. Sentinel Health Event or Awareness of Exposure Hazard
   a. Section Overview
   b. Occupational History
   c. Sentinel Health Event Discussion
   d. Summary Points

3. Qualitative Exposure Assessment
   a. Section Overview
   b. Discussion of Terms and Concepts
   c. Information Gathering Exercise and Discussion
   d. Conducting a Walk-through Survey Exercise and Discussion
   e. Chemical Exposure Exercise and Discussion
   f. Summary Points

4. Defining Exposure Profiles and Hazard Judgement
   a. Section Overview
   b. Discussion of Terms and Concepts
   c. Similar Exposure Groups Exercise and Discussion
   d. Exposure and Health Effects Discussion of Terms
   e. Rating Exposure and Health Effects Exercise and Discussion
   f. Summary Points

5. Quantitative Assessment
   a. Section Overview
   b. Surveillance Discussion
   c. Quantitative Exposure Assessment Lecture and Discussion
   d. Quantitative Exposure Assessment Exercise and Discussion
   e. Summary Points

6. Interventions
   a. Section Overview
   b. Exposure Reduction Discussion
   c. Evaluating Controls Exercise and Discussion
   d. Policy Exercise and Discussion
   e. Summary Points

7. Course Evaluation
1. **Course Overview**

   a. **Introduction to Course Objectives, Format, and Materials**

   **Instructor:**
   - *Introduces self*
   - *Asks for student introductions*
   - *Orients students to objectives, materials, sections of course, activities*

   **Materials**
   - Index cards
   - Markers
   - Name Cards
   - Course materials
   - Flipchart and tape

   **Things to do**
   - Distribute student course materials, index cards and markers

   **Recommended method of delivery**
   - 15 minutes Introductions
   - Introduction of faculty and students, course organization and course materials.
   - 30 minutes Presentation on Framework and Extent of the Problem
   - Instructor presents information in Presentation 1-Introduction to Occupational Safety and Health

   **Objectives:** At the end of this module participants will be able to:
   1) Recognize a sentinel health event as an indicator for workplace exposure
   2) Diagnose a pesticide poisoning case
   3) Complete an occupational history for a farm worker
   4) Complete a job hazard analysis for pesticide applicators
   5) List exposure groups for farm workers
   6) Complete an exposure and health effect rating chart
   7) Develop a strategy for collecting quantitative data
   8) Discuss surveillance techniques for worker and community populations
   9) Recommend intervention strategies for reducing exposure

   **Specific Skills:**
   - ✓ Fill in a work history form
   - ✓ Complete a process description
   - ✓ Generate and complete a workplace assessment (walkthrough) checklist
   - ✓ Read a material safety data sheet
   - ✓ Read a label
   - ✓ Fill in exposure and health effect rating chart
   - ✓ Use hierarchy of controls fact sheet
   - ✓ Develop a checklist for field observation
   - ✓ Recommend employee, work site specific, and community policies for reducing workers risks to injuries and illnesses
   - ✓ Communicate about the issues of workplace health and safety
Administration of Sections in this Module
Several sections are designed to be delivered using a lecture/discussion training method. Other sections are designed to be delivered using the small group activity method. Participant generated ideas will provide guidance to the trainer on how the module will be completed. The trainer should use the summary points to provide guidance on the essential points from these activities.

Student Materials
- Agenda
- Student Satisfaction Critique
- Course materials
- Handouts

Recommended Resources
- ILO Report VI (1) Safety and Health in Agriculture 88th Session 30 May-15 June 2000
- National, regional, or industrial based regulations.

Recommended method/time of delivery for this section
- 15 minutes Introductions
  - Introduction of faculty and students, course organization and course materials.
- 30 minutes Presentation on Framework and Extent of the Problem
  - Instructor presents information in Presentation 1-Introduction to Occupational Safety and Health
b. Introduction to Occupational Safety and Health Presentation (Presentation)

INTRODUCTION TO THE WHO MODULES IN OCCUPATIONAL SAFETY AND HEALTH

The health and safety of workers is generally given a low priority across economic sectors. Sustainability, human and material resources, and production are primary concerns in both large and small enterprises; in the informal sector, subsistence is critical. The trend toward “globalization” provides additional challenges to worker health and safety. This course is designed for public health personnel who are charged with the responsibility of protecting the health of workers. This may include public health officers, physicians, nurses, policymakers, plant managers, and union health and safety representatives.

This curriculum takes an interdisciplinary approach to addressing the injuries and illnesses related to work. It is based on the premise that primary prevention is the optimal approach to protecting the health of workers. Each section of this course helps to complete the puzzle of the people, methods, technology, and policy it takes to reduce worker illness and injury. By mastering the knowledge and skills presented, participants will be able to respond to a wide range of occupational health and safety problems across industries, in large and small enterprises.

A process-based framework has been developed for addressing health and safety in all size enterprises. Each section is based on actual cases that have come to light in different locations throughout the world. Whether it is an injured worker, an ill workforce, an unanticipated chemical release or a chronic, hazardous exposure, this framework offers a systematic approach to gathering and interpreting information and making decisions, even with limited resources. The ultimate objective is to characterize and reduce or eliminate workplace hazards.

A schematic diagram of the approach developed for this series is shown in Figure 1. It is an adaptation of the approach presented in Mulhausen and Damiano (1998). It shows a flow chart that moves linearly but loops back in several locations. The user may enter the problem-solving process at a number of locations in the diagram, depending on how s/he becomes aware of the workplace hazard. After completing individual sections (boxes), the user may move forward or go back and re-evaluate prior steps, filling in information, as needed. The ultimate goal is to reach the bottom of the chart—that is, to decide on an appropriate set of interventions with a strategy for implementing them.

It should be noted that while an approach to controlling workplace hazards may be applied internationally, a single course could not take into account all of the economic, political, social, and cultural circumstances that affect workplace health and safety around the world. There are local and international resources available that may help to inform specific solutions to specific problems. These may be brought into the framework of this WHO curriculum, or applied in other ways.
Scheme for Addressing Health and Safety in the Workplace
Basis for the Instructional Approach in this Module
Diagram Box #1: Sentinel Health Event or Awareness of Exposure Hazard

The first step in the process is recognition that a workplace health hazard exists. This may come to light because of a worker who has been made ill, because workers or managers recognize a hazardous situation, because a change in process is planned or anticipated, because a major event, like a chemical release, has occurred, etc. A “sentinel health event” is a work-related injury or illness that alerts you to the fact that workers are at risk. It is also possible to recognize a hazardous situation before anyone becomes ill: if you know about the presence of a toxic chemical or dangerous machinery, it is possible to take action before a worker gets injured.

Once a sentinel event or exposure hazard is recognized and there is an understanding that workers are at risk, the next step is to define or characterize the problem through further investigation. It is important to determine the goal of the investigation prior to starting:

- Do you want to determine if the exposure(s) are high enough to cause disease?
- Do you want to ensure compliance with standards or guidelines?
- Do you want to evaluate the effectiveness of new controls?
- Do you want to begin building an exposure profile (database)?
  - For each worker?
  - For each process?

By taking time to define the problem, it is more manageable to implement the next steps--conducting an assessment and deciding on what additional information is needed. Characterization of the problem is also useful in developing a team vision for addressing the problem. A multidisciplinary approach, while ultimately the most effective, can also be a challenge because of differences among the experts as to the definition of the problem.

Other questions that should be answered include:

- Are you investigating the risk to one worker?
- Are you investigating one incident involving one or more workers?
- Are you investigating the risk to the workforce from one hazardous agent or one part of the work facility?
- Are you investigating the risk to the entire workforce at one facility?

Most often, it is an individual--e.g., a health care worker, a manager, a union official, a worker--who identifies a sentinel event or existing hazard. This individual will need to consider whom to include in an assessment of the problem. Those included could be workers or worker representatives, supervisors and managers, health care providers, safety and health professionals, epidemiologists, government, and/or non-governmental organizations. In some settings, team or multidisciplinary problem-solving may not be available and these roles may all need to be carried out by the same person. If an interdisciplinary team is assembled, it will need to discuss the purpose of the investigation and their point of reference. Is the purpose…

- Diagnosing and treating disease?
- Controlling exposure?
- Policy-making?
- Organizing workers?
- Other?

Answering these questions will provide important guidance for the comprehensive assessment, control and prevention of work related injuries and illnesses. The following sections provide concepts
and tools for characterizing workplaces, assessing hazards (health and exposure), and making recommendations on the control and prevention of workplace injuries and illnesses.

**Outcome of this stage of investigation: A list of goals for further investigation.**

**Diagram Box #2. Qualitative Assessment**

**Qualitative Exposure Assessment**

The overall goal of the qualitative assessment is to characterize the workplace—that is, to provide a complete summary of all available essential information on workers, tasks, agents, potential exposures, and potential health effects.

The “qualitative assessment” step involves understanding the process leading to potential exposures; developing an inventory of chemical, physical, and biological agents; characterizing the workforce, including job descriptions, tasks, and number of workers; and characterizing the environmental agents by examining the available health effects data and current regulations and exposure limits. The investigation may concern one worker or one agent or a whole or part of a workplace or a workforce. Checklists are extremely useful tools for gathering comprehensive, organized material.

Background information is a building block to understanding and defining the problem. Collect and organize available information on:

- Manufacturing or work process(es)
- Job tasks
- Raw materials
- Products
- By-products
- Waste products
- Processing aids

Detailed literature is available on processes, activities, materials, job tasks, etc. Most economic sector processes are well known and described somewhere. Information is available through books, journals, internet sites, government documents, and trade and industry publications. Information is also available from newspapers and other public documents. In addition, in some countries companies are required to collect data on exposure and injuries and illnesses and maintain these records for up to 30 years. In other countries worker representatives have the ability to collect and maintain records. Compiling general and if possible specific information on a process or task is useful for defining the scope of the problem.

In focusing the problem, well-researched background information can also be helpful in:

- Targeting resources (time, staff, financial)
- Highlighting a particular problem or concern (imminent danger) or for justifying the implementation of a less aggressive intervention
- Guiding decisions based on the similarities of the existing situation with those found in the literature.

The goal is to collect as much information on the work process as is available.
Outcome of this stage of investigation: Complete summary of available essential information on workers, community members, tasks, agents, potential exposures, and potential health effects

**Qualitative Health Assessment**

The overall goal of the qualitative health assessment is to get a sense of the illnesses and/or injuries that may occur in a workplace, given a known set of exposures. Adverse health conditions may come to the attention of public health practitioners through presentation of individuals or groups of workers with an illness or injury. Alternatively, and optimally, knowledge and understanding of hazardous workplace conditions should lead to preventive measures prior to disease development.

While primary prevention is the goal, the next best alternative is recognition of an adverse health condition when it can still be reversed (secondary prevention). For an individual and a population of workers, death, disability, and chronic disease represent major failures of the public health system. We should not need to “count the bodies” before recognizing that the potential for injury exists.

Some workplaces conduct health monitoring of their employees because of the presence of known hazards. If available, examination of existing health records may enhance the understanding of the impact of a given industry on the health of its workers.

As in qualitative exposure assessment, gathering background information about health—in this case, toxicology and epidemiology—is critical to understanding how workplace conditions and chemical/physical/biological agents interface with the human organism to cause illness or injury. Through textbooks, scientific journals, internet sites, and government documents, the scope of occupational illness and injury can be defined. It is health data, and knowledge of mechanisms of disease development, that should drive control of workplace hazards.

Outcome of this stage of investigation: a summary of health effects of a possible exposure hazard; a list of resources that cover this information

**Diagram Box #3. Hazard Judgment or Exposure Profile**

Based on elucidation of exposure hazards and the consequent adverse health effects, a judgment about the hazard potential of a workplace may be made. The process of evaluating the health and safety of a workplace include developing an exposure profile, determining whether adverse health conditions exist, and reviewing background information on the relationship between exposure and disease. At this point, the public health practitioner must make a determination of whether:

- There is a health and safety problem in the workplace
- An imminent hazard exists
- A more in-depth assessment of exposure and disease is necessary

One way to approach these questions is to utilize the “criteria for causation” developed by Sir Bradford Hill.

- Temporal consistency: exposure to a given agent always precedes disease development. Workers’ illness should follow exposure to a putative agent or condition.
- Strength of association: expresses the disparity between the frequency of a given cause if found in disease states versus non-disease states; i.e., how tight is the association between exposure and disease. An assessment of this should come from reviewing scientific literature.
- Biological gradient: dose-response relationship—the higher the dose of exposure the more likely disease will develop and the more severe the symptoms. If studies have shown this, then there is more likely to be a cause effect relationship between a putative exposure and development of disease.

- Biological plausibility: effect is predictable based on the effects known to be caused by the agent or by agents similar to it in actions. When studies are not conclusive, one needs to consider whether the health condition in question could possibly be related to the exposure of concern.

- Consistency: similar observations by multiple investigators in different populations under different circumstances. Again, if many different studies under different circumstances have linked a specific exposure and disease outcome, one would use that information to judge the connection between the current exposure of interest and disease.

- Specificity: a unique exposure-response linkage (i.e., if you see a disease, you can assume the exposure). Malignant mesothelioma, a cancer of the lining of the lung is very rare and has been shown to be related to asbestos exposure. In fact, this cancer is almost never seen without prior exposure to asbestos.

- Coherence: cause and effect interpretation for an association is not in conflict with other scientific data. A careful review of scientific data is important to assure that there is logic in assuming a causal connection between exposure and disease.

- Analogy: Do other similar agents have similar effects? When scientific data are sparse, one could consider studies that have looked at workplace conditions or chemicals that are similar to the current chemical agent of concern.

If you gather enough background information to allow rigorous consideration of each of Bradford-Hill’s criteria, this should assist in making a judgment about whether a hazard exists that needs attention.

The current concept of “control banding” fits the qualitative assessment and hazard judgment boxes in this schematic diagram. It usually is possible to determine whether a workplace problem needs attention without actually monitoring and quantifying the hazard. Rather than using resources to get exact quantification of the amount of a chemical agent in the air, Control Banding focuses resources on exposure controls. Since it is not possible to assign a specific Occupational Exposure Limit to every chemical in use, a chemical is assigned to a "band" for control measures, based on its hazard classification according to international criteria, the amount of chemical in use, and its volatility/dustiness.

**Outcome of this stage of investigation:** a decision about whether a hazardous condition exists that requires attention

**Diagram Box #4. Quantitative Assessment**

*Quantitative Exposure Assessment*

Quantitative Exposure Assessment is conducted when more information is needed to determine a baseline or routine exposure; to assess compliance with existing regulations; or for diagnostic purposes. If the information is not needed for any of these reasons, then quantitative assessment may not be necessary—again, Control Banding would be the proper approach. Prior to beginning a quantitative assessment, it is essential to define the monitoring objectives and outline an exposure assessment strategy. Quantitative exposure assessment requires an understanding of:

- Routes of exposure (inhalation, ingestion, dermal absorption)
- Principles of industrial hygiene (it is best to control the hazard at the source, rather than at the worker (i.e., alter the machinery or work process before requiring personal protective equipment)
- Specialized equipment and operator skills
• Skills in data analysis and interpretation.

In some cases, observations and limited measurement information can be used to estimate exposure level. These include an estimation of average exposure from point measurements, and estimating changes based on observation of process and tasks.

Quantitative exposure assessment can be important, useful or essential if the information is needed for compliance, determining baselines or for diagnostic purposes. However, if the monitoring objectives and assessment strategy are not well thought out and available equipment and resources are scarce a more complete qualitative assessment may provide the necessary information for making decisions.

**Outcome of this stage of investigation: a decision about whether to conduct an exposure assessment; a plan for the assessment**

**Quantitative Health Assessment**

A further, quantitative health assessment may be conducted if:

• It is determined that a potential for illness or injury exists
• There are reasons to believe a workplace exposure is related to disease, but not enough research has been conducted or published in this area
• Justification for instituting environmental controls is required

The health assessment may consist of:

• A survey of workers (e.g., questionnaire, interviews) regarding exposure and health
• Physical and laboratory examination of workers
• Research on a cohort of workers to evaluate the relationship of an agent and consequent disease

**Outcome of this stage of investigation: a decision about whether a quantitative assessment is needed; a design for further investigation**

**Diagram Box #5. Interventions**

**Exposure Control**

There is an order or priority when it comes to evaluating controls. The best controls are those that work at the source of the problem; the least desirable are those that control the exposure when it gets to the worker. The further from the source, the less desirable or effective is the control. Again, the hierarchy is as follows:

Best: At the source
Second Best: Along the path
Least Desirable: At the worker

Every particular process must be evaluated individually to determine the optimal method of control. In some cases it will be necessary to combine a number of different methods to control, successfully and completely, a particular hazard or dangerous process.
Engineering Controls - the optimal way to prevent illness and injury

- Substitution: substitute a less hazardous alternative
- Redesign the process
- Mechanize the process
- Use local exhaust ventilation
- Improve general ventilation
- Create barrier or “dike” the process

Administrative Controls

- Isolate the process
- Improve housekeeping
- Conduct routine and Preventive Maintenance
- Implement special work methods (e.g., wetting down dusty processes)
- Incentives/disciplinary measures
- Posting of warning signs
- Proper supervision

Personal Protective Equipment

- Match the equipment to the hazard
- Fit the worker
- Train in use of the equipment
- Maintain or replace equipment
- Implement record keeping

General Cleanliness

- Sweep dirty floors and surfaces
- Frequent weeding
- Proper arrangement of working tools
- Proper disposal of waste and waste collection

Medical Interventions and/or Surveillance

Occupational health services are designed to provide prevention, diagnosis and treatment for occupational injuries and illnesses. **Primary prevention** is aimed at the individual who has the potential for exposure, but has not yet developed the disease. In this case, the goal is to change exposure conditions. This is addressed, above, in the hygiene interventions sections. In **secondary prevention**, the focus is on the individual in whom the disease has started, but the symptoms have not yet appeared or are reversible. The goal here is to reverse the process before disease develops. **Tertiary prevention** is aimed at individuals with symptomatic disease. The goal here is to cure or control the disease. The need for secondary and tertiary prevention is evidence of failure of the system to control exposure.

An occupational example of primary prevention is eliminating a hazardous substance, substituting a hazardous substance with a less hazardous substance. An occupational example of secondary prevention is the withdrawal of lead-intoxicated workers from the workplace. In this case, damage may be stopped or reversed. Obviously, the workplace must be cleaned up to prevent re-exposure to lead. Treatment of a back injury is an example of tertiary prevention. The worker undergoes clinical treatment (e.g., medication and physical therapy) to treat his back disease. When he is cured or significantly improved, he may return to the workplace. Again, intervention strategies designed to prevent re-injury of the back are important for this worker and his co-workers. Interventions may also be necessary for the continued care of workers with permanent disabilities.
Surveillance is the monitoring of health events and hazardous exposures in working populations to prevent and control hazards and their associated diseases and injuries. There are four components to a surveillance system:

- Gathering information on exposure and health outcomes
- Distilling and analyzing the data
- Disseminating data in an organized form
- Using data to target or evaluate interventions

A surveillance system is an intervention strategy that can be used to monitor and intervene in workplace health and safety.

**Policy Interventions**

In addition to the workplace based interventions there can be political and legal interventions that would control exposure. These interventions include regulations, policies, and programs that are implemented on a regional or national level. The policies may be developed and promoted by the government, trade or professional associations, or by employer and employee groups.

Policy recommendations for the prevention of work related disease have been set forth by the World Health Organization (WHO). In 1981 the WHO Occupational Safety and Health Conventions stated that for all branches of economic activity: “Each member shall, in the light of national conditions and practice, and in consultation with the most representative organizations of employers and workers, formulate, implement and periodically review a coherent national policy on occupational safety, occupational health and the working environment. The aim of the policy shall be to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimizing, so far as is reasonably practicable, the causes of hazards inherent in the working environment.” This principle provides a direction for the development of national, regional and local policies designed to reduce injury, illness and death to workers.

**Outcome of this stage of investigation:** to decide on and implement an appropriate health and/or exposure-related intervention; to design a plan for evaluating that intervention

**Diagram Box #6. Risk Communication**

Workers and their families have an obvious concern about the impact of work on health. Is the worker safe in the short run and in the long run? Will the worker be able to contribute economic support to his/her families as long as necessary? Will the worker stay healthy into old age, even after he stops working? Are family members at risk from one member’s job? Communicating findings from evaluations, plans for interventions, and effects of ongoing intervention programs is an important way to allay fears and gain cooperation of workers in health and safety programs.

**Outcome of this stage of investigation:** a strategy for communicating risk to interested parties
2. Sentinel Health Event or Awareness of Exposure Hazard

a. Section Overview

Objectives
1. Recognize the potential of adverse health outcomes from workplace exposures
2. Complete a worker exposure history
3. Define a sentinel event

Materials Needed
- Chalkboard or flipchart
- Markers
- Student Materials
- Handouts for questions 1-9
- Skit dialogue

Things to do before the lesson
- Post case related pictures/information on the wall and/or as a handout
- Workers
- Pesticide container
- Pesticide label
- Physical Exam form
- Work history form
- List categories of disease
- List organ systems
- Molecule drawings
- Blank tables

Recommended Methods for Delivery (Page 2 of Participant Materials)

5 minutes  Section Overview
The instructor should orient the students to the materials posted around the room. These materials are useful resources in helping to understand the process for diagnosing illnesses.
*Discussion-What are common symptoms of exposure to chemicals? What kinds of illnesses have you seen with agricultural workers?

5 minutes  Presentation of Case Study
One student reads the case report aloud.
*Ask the participants if they have questions about the case. If there are questions ask other participants if they can answer or clarify.

10 minutes  Role Play: Taking an occupational history
Instructor asks for two volunteers, one to play the part of patient the second health care provider, advocate, or co-worker. If students do not volunteer, instructors should take the parts. The participants are given a copy of the skit to follow along and an example of a work history form.

35 minutes  Exercise: Using an Occupational History Form
Pair the students. Have each one fill out the occupational history form, asking partner the questions on the form (20 minutes). Discussion of Exercise (20 minutes)
Discuss the exercise and answer the discussion questions in a large group.

5 minutes  Review Summary Points
**Case Presentation**

JM is a 19-year-old man who is carried to the emergency room of a community hospital because of difficulty breathing and confusion. According to his co-workers, he has been coughing for the last few days. Today his cough worsened, he developed diarrhea, and, in the hour prior to arrival at the hospital, he became confused. The patient is unable to provide a medical history. His coworkers state he is generally healthy and is on no medication. On physical examination, JM appears anxious and confused, and is in mild respiratory distress. His blood pressure is slightly elevated, his heart rate a little slow. His skin is wet with sweat and wheezing is heard in his chest.

The doctor questions the co-workers about what JM has been doing at work. He finds out that they were spraying strawberries with pesticides. The doctor recognizes that JM has pesticide poisoning—specifically, organophosphate poisoning. The doctor treats JM appropriately, and in two days he appears completely healthy.

b. **Occupational History Exercise**

In many places, medical schools do not teach doctors-in-training to recognize or ask about the relationship between work and illness. In this case, J.M. was lucky because his co-workers were available to answer questions and the doctor recognized the signs and symptoms of organophosphate pesticide poisoning. However, it is important that doctors and other health care providers ask an exposure/workplace history so that they do not miss an important diagnosis.
Script for Role Play: Taking an Occupational History

**Scenario:** A worker goes to the doctor because he is not feeling well.

**WORKER/PATIENT:** I haven’t been feeling well for just about a week.

**CLINICIAN:** What seems to be the problem?

**WORKER/PATIENT:** Every day this week I’ve started the day feeling just fine. But sometime in the afternoon I start to feel weak and shaky. I’m sweating a lot, and I feel nauseated. This lasts until I go to bed, but it disappears while I am sleeping. I think I must have some kind of virus.

**CLINICIAN:** Have you had a headache, fever, vomiting, dizziness, or changes in your vision?

*(Worker/patient shakes his head “no” to all of these.)*

**CLINICIAN:** Any change in your appetite? Is anyone else at home sick?

**WORKER/PATIENT:** Well, my appetite is poor, but I just can’t figure out what it is.

**CLINICIAN:** Do you have any medical illnesses? Do you take any medication?

**WORKER/PATIENT:** Nope

**CLINICIAN:** What kind of work do you do?

**WORKER/PATIENT:** I’m a farm hand at a private farm nearby.

**CLINICIAN:** Are you doing anything unusual at work this week? I mean something that you don’t usually do?

**WORKER/PATIENT:** I do all different things on the farm—whatever’s needed. I repair machinery, drive a tractor, help with the planting and the harvest…a whole lot of things. This week I’ve been spraying the strawberries.

**CLINICIAN:** Do you know the name of the chemicals you’re spraying?

**WORKER/PATIENT:** Well, one of the chemicals is malathion. There are a couple of other ones, too.

**CLINICIAN:** Can you describe the operation to me? What are you wearing? How many people are around you? What’s the delivery system for the pesticide?

**WORKER/PATIENT:** Well, I do it like I’ve always done it. I wear a long sleeve shirt, long pants, and my work boots. I roll up my pants and take off my shoes so they won’t get stuck in the mud. Then I pull the sprayer up on my back and I walk down the rows; I hold the wand and spray the crop.

**CLINICIAN:** Do you ever get any on your skin? I mean do your clothes get soaked?
WORKER/PATIENT: Oh, sure. Especially when one of the farm workers pours the chemicals into the sprayer while it is still on my back. I could be walking around with soaked clothes for hours.

CLINICIAN: I think I know what the problem is. You’re probably getting some pesticide poisoning. I need to look up that chemical and find out what kind of problems it causes.

WORKER/PATIENT: I’ve sprayed a lot over the years, but I’ve never had a problem like this before!
**Exercise and Discussion**

**Exercise**

In pairs, complete the Occupational History form (following pages). One person should act as the clinician and ask the other about his or her current job and occupational history. When you have finished, switch roles and complete the form again.
## Occupational History Form

Name: ____________________________  Gender:  M  F

Birthdate: ____________________________

The following questions refer to your current or most recent job:

Job title: ____________________________  Describe this job:

Type of industry: ____________________________

Name of employer: ____________________________

Date job began: ____________________________

Are you still working in this job?  Yes  No

If no, when did the job end?  ____________________________

Fill in the table below, listing all jobs you have worked including short-term, seasonal, part-time employment, and military service. Begin with your most recent job. Use additional paper, if necessary.

<table>
<thead>
<tr>
<th>Dates of Employment</th>
<th>Job Title and Description of Work</th>
<th>Hazards*</th>
<th>Protective Equipment</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

*List the chemicals, dusts, fibers, fumes, radiation, biologic agents, physical agents (extreme heat, vibration, noise, etc), trauma hazards (lifting, repetitive motion, work at heights, driving, operating machinery, etc.), and psychological hazards.
Have you ever worked at a job or hobby in which you came into contact with any of the following by breathing, touching, ingesting (swallowing)?

<table>
<thead>
<tr>
<th>Acids</th>
<th>Chloroform</th>
<th>Pesticides</th>
<th>Manganese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkalis</td>
<td>Halothane</td>
<td>Phosgene</td>
<td>Mercury</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Chloroprene</td>
<td>Coal dust</td>
<td>Nickel</td>
</tr>
<tr>
<td>Alcohols</td>
<td>Chlorinated naphthalenes</td>
<td>Asbestos</td>
<td>Welding fumes</td>
</tr>
<tr>
<td>Solvents</td>
<td>Trichlorethylene</td>
<td>Talc</td>
<td>Radiation</td>
</tr>
<tr>
<td>Benzene</td>
<td>Dichlorobenzene</td>
<td>Silica Powder</td>
<td>X-rays</td>
</tr>
<tr>
<td>Toluene</td>
<td>PCBs</td>
<td>Talc</td>
<td>Other (specify)</td>
</tr>
<tr>
<td>Styrene</td>
<td>Methylene chloride</td>
<td>Arsenic</td>
<td></td>
</tr>
<tr>
<td>Ketones</td>
<td>Carbon tetra-chloride</td>
<td>Beryllium</td>
<td></td>
</tr>
<tr>
<td>Phenol</td>
<td>Perchloroethylene</td>
<td>Cadmium</td>
<td></td>
</tr>
<tr>
<td>PBBs</td>
<td>Trinitrotoluene</td>
<td>Chromates</td>
<td></td>
</tr>
<tr>
<td>Ethylene dibromide</td>
<td>Isocyanates (TDI, MDI)</td>
<td>Lead</td>
<td></td>
</tr>
</tbody>
</table>

Have you ever worked at a job with exposure to:

<table>
<thead>
<tr>
<th>Noise</th>
<th>Operating machinery</th>
<th>Mandatory overtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration</td>
<td>Work at heights</td>
<td>Evening/night shift</td>
</tr>
<tr>
<td>Extreme Heat</td>
<td>Electrical work</td>
<td>Other (specify)</td>
</tr>
<tr>
<td>Extreme Cold</td>
<td>Driving</td>
<td></td>
</tr>
<tr>
<td>Infrared radiation</td>
<td>Repetitive/forceful tasks</td>
<td></td>
</tr>
<tr>
<td>UV Radiation</td>
<td>Lifting</td>
<td></td>
</tr>
<tr>
<td>Microwaves</td>
<td>Infectious Diseases</td>
<td></td>
</tr>
<tr>
<td>Lasers</td>
<td>Work with animals</td>
<td></td>
</tr>
</tbody>
</table>

Have you ever been off work for more than one day because of an illness or injury related to work? Yes No

Have you ever been advised to changes jobs or work assignments because of any health problems or injuries? Yes No

Has your work routine changed recently? Yes No

Is there poor ventilation in your workplace? Yes No

If you answered Yes to any of the questions, please explain.
Discussion

What is the purpose of the work history form?

(Note to instructor: Students only have questions in their manual; the italicized answers are for the instructor, only)

*It serves as a template for asking a work history. It reminds the clinician what questions are important.*

What are the advantages and disadvantages to using a work history form?

*It gives the physician a template for asking about work. It gives the patient a framework for thinking about workplace hazards. One disadvantage is that it is inflexible—it does not cover every possible workplace hazard, so the clinician needs to think beyond the form.*

How does this information relate to the information taken in during the physical exam?

*This addresses exposure issues, which may be important in considering the cause of illness, in treatment of illness, or in prevention of illness.*

The key question: “Tell me about your job”

In general, occupational and environmental illness can only be diagnosed accurately if health care providers ask people about their work. There are very few occupational diseases that are easily recognized as such (for example, acro-osteolysis and hepatic angiosarcoma in vinyl chloride monomer workers). In all other cases, the presenting problems and physical findings of people with occupational diseases are identical to many non-occupational diseases. The most effective role of clinician is to recognize the role of occupational exposure in causing illness (in addition to taking a complete general medical history) and to ask all patients about their work.

In our case, JM could have had any one of many non-occupational diseases - from encephalitis to asthma to hypoglycemia. Obtaining information about JM's work may have saved his life. It may have also prevented illness and even death among his co-workers.

Working with limited information

Having a standardized approach allows one to take a complete and efficient occupational history. Even with such an approach, difficulties arise in characterizing workplace exposures. Frequently patients' occupational activities are described in workplace jargon. Additionally, the patient may know very little about the chemicals or other hazards to which he or she may be exposed. While the approach listed below is useful, often, additional data gathering is necessary after the interview is over. Sources of such information may include labor unions, governmental publications, documents from the employer, interviews with coworkers, documents from the manufacturer of workplace materials, as well the medical literature. One must keep in mind the possibility of repercussions that the patient/employee may suffer as a consequence of such questioning. Obtaining consent from the patient before speaking to others is crucial.

Once more information is gathered, the patient may need to be interviewed again to better characterize his/her exposures. If such investigation successfully identifies a workplace chemical, it can be
important to re-evaluate patients. In particular, if organ systems other than those of initial concern can be affected, these systems must be assessed.

In our case, the patient was unable to provide any useful information about his occupational exposures. His co-workers were able to provide a basic sketch of the job and some idea of the hazards involved. Additional data gathering allowed the offending pesticide to be identified.

General principles in the occupational history

By taking an occupational history the health care provider seeks to gather information about workplace exposures. This information, when combined with information about the patient's illness (or injury) will be used to make an assessment: How likely is it that patient's illness is occupational?

In order to make such an assessment, the exposure must be characterized: to what physical, chemical, and biological hazards is the patient exposed? Since "the dose determines the poison," one must assess the magnitude of these exposures. What is the duration of these exposures? In what setting do the exposures occur? How frequently do they occur? What efforts are in place to prevent or minimize these exposures? What is the temporal relationship between exposures and symptoms? Is there evidence of illness among co-workers? Do animals or plants in the vicinity of exposure show signs of illness? Because there may be long latencies (often decades) between exposure and illness, patients must be questioned about all prior jobs. Information about environmental exposures at home (focusing on air/water/food quality, hobbies, lead, carbon monoxide, asbestos, proximity to known hazards such as waste dumps or pollution sources) is also crucial.

Although treating JM was possible once some very basic occupational information became available, this is typically not the case. Questions regarding the magnitude of exposure and preventive measures are crucial now in understand the risk to which other local agricultural workers are exposed. These questions will be revisited in the "Qualitative Exposure and Health Assessment" and "Quantitative Exposure and Health" sections.
c. Sentinel Health Event Discussion

Case Information

An agricultural worker, JM, age 19, was discovered, in the emergency department of the local hospital, to be ill from organophosphate pesticide toxicity. The physicians on duty recalled several similar cases that occurred over the prior few years. They recognized that pesticide poisoning is a dangerous, but preventable condition. This case served as a warning signal that controls are not in place and that other workers may be at risk.

(instructor may write definition, below, on the board or have one student read aloud from student materials)

SENTINEL OCCUPATIONAL HEALTH EVENT: is an index case of a disease, disability, or untimely death that is occupationally related and which signifies failure of preventive measures that protect workers from workplace hazards.

Discussion:

What is the sentinel event, in this case?

Pesticide poisoning.

If you treat this farm worker and send him back to the same workplace, what is the risk for him? What is the risk for his co-workers?

Pesticide poisoning may recur in this farm worker because the fact that you already saw a poisoned worker means that safety and hygiene controls are not currently in place to prevent it. J.M.’s co-workers are also at risk, because they probably work under the same conditions with the same work practices.

What is the value of the Sentinel Health Event concept?

- Serves as a warning signal that more cases may occur if preventive measures are not taken
- Globalizes an individual’s problems so that an intervention may be approached on a population basis
- Gives public health workers a way to evaluate whether interventions are working (i.e., are pesticide poisonings continuing to occur even after an intervention has been implemented?)

What information do you need to determine if other workers are exposed? What are the barriers to gathering more information? Who else would you contact or could you contact to assist you?

Possible barriers include access to the workplace or the home and whose role is it to go to the workplace? Possible contacts that could assist include public health officers, university professors, cooperative extension, chemical manufacturer, other physicians, occupational hygienists, toxicologists, and epidemiologist. Sometimes the owner or supervisor in the workplace can provide information.

Discuss local enforcement laws, whose role it is to go into the workplace, what kind of information is collected and what is done with the information

How would you determine the factors that led to this case of organophosphate poisoning?
When JM was discharged from the hospital, your or others in the town could conduct a “follow back” to determine the work conditions that led to his poisoning by pesticides. You could visit him in his home and go to his workplace and/or get information from other sources, identified above.

Case Information

A follow back was conducted. Public health workers found that JM is a farm worker. He generally drives a tractor and works in the fields. In the days prior to his hospitalization, JM had been mixing pesticides for spray application because the worker who generally handles pesticides became ill. He had seen his co-worker mix pesticides, but he had never undergone training, himself. He was not aware of protective equipment, and had not been offered any by his employer.
d. **Summary Points**

1. O.P. pesticide poisoning is a common condition seen in agriculture
2. Taking an occupational history is essential in diagnosis and management of disease, in general. Certain conditions like pesticide poisoning are difficult to diagnose.
3. Recognizing disease as a sentinel health event is essential to preventing morbidity in other exposed workers.
3. Qualitative Exposure and Health Assessment

a. Section Overview

Common job tasks and associated exposure information is available through a variety of sources. A great deal of information is available on health and safety hazards to workers in agriculture. Resources are available through local governmental agencies and non-governmental organizations; books and pamphlets; journal articles; health care providers and workers and employers. In this section we will identify sources of information that can be used to explain the potential hazards to JM; use tools to organize the information and prioritize hazards for making decisions on intervention strategies and the need for further data collection.

Objectives

1. Identify sources of information about agricultural hazards
2. Complete Checklist for Information Gathering
3. Conduct a “walkthrough” assessment of the workplace

Materials Needed

Chalkboard or flipchart
Markers
Student Materials
Checklist for Information Gathering
Label and MSDS for pesticide exercise
Questions for Label and MSDS exercise
Photos for “walkthrough” exercise
Resources for process description: ILO Description, ILO Encyclopedia

Things to do before the lesson

Post case related pictures/information on the wall:
Worker
Pesticide container
Pesticide label
Physical Exam form
Work history form
List categories of disease
List organ systems
Photos for walkthrough
Prepare a flipchart with the headings for the components of a comprehensive qualitative assessment
Prepare flipchart sheet that looks like the chart

Recommended Methods for Delivery (Page 9 of Participant Materials)

5 minutes  Section Overview
25 minutes  Definition of Terms and Concepts
The instructor should list the following headings on the board or a piece of paper
Source information
Work force characterization
Characterization of Agents
Characterization of Health Effects
Characterization of Existing Controls
Reviewing Historical Data
**Discussion**

Instructor should ask students to brainstorm to generate a list under each of the components for preparing for a comprehensive qualitative assessment. The instructor should list these on the piece of flipchart paper. Participants should use the handout entitled qualitative information categories. Since this is an exercise focusing on hazards in agriculture circle the hazards named that are relevant to this industry. The instructor should review the lists and discuss the value of approaching this problem using categories.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Description</th>
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</thead>
</table>
| 90 minutes | **Checklist for information gathering**  
Distribute checklist for information gathering. The instructor should describe the checklist and its purpose; highlight the various sections; introduce the available references; and identify “experts” that can provide information about the process.  
Have participants work in groups of two or three to complete the chart using the information posted on the walls; the information found in the case study and physical exam; work history; additional information on the process and reference materials.  
Participants should also answer questions 10-15. (60 minutes). The instructor should debrief the class on what they were able to find to complete the process description and discuss the answers to the discussion questions. (30 minutes) |
| 20 minutes | **Conducting a Walkthrough Survey**  
The instructor should refer students to the workplace photos posted on the walls (or use slides). The instructor should also provide each group with a set of photos. Using the worksite survey form, identify tasks, hazards, and controls in each photo. The instructor should name one instructor to be a worker at the worksite and one instructor to be the boss, owner, employer to serve as additional sources of information on the tasks, hazards, or controls. Using a different color pen the participants should add more information to the chart. |
| 35 minutes | **Chemical Information**  
When the participants ask to see the label for the container or pesticides the worker or employer should provide it along with the MSDS and the questions that should be answered for this part of this exercise. (20 minutes). The instructor should debrief the class on how they addressed the walkthrough and the answers to the label and MSDS exercise. (15 minutes) |
| 5 minutes | **Review Summary Points**                                                                                                                                                                                         |
b. Discussion of Terms and Concepts

To prepare for a qualitative assessment, you need to think about the type of information you need to collect. Go to the schematic diagram from the opening and read the section from Diagram Box #2 on Qualitative Assessment. Then brainstorm with the class about what you want to address for this case.

Instructor writes the following, bold, headings on the board. Instructor should ask students to brainstorm to generate a list under each of the components for preparing for a comprehensive qualitative assessment. The instructor should list these on the piece of flipchart paper. Participants should use the handout entitled qualitative information categories. Since this is an exercise focusing on hazards in agriculture, circle the hazards named that are relevant to this industry. The instructor should review the lists and discuss the value of approaching this problem using categories.

Sources of Information


Work Force Characterization

job title / job description
task analysis
exposure duration
shift length; continuous
number of workers
other considerations
children

Characterization of Agents

biological (bacteria, viruses, allergens, genetically modified organisms);
chemical (aerosols (dusts, mists, fumes), gases, and vapors in air, liquids, and solids which contact the skin);
physical (temperature extremes (heat, cold), noise and vibration, ionizing radiation, non-ionizing radiation (uv, visible, ir, microwave/radiowave, power transmission) );
traumatic (acute and cumulative); and
psychosocial (stress, violence, ).

Characterization of Health Effects

symptoms
organ systems affected

Characterization of Existing Controls

personal protective equipment
local ventilation
training
written programs
permits

Historical data-available data
Past assessments/results
  - literature, company records
Historical exposure data
  - past permits, regulatory agency data, company data
Environmental emission data
  - regulatory agency data, permits, company data, literature
Past biological monitoring data
  - company data, health department data
c. Information Gathering Exercise and Discussion

Prior to the walkthrough, developing a complete understanding of the workplace is essential. This should include the products, processes, jobs, and technology to provide information on the possible health and safety problems that might be common. The information can be used to develop a site-specific checklist that includes anticipated hazards common to the work process; alternatively, a standardized checklist may be used. In the latter case, there may be some modifications made to the checklist based on the process description.

Case information

As a public health officer, the physician at the local hospital contacts you about a pesticide poisoning case. The first thing you do is interview JM about his recent employment and exposure profile. JM has worked as a farm worker for 4 years. He lives in a community adjacent to several farms with his mother, father, 3 sisters and 1 brother. JM generally works on three or four different farms during the summer and is a guest worker in a neighboring country in the winter. JM works for a number of different farm owners. He generally waits on the corner of street A and street B for a truck from one of the farms to pick him up. Most recently, JM has been working on Farm A, picking strawberries. However, for the past few days he has been spraying pesticides.

Farm A is a medium sized property that produces strawberries. The strawberries are grown for export. Farm A employs about 20 people in both manual and mechanical jobs. Jobs include preparing the field for seeding, seeding and fertilizing, applying pesticides, picking, sorting and processing, and transport. The pesticide applicators apply malathion to the strawberries during the 3rd and 5th week of the growing cycle. In addition malathion is applied two days before picking.

Exercise

The purpose of this exercise is to develop an understanding of the processes and hazards through existing data sources. Review the Worksheet #2: Checklist for Information Gathering, that follows. Based on the description in the box, above, and the Occupational Hazard Sheet for “Field Crop Worker”(provided in the resources section of the student manual), complete as much of the checklist as you can. Then answer the following questions.

Discussion

What hazards did you identify that these workers might be exposed to?

Did you add anything to the checklist?

Is there anything that you would remove from the checklist (for this case)?

Which resources were the most useful?

Generate a list of the pieces of information that the participants need from the workplace in order get a more complete picture of the tasks, hazards, or controls.
## Checklist for Information Gathering Form

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Source</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
### Process Description
|     |    |        |          |
|     |    |        |          |
### Literature Review
#### Toxicology
|     |    |        |          |
|     |    |        |          |
#### Epidemiology
|     |    |        |          |
|     |    |        |          |
#### Medical case reports
|     |    |        |          |
|     |    |        |          |
#### Environmental/IH
|     |    |        |          |
|     |    |        |          |
#### Control/Intervention
|     |    |        |          |
|     |    |        |          |
### Records
#### Company Records
|     |    |        |          |
|     |    |        |          |
#### Past assessments/ environmental monitoring
|     |    |        |          |
|     |    |        |          |
#### Injury/ illness records
|     |    |        |          |
|     |    |        |          |
#### Biological monitoring
|     |    |        |          |
|     |    |        |          |
#### Medical records/ visits
|     |    |        |          |
|     |    |        |          |
#### Environmental permits
|     |    |        |          |
|     |    |        |          |
#### Other records
|     |    |        |          |
|     |    |        |          |
#### Environmental permits/ inspections
|     |    |        |          |
|     |    |        |          |
#### Health and safety inspections
<p>| | | | |
|     |    |        |          |</p>
<table>
<thead>
<tr>
<th>Labor and health statistics</th>
<th></th>
<th></th>
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</thead>
</table>

Potential Hazards (based on process description and literature review)

<table>
<thead>
<tr>
<th>Chemical Agents</th>
<th>Name</th>
<th>OEL</th>
<th>Route of exposure</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td></td>
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<td>Products</td>
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<td>By-products</td>
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<tr>
<td>Waste products</td>
<td>Yes / No</td>
<td>Source(s)</td>
<td>OEL</td>
<td>Comments</td>
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<td>----------------</td>
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</tr>
<tr>
<td>Processing aids</td>
<td></td>
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<tr>
<td>Other</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Physical Agents</th>
<th>Yes / No</th>
<th>Source(s)</th>
<th>OEL</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Noise</td>
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<tr>
<td>Vibration</td>
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<td>Heat</td>
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<tr>
<td>Cold</td>
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<tr>
<td>Ionizing radiation</td>
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<tr>
<td>Non-ionizing radiation</td>
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<tr>
<td>Category</td>
<td>Subcategory</td>
<td>Description</td>
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<td>UV</td>
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<td>Ir</td>
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<tr>
<td>Microwave</td>
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<tr>
<td>Power transmission</td>
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<tr>
<td>Other</td>
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<tr>
<td>Biological Agents</td>
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<tr>
<td>Blood/ Body fluids</td>
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<tr>
<td>Animal products</td>
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</tr>
<tr>
<td>Mold</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Other allergens</td>
<td></td>
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<tr>
<td>Other</td>
<td></td>
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<tr>
<td>Cumulative trauma/ Repetitive stress hazards</td>
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<tr>
<td>Repetitive motion</td>
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<tr>
<td>Forceful motions</td>
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<tr>
<td>Lifting</td>
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<tr>
<td>Other</td>
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<tr>
<td>Safety Hazards</td>
<td></td>
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<tr>
<td>Walking/working surfaces</td>
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<td>Compressed gases</td>
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<tr>
<td>Electricity</td>
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<tr>
<td>Ladders</td>
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<tr>
<td>Machinery</td>
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<tr>
<td>Hand tools/ portable</td>
<td></td>
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<tr>
<td>power tools</td>
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<tr>
<td>Forktrucks/ other</td>
<td></td>
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<tr>
<td>internal transport</td>
<td></td>
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<tr>
<td>Cranes</td>
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<tr>
<td>Eye hazards</td>
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<tr>
<td>Liquids</td>
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<tr>
<td>Solids</td>
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<tr>
<td>Welding</td>
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</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psycho-social Hazards</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td></td>
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<tr>
<td>Violence</td>
<td></td>
<td></td>
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<tr>
<td>Hazards not completely</td>
<td></td>
<td></td>
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<tr>
<td>within the control of</td>
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<tr>
<td>the</td>
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<tr>
<td>Traffic</td>
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<tr>
<td>Multi-employer worksite</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual harassment</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Contact Persons</td>
<td>Name</td>
<td>address</td>
<td>phone</td>
<td>e-mail</td>
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<td>---------------------</td>
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<tr>
<td>Physician/nurse</td>
<td></td>
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<tr>
<td>Safety</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Industrial hygiene</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process engineer</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Plant manager</td>
<td></td>
<td></td>
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<tr>
<td>Others</td>
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<table>
<thead>
<tr>
<th>Person/ Position</th>
<th>Question</th>
<th>Answer</th>
</tr>
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</tbody>
</table>
d. **Conducting a Walkthrough Survey Exercise and Discussion**

An essential component of a qualitative assessment includes the recognition of hazardous processes and identification of agents. The purpose of the walk through is to look at a range of activities in a workplace and identify major health and safety problems.

Components of the walk through include looking at the workplace, either literally—visiting the workplace—or by “virtually” walking through using photographs or maps. In order to fully understand work processes and practices and identify agents, it is also helpful to speak with workers and supervisors about the process, what could go wrong, and how this can be controlled.

When you visit the worksite, what information about crops, chemicals, and work processes do you need to obtain?

- Names of chemicals, names of crops, domestic use or export, schedule of pesticide application, reentry times, sanitation facilities, number of workers, job titles/ description, shift length/ work schedule,

What work activities and tasks do you need to observe?

- You need to look at all activities where people contact pesticides.
- **Mixing, Application, Storage, and Waste Disposal.**
- By-standers during activities involving direct handling of pesticides.
- Reentry, picking, weeding, or other field work after application.
- Whether the pesticide is in the air (are there visible clouds?),
- Do workers get liquid or powdered pesticides on their skin?
- Are workers eating or drinking in the work area?

Whom do you need to talk with in order to fully understand the process and activities and to obtain other information such as chemical labels, MSDS, chemical inventories, etc.?

- You should try to talk to as many people as possible, including the owner, supervisor, workers.

**Exercise**

The purpose of this exercise is to identify hazard sources, number of workers affected, agents, and controls that are currently in place to reduce exposure. This information is a more detailed site-specific summary that enables you to be more specific about the exposures at a particular work site.

First, you speak with the owner and a worker to get some background information about the workplace. They provide you with the following information:

**Case Information**
Additional information that could be available from the “employer” or “worker.”

The major agricultural crops are:

| Domestic: | Potatoes (short growing season) |
| Export:   | strawberries, tomatoes          |

Nearly continuous growing season results in nearly continuous exposure potential to pesticides.

The following pesticides are reported to be used:

- Organophosphates: diazinon, parathion, malathion, mevinphos (Phosdrin), monocrotophos (Azodrin)
- Carbamates: carbofuran, carbaryl (Sevin), methomyl (Lannate)
- Organochlorines: Dicofol (Kelthane), Endosulfan (Thiodan)
- Thiophthalimide Fungicides: Thiophthalimide (Captan)

Then you do a walk-through. The instructor will present photographs in the worksite and lead you through a discussion of what you are seeing. Record the important information in the Worksite Survey form, following.
<table>
<thead>
<tr>
<th>Location/ task</th>
<th>Number of workers in area</th>
<th>Chemical</th>
<th>Physical</th>
<th>Biological</th>
<th>Ergonomic/ Mechanical</th>
<th>Psycho-social</th>
<th>Controls in place/ assessment of effectiveness</th>
</tr>
</thead>
<tbody>
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</table>
e. **Chemical Information Exercise and Discussion**

Qualitative information on chemical exposure is available from the label, materials safety data sheets (MSDS) and the ILO International Occupational Safety and Health Information Centre (CIS). MSDSs are prepared by a chemical manufacturer and provide basic information on the chemical/physical properties, and related health effects. The MSDS gives guidance on using, storing and handling substances safely on the job and in emergencies such as fires and spills. However, information on MSDS may be incomplete or inaccurate. Labels are another piece of information that can help to better understand workplace exposures. The CIS forms contain information on types of hazard/exposure, acute symptoms, prevention and first aid/fire fighting.

**Exercise**

The purpose of this exercise is to enable you to locate information on a MSDS, label, and CIS form and add this information to the other qualitative information collected during the Information Gathering and the Worksite Survey. In a small group (3-4 persons), use the MSDS, label, and CIS Safety Card to answer the following questions. Have one person in the group record the answers.

Describe the potential health effects from exposure to this chemical.

Does this chemical have exposure limits? If yes what are they?

Does this chemical cause cancer?

What are the ways this chemical can get into the body?

What are the symptoms from exposure to this chemical?

What does this chemical look like?

How should this chemical be stored?

What are the recommendations for limiting exposure when using this chemical?

Using the **pesticide label**, answer the following questions.

What is the precautionary statement?

CAUTION

How does the chemical get into the body?
Ingestion, inhalation, and absorption (not on the label given, but should be there—point of discussion)

If you are entering to water plants, what is the re-entry time?

12 hours

If you must enter before the re-entry time is expired, what Personal Protective Equipment and other controls/ activities are necessary?

Long sleeve shirt, long legged pants, chemical resistant gloves

What is the appropriate application rate for peas to control aphids?

1.5-2 pints per acre

Are there other precautions or restrictions for use with peas?

Do not apply within 7 days of harvest. Do not graze livestock on treated crop.

Discussion

In a large group, discuss the exercise:

How useful did you find the MSDS and Label?

What are the strengths of these types of information?

What are the limitations of these types of information?
f. Summary Points

1. Material Safety Data Sheets and product labels are readily available sources of information about chemical agents and their hazards
2. Completing a process description and checklist of available information is useful in orienting the investigator before visiting a worksite.
3. A worksite visit is an important part of judging hazards—noting presence or absence of suspected hazards, intensity of exposure specific to a worksite—and figuring out controls
4. Defining Exposure Profiles and Hazard Judgement

Based on elucidation of exposure hazards and the consequent adverse health effects, a judgment about the hazard potential of a workplace may be made. The process of evaluating the health and safety of workplace, includes development of an exposure profile, determining whether adverse health conditions exist, and reviewing background information on the relationship between exposure and disease.

a. Section Overview

Objectives
1. List exposure groups and agents for which the exposures are acceptable
2. List exposure groups and agents for which additional information is needed
3. List exposure groups and agents for which the exposures are unacceptable

Materials Needed
- Chalkboard or Flipchart
- Markers
- Student Materials
- Handouts

Things to do before the lesson
- Prepare a large version of the two graphs on the chalkboard or flipchart

Recommended Methods of Delivery (Page 24 of Participant Materials)
5 minutes  Section Overview
10 minutes  Introduction to Terms and Concepts
Instructor will describe exposure pathways, “Similar Exposure Groups,” and the relative rating systems used to prioritize hazards.
20 minutes  Similar Exposure Groups
In small groups, students will use Information Gathering checklist, Worksite Survey form, and the Similar Exposure Group table to assign each worker to at least one Similar Exposure Group. The instructor should go through at least one example (one line of form) with the group as a whole before beginning exercise. (10 minutes).
Instructor will lead discussion of exercise (10 minutes).
25 minutes  Exposure/Health Effect Rating
Instructor will explain the exercise and give an example of how to use the chart. Students will work in small groups to complete the exposure/health rating exercise. (15 minutes). Instructor will debrief exercise (10 minutes)
5 minutes  Summary Points
b. Discussion of Terms and Concepts

Exposure Pathways

How can workers be exposed from a process? What are the exposure pathways?

The diagram, above, shows the ways in which workers may be exposed to chemical agents. The top, left box represents the work process of interest. Chemical agents from that process may be volatilized or aerosolized into the air where they may be inhaled or ingested; the airborne agent may also land on work surfaces (top, right box) where it could be touched by workers; or it may land directly on skin, allowing for absorption, directly or ingested by smoking/eating on the work site. Note the routes of entry into the human body in the three boxes across the bottom.
c. Similar Exposure Groups (SEG) Exercise and Discussion

Exercise

Using the information you have collected so far (Information Gathering checklist, Worksite Survey form), you should assign “health risk” to the workers for each of the exposures. First, make a list of job tasks (refer to Worksheet #3).

- Applicators
- Pourers
- Mixers

Now make a list of each agent (physical, chemical, biological, ergonomic, psychosocial) to which they are exposed in their work.

- Malathion
- noise
- uv radiation
- heat
- dust
- ergonomic stresses

For the pesticide, malathion, the workers have the potential to inhale the mist, and have it absorbed into the skin (ingestion is also possible).

For each hazard, decide which workers fall into “similarly exposed groups” (SEGS). For example, do all the workers have the same potential for inhaling the mist of malathion? How about for noise exposure?

No, the applicators are most exposed. Again, the applicators are most exposed.

Discussion

Each group should report the SEGs to the large group. Did the class agree on the SEGs? Why or why not?

What is the value of categorizing workers in this way?

Breaks down the tasks and the exposures to help focus on which job tasks should be modified to reduce risk.
d. **Exposure and Health Effect Rating: Discussion of Terms and Concepts**

**Exposure Rating**

In order to better quantify risks to workers, it is important to look at the intensity of the exposure and the potential for adverse health outcomes. This can help target areas that require intervention to reduce risk.

Exposure limits are recommended by research agencies and may be set (for enforcement) by governmental agencies. Exposure ratings are established using the intensity of the exposure relative to some occupational exposure limit, such as the Threshold Limit Value. The following scheme is suggested.

**Exposure Effects Rating Scheme (Mulhausen and Damiano, 1998)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Health Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Greater than Occupational Exposure Limit</td>
</tr>
<tr>
<td>3</td>
<td>Between 50% and 100% of Occupational Exposure Limit</td>
</tr>
<tr>
<td>2</td>
<td>Between 10% and 50% of Occupational Exposure Limit</td>
</tr>
<tr>
<td>1</td>
<td>Less than 10% of Occupational Exposure Limit</td>
</tr>
</tbody>
</table>

**Health Effect Rating**

Health Effects Rating Scheme (Mulhausen and Damiano, 1998)

<table>
<thead>
<tr>
<th>Category</th>
<th>Health Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Life-threatening or disabling injury or illness</td>
</tr>
<tr>
<td>3</td>
<td>Irreversible health effects of concern</td>
</tr>
<tr>
<td>2</td>
<td>Severe, reversible health effects of concern</td>
</tr>
<tr>
<td>1</td>
<td>Reversible health effects of concern</td>
</tr>
<tr>
<td>0</td>
<td>Reversible effects of little concern, or no known or suspected adverse health effects</td>
</tr>
</tbody>
</table>
e. Rating Exposure and Health Effects: Exercise and Discussion

Exercise

Look at the table below (Worksheet #4) to assign an exposure rating to each using a scale of 0-4 with 0 being the lowest exposure and 4 being the highest exposure.

Using the information gathered so far, (epidemiological, toxicological, clinical information) and the scale shown in the following table (Worksheet #4), assign a health effect rating to each hazardous agent and add this to the table.

Hazard Grouping Table

<table>
<thead>
<tr>
<th>SEG #</th>
<th>Agent</th>
<th>Worker/Task</th>
<th>Exposure Rating</th>
<th>Health Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>malathion-dermal</td>
<td>pesticide mixers</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>malathion-dermal</td>
<td>pesticide applicators</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>malathion-dermal</td>
<td>pesticide pourers</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>malathion-airborne</td>
<td>pesticide mixers</td>
<td>3-4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>malathion-airborne</td>
<td>pesticide pourers</td>
<td>2-3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>malathion-airborne</td>
<td>pesticide applicators</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>noise</td>
<td>pesticide applicators</td>
<td>2-4</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>noise</td>
<td>pesticide mixers</td>
<td>2-3</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>uv radiation</td>
<td>all workers</td>
<td>2-4 depending on weather and clothing</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>heat</td>
<td>pesticide applicators (carrying heavy pack; highest dermal exposure to pesticides)</td>
<td>3-4 depending on weather and clothing</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>heat</td>
<td>pesticide mixers</td>
<td>2-3 depending on weather and clothing</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>dust</td>
<td>all workers</td>
<td>1-2</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>ergonomic stresses</td>
<td>mixer- awkward posture to get water, lifting heavy bucket from below knees</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>ergonomic stresses</td>
<td>applicator- carrying heavy pack</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>ergonomic stresses</td>
<td>pourers- lifting heavy bucket above shoulder height</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

What additional information do you need to assign a health effect rating? Who could you contact or where could you look to obtain this information?
Discuss the uncertainty in your assigned ratings; How much uncertainty is there? Is the uncertainty in the exposure rating or health effect rating or both?

Using the information from the Hazards Grouping Table (worksheet #4), for each SEG, place the SEG number on the Exposure Rating / Health Effect Rating (Worksheet #5) chart. Examine the graph and decide which exposure(s) are acceptable, unacceptable, or uncertain.

*Based on worksheet #4 in the Instructor Manual the table would be completed as shown on worksheet #5 below. The discussion should focus both on the students idea of the exposure hazard and health effects, as well as, how worksheets #4 and #5 help in prioritizing hazards to target interventions.*

**Worksheet #5: Exposure Rating / Health Effect Rating Chart**

<table>
<thead>
<tr>
<th>Health Effect Rating</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Exposure Rating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**Discussion**

Why did different groups assign different ratings?

*Some agents such as noise cause an irreversible health effect, which if severe enough can be disabling. Other agents, such as malathion and heat, induce reversible health effects, but these become life-threatening if not recognized and treated and if the exposure is not reduced or eliminated.*

*The intensity of exposure to certain agents, such as noise and heat are difficult to determine from photos, and individual judgements will vary depending on individual experience.*

For those exposures that are acceptable, what is the next step?

*The workers, and other interested parties should be informed of the results of your evaluation, and records should be prepared and kept for future re-evaluation*

For those exposures that are uncertain, what is the next step?
Quantitative Assessment: if the uncertainty lies in the intensity of exposure, then further information regarding exposure is necessary (quantitative exposure assessment section). If the uncertainty is with the health effects, then further health information is necessary (surveillance section).

For those exposures that are unacceptable, what is the next step?

*Develop intervention strategies to eliminate or reduce exposure (Intervention Section).*

What kinds of records would you want to keep that would identify exposure hazards from agricultural work?

*One approach is to establish a log of illnesses and injuries that occur in the workplace, to conduct regular summaries and establish a mechanism for addressing problems. This describes workplace surveillance and is addressed in the Quantitative Hazard Assessment section, below.*
Summary Points

1. Exposure pathways describe the paths along which an agent travels from the process (source) to the workplace and from the workplace to the worker.
2. Inhalation, dermal absorption, and ingestion are three routes of entry to the body.
3. Exposure and health ratings provide a system for prioritizing hazards to target interventions or for further information gathering.
5. **Quantitative Assessment**

   a. **Section Overview**

**Objectives**
1. To become familiar with the value and use of surveillance in assessing workplace health and safety
2. To become familiar with the background work necessary to decide on an appropriate surveillance program
3. To become familiar with the concept of biomarkers in surveillance
4. To define environmental monitoring objectives
5. To outline an exposure assessment strategy

**Materials Needed**
- Chalkboard or flipchart
- Markers
- Student Materials

**Recommended Methods for Delivery (Page 29 of Participant Materials)**

- **5 minutes** Section Overview
- **55 minutes** Surveillance Discussion
  - This section is formulated as an instructor-led class discussion. The instructor should make notes on the blackboard as needed.
- **20 minutes** Quantitative Exposure Assessment Lecture
  - The section should be delivered as a lecture. Lecture is not prepared in this module. Should speak monitoring, sampling. End with questions and answers.
- **20 minutes** Quantitative Exposure Assessment Exercise and Discussion
  - The exercise should be performed in small groups, using all the information, charts, checklists gathered to this point. Particular attention should be paid to the SEG assignments and the prioritization indicating that exposure to noise was uncertain. (20 minutes). Instructor should lead discussion of exercise (15 minutes)
- **15 minutes** Discussion of Exercise.
- **5 minutes** Summary points
b. Surveillance Discussion

The overall goal of surveillance and screening of this population is:
- to ascertain the effect of exposure on the community, as a whole
- to ascertain exposure in agricultural workers (worker population)
- to understand the role of biomarkers in surveillance
- to understand the role of a questionnaire in surveillance
- to understand the role of field observation in surveillance (does this go in exposure assessment section?)

Case Information

Z.M. is a small town where more than ¼ of the adult population works in agriculture. One of the largest crops in the area is strawberries; strawberries and other common crops in Z.M. require the use of organophosphate pesticides. As we learned at the beginning of the course, this class of chemicals has adverse health effects that get worse as the exposure increases. We learned the signs and symptoms of organophosphate pesticide poisoning and what a health care worker might see when s/he examines a poisoned farm worker. When you know of a hazard, it is best to prevent it before human exposure happens, but that is not always easy.

What are reasons you would want to characterize the severity and the extent of pesticide poisoning in this town?

1. To make a decision about whether an intervention is necessary: if there is no poisoning, there may not be a reason to intervene.
2. To institute/justify a preventive program, you may have to prove to employers (farm owners) or local officials that a problem exists.
3. Once you institute a program, you may want to know whether it is successful.
4. Others?

In this community, what question would you like to answer (i.e., what do you need to know to determine the extent of the problem?)

1. How many people are potentially exposed?
2. What are the ways they get exposed?
3. How many people have gotten sick from pesticides (in the past month, year, years)?
4. What do workers do when they or their co-workers have symptoms of pesticide poisoning? Do they go to the doctor or hospital or report it somehow?
5. Have any people died from pesticide poisoning?
6. Are there any preventive practices at this time?

Case Information

In talking to some of the people in the town, you find out that several of them know one or two farm workers who have been taken to the local hospital this summer to be treated for pesticide poisoning. Last year one worker died. Most of the people go either to the one clinic in the area or, if they are very sick, they travel to the nearest (and only close) hospital, several kilometers away.

You want to try to figure out how many people have gotten sick from pesticides in the past year. Now that you know about local health care, how could you go about that?

1. Talk to health care workers at the clinic
2. Talk to health care workers at the hospital
3. Look at medical records
4. Interview the workers themselves
5. Interview employers
6. Go door-to-door and do a survey
Case Information
You decide to approach the clinic first. When you call, you find out that they keep medical records (paper charts) on each patient. The records are not computerized. If you want to learn about pesticide poisoning among patients from Z.M. who have gone to the clinic in the last year, you will have to read every chart. There were 3000 patient visits in the last year. Patients came from several surrounding towns.

Do you want to take this approach; i.e., review all of the medical records or a sample of them? Discuss the time and resources available to undertake this. How many hours would it take? Who would do it?

*A chart review can be useful. However in a rare condition, such as pesticide poisoning, you would have to review a lot of charts to find a single case. This may not be a good use of time.*

Case Information
You decide to call all of the doctors in the area—the clinic and hospital have about 10 doctors. To prepare for the calls, you decide to write down the questions you want answered.

What questions will you ask them?

1. Have you ever seen a patient with pesticide poisoning?
2. How do you make a diagnosis of organophosphate pesticide poisoning in a patient?
3. How many in the last week? Month? Year? Two years? Five years?
4. Do you report these cases to anyone (health dept, local OSH enforcement agency, other)?
5. What percent of pesticide poisoning cases do you think are seen by a doctor? (or how common do you think this is).
6. What are the barriers to workers paying you a visit?

**Telephone Survey of Local Health Care Providers**

Number of doctors interviewed: 10/10
Number of doctors who have seen pesticide poisoning: 8/10
How diagnosis is made: symptoms, alone (9); symptoms plus blood cholinesterase test (1)
Number of cases seen in last week: 1
Number in last month: 3
Number of cases in last year: 10
Doctors sometimes do not have time to report all cases
Majority of cases are mild and probably not seen by doctor
Distance, loss of income, cost are barriers to seeking medical attention

Are there any questions about these results?

What is the value of calling local health care providers to find pesticide poisoning cases?

*It is a way of ascertaining cases in the community. It also has the benefit of increasing awareness of health care providers in the community.*
Cholinesterase Testing

Cholinesterase is an enzyme in the body that is lowered, or inhibited, by organophosphate and carbamate classes of pesticides. When cholinesterase is low, nerves over-act, causing many of the symptoms described at the beginning of this case (sweating, salivating, small pupils in the eyes, altered mental status). It is possible to do a blood test to determine cholinesterase levels in individual farm workers. In fact, there are small test kits that require only a finger stick and one drop of blood. The best way to test this is to check an individual before he is exposed—it is best to have a baseline value for each individual-- and then to check again after he is exposed. If significant exposure has occurred, the level will be much lower on the second test.

A blood test that gives an objective measure of exposure is a biological marker, or biomarker. Sometimes the test is for the toxin, and sometimes the biomarker test is for a physiological abnormality that occurs because of a toxic exposure.

Again, you found that medical records are not computerized and you will have to go through a lot of charts to find the few pesticide cases that have reportedly occurred. Also few workers go to the doctor for pesticide poisoning. What is another approach you can take?

1. Survey the workers and/or community
2. Ask the doctors to keep a log of pesticide-poisoned workers
3. Speak with farm owners about recording this information

To figure out the extent of pesticide poisoning, you decide to survey the entire community by going door-to-door and interviewing one person in every household that has a farm worker. You will also check blood cholinesterase at the beginning of the growing season, and at the end.

Before you write your questionnaire survey, you need to develop a case definition of pesticide poisoning. How will you decide which of those people surveyed were actually poisoned?

Is their saying so enough?

Should they have a list of symptoms that they must have experienced to call them a “case?”
Do they need a hospital visit or a doctor’s diagnosis? Do they need blood work?

What is the final case definition decided by the class (list of symptoms, doctor’s diagnosis, occurred within several hours of being exposed...)?

What questions will you ask on the survey?

Do you do agricultural work?
Age
Do you mix pesticides at work or at home?
Do you spray pesticides at work or at home?
What class of pesticides?
Are you present when pesticides are being sprayed?
Describe the process of spraying.
What do you do to protect yourself?
Do you believe you have ever been poisoned by pesticides?
If yes, describe incident:
Did you go to the doctor for this?
Have you ever gone to the doctor because of pesticide poisoning?
Make checklist of signs and symptoms of pesticide poisoning and see if they had any?
Who will you do cholinesterase testing on?

*Choices: only people spraying, all farm workers.*

What are the value and the problems of a door to door survey?

*A lot of people need to be surveyed in order to find positive cases, follow-up is difficult, tests can be costly, people might not want to participate, requires a lot of personnel to implement.*

Case Information

You design a surveillance project to determine the extent of the problem and to help you decide whether to implement an intervention. Through the questionnaire, you find that there is a significant exposure and that many farm workers describe intermittent symptoms that are consistent with pesticide poisoning. The cholinesterase testing that you were able to complete did not show a difference between the exposed workers and the controls; there was a slight drop in cholinesterase over a work shift. Because of the problems with the equipment used to test cholinesterase and your inability to do adequate testing, you rely on the questionnaire data and go on to consider an intervention.

Epilogue: After finding out the extent of the problem, you decide that an intervention is necessary to prevent further poisoning. Although there are laws on the books designed to prevent it, pesticide poisoning is still occurring. You partner with the local health department and a NGO to develop training courses, utilizing the many existing training materials on this topic. You solicit affected individuals through the three local churches and conduct classes. You develop a surveillance project to determine the effectiveness of this intervention: a door-to-door survey is conducted once per year. Also, all 10 health care providers agree to keep a log of cases they see.
c. Quantitative Exposure Assessment: Lecture/ Discussion:

Monitoring Objectives

What are reasons to monitor for workplace hazards?

- **Baseline/routine surveillance** (what is the typical exposure? does the exposure need control?)
- **Compliance** (are exposures within the legal limits?)
- **Diagnostic** (is the process or control equipment performing as originally intended? does the process or control equipment meet manufacturers specifications? what is the effect of following implementation of a control device?)

Sampling Strategy

If you are concerned about a chemical exposure in a workplace, and you have the opportunity to set up monitors, where are the potential places you could sample?

- **Personal**
- **Area**

Who would be the best to monitor?

- **Representative sample of workers for each job task**
- **Worst case analysis**—monitor the most hazardous areas, or the areas where an unexpected incident could cause serious harm to the workers.
- **Some standards require routine monitoring or baseline monitoring**

When is the best time to sample?

- **Winter vs. summer**
- **Day shift vs. night shift**

How long should monitoring be done? How many samples should be taken?

- **Single sample can be collected over the entire work shift, such a sample gives a 8-hr (or other time) time weighted average, but gives no information on temporal or spatial variation**
- **Consecutive samples over the entire workshift can also give an 8-hr TWA measurement and some indication of temporal (and spatial, if worker activity is also recorded) variation**
- **It is common to do both 8 hr TWA measurement and short term sampling during activities which are thought to be high exposure activities**
- **For agents which have health effects following short term exposures (chemicals with short term exposure limits or ceilings), may have to do short term sampling at times when you expect highest concentration.**
- **Sampling time is also dependent on the sampling method**
How to sample?

<table>
<thead>
<tr>
<th>Equipment Selection</th>
<th>Method Selection</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method specific</td>
<td>Survey of process</td>
<td>Coordination with</td>
</tr>
<tr>
<td>Reliability</td>
<td>Nature of contaminants</td>
<td>laboratory</td>
</tr>
<tr>
<td>Type of sample</td>
<td>Sensitivity of methods (LOD)</td>
<td>Media and pumps</td>
</tr>
<tr>
<td>Duration of sample</td>
<td>Availability of equipment</td>
<td>Availability of continuous</td>
</tr>
<tr>
<td>Professional judgement</td>
<td>Flow rate (function of LOD, pump, expected concentration, exposure limit)</td>
<td>instruments</td>
</tr>
<tr>
<td>Physical and chemical characteristics of material</td>
<td>Protection of pump</td>
<td>Equipment rental</td>
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<tr>
<td>Interferences</td>
<td>Sampling time</td>
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<tr>
<td>Regulatory requirements</td>
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<td>Complexity</td>
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<td>Cost</td>
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d. Quantitative Exposure Assessment Exercise and Discussion

Introduction

The qualitative assessment and prioritization indicates that additional information regarding noise exposure is necessary.

Quantitative assessment is useful for the purpose of legal compliance, surveillance, or for research interests. However, Quantitative Assessment is complicated and requires equipment and personnel that is skilled in using it. Understanding that an exposure hazard exists does not require sampling. The following exercise is designed to give an example of the considerations that are essential in deciding when and how to sample.

What monitoring objectives would you define?

- to determine noise exposure level or intensity for the pesticide applicators (SEG 7) and for the mixers and pourers (SEG 8)
- to characterize the exposures as a function of task (look at source sound level, and amount of time worn/used)

Exercise: In small groups, develop an exposure assessment strategy.

You should assume that you have access to 10 personal noise dosimeters that will give you a full-shift average exposure.

Where to sample?

Personal sampling would be most appropriate for objective 1. Objective 2 could be achieved using personal measurements and observed work activities, or by using a sound level meter to measure the sound source. This would be a useful measurement if source controls are necessary.

If the monitoring objective is compliance with a standard or guideline, then personal exposure monitoring is necessary.
Whom to sample?

If you have access to 10 dosimeters, then you could measure the mixer, 3 of the pourers (out of 4 or 5); and 6 of the 11 applicators. The goal is to have a representative sample of each SEG. In this case we would have 6 measurements in the SEG 7 and 4 measurements in SEG 8. It would also be very important to observe the work practices of the workers. Of particular interest is the amount of time the workers are engaged in tasks that expose them to noise.

If compliance is the objective, then monitoring of the highest exposed workers is necessary.

When to sample?

It is important to measure noise during a time when the noise generating equipment is being used. However, if an assessment of overall noise exposure and, therefore, risk to hearing is desired, low noise-exposure times should also be monitored.

If compliance is the objective, then the monitoring should be done during the highest exposure times.

How long to sample? How many samples?

Since hearing impairment results after long durations of exposure, long monitoring times should also be used. Full shift samples are usually collected. This gives the average over the monitoring time. A sound level meter provides estimates of noise exposure at various times. Some noise dosimeters will display the noise history for the monitoring period, in addition to the average exposure and dose. This is useful in examining sources of exposure (equipment, tasks, etc).

How to sample?

Noise dosimeters must be programmed carefully if the results are to be meaningful. For compliance with some standards a threshold level, criterion level, and exchange rate must be programmed. The instruments must be calibrated before monitoring and the calibration must be checked after monitoring. The microphone should be placed in the worker’s hearing zone.

How would you modify your strategy if you have access to 3 personal noise dosimeters?

Use 2 dosimeters in SEG 7 and one dosimeter in SEG8.

How would you modify your strategy if you have access to 1 sound level meter that will give an instantaneous measurement of sound level, but not an average over some time period?

Use the SLM to measure noise level in a representative sample of each SEG for each task. The SLM gives a point estimate of exposure. Using the SLM to estimate average exposure, requires very detailed measurements for each task and very detailed observations of how long workers spend doing each task.

What assumptions do you need to make in each case regarding generalization of the data to other workers, other workplaces, other times of the year, etc?

that monitored workers are representative of other workers doing the same tasks
that workers use the same type of equipment (age, state of repair, etc)
that the work is done for the same length of time at different times of year
How does surveillance, qualitative assessment and quantitative assessment relate to the concept of Sentinel Health Events, referred to in the beginning of this course?

Sentinel health events alert the practitioner to an unwanted exposure. Qualitative and quantitative exposure assessments have, as their goal, characterization of the hazard and its risk. Through these assessments, other hazardous conditions may be uncovered.

What is the role of health professionals, labor inspectors, advocates, and employers in assessing workplace hazards?

There is no right answer to this question. The goal is to have students reflect on issues and activities that have taken place until now.
e. **Summary Points**

1. Exposure profiles and hazard judgment are helpful in prioritizing occupational health problems, planning and implementing interventions, and evaluating these efforts.
2. Monitoring objectives are important when developing an exposure assessment strategy.
3. The exposure assessment strategy defines where to sample, whom to sample, when to sample, how long to sample, how many samples to take, and how to sample.
4. Sentinel health events are important for alerting health professionals, labor inspectors, advocates and employers that a hazard exists and that they need to act to prevent injury or disease.
6. Interventions

a. Section Overview

Objectives
1. Recommend intervention strategies for the identified hazards
2. Discuss advantages and limitation of the controls
3. Prioritize control efforts
4. Apply the ILO principles on occupational safety and health to an awareness campaign
5. Discuss roles of institutions, employers and employees and their representatives in protecting workers health and safety

Materials Needed
- Chalkboard or flipchart
- Hierarchy of Controls Fact Sheet
- Policy Handout
- Poster Paper
- Markers (enough for each group to have several colors)

Recommended Methods for Delivery (Page 36 of Participant Materials)

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
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<tbody>
<tr>
<td>5 minutes</td>
<td>Section Overview</td>
</tr>
<tr>
<td>25 minutes</td>
<td>Exposure Reduction Lecture/ Discussion</td>
</tr>
<tr>
<td></td>
<td>The instructor should discuss the case, to this point by going through the first 5 questions. Refer back to the Framework Schematic at this point. The instructor should go over the Hierarchy of Controls Factsheet.</td>
</tr>
<tr>
<td>50 minutes</td>
<td>Exposure Reduction Intervention Exercise and Discussion</td>
</tr>
<tr>
<td></td>
<td>The exercise should be performed in small groups, using all the information, charts, checklists gathered to this point. Particular attention should be paid to those exposures which were unacceptably severe, working from the most severe to the least severe in the “unacceptable” category (20 minutes). Discussion of Exposure Reduction Exercise (30 minutes)</td>
</tr>
<tr>
<td>60 minutes</td>
<td>Policy Exercise and Discussion</td>
</tr>
<tr>
<td></td>
<td>The exercise should be performed in small groups, using all the information, charts, checklists gathered to this point. The handout “C155 Occupational Safety and Health Convention, 1981” should be used. (30 minutes). Discussion of Policy Exercise (30 minutes)</td>
</tr>
<tr>
<td>20 minutes</td>
<td>Summary points</td>
</tr>
</tbody>
</table>
b. Exposure Reduction Discussion

Most agricultural work is carried out in the open air and consequently agricultural workers are dependent on weather changes to perform their tasks. This factor not only undermines the efficiency of the operations, but also influences working conditions, making them difficult and dangerous (e.g. a rainstorm while harvesting, gusts of wind when pesticides are being applied, etc.).

For those exposures that are acceptable, what is the next step?

*Recordkeeping, re-evaluation*

For those exposures that are unacceptable, what is the next step?

*Interventions*

For those exposures that are uncertain, where is the uncertainty, i.e., do you need more exposure information or more health information, or both?

*Quantitative Assessment*

What controls that are in place do you feel are proper? Why? (use fact sheet and your worksheets)

*none*

Which ones do you feel are inadequate? Why? (use fact sheet and your worksheets)

*there were no controls*
c. Evaluating Controls Exercise and Discussion

Exercise

The purpose of this exercise is to develop skills in evaluating whether or not the proper controls are in place to prevent serious exposure to toxic hazards in the workplace. In small groups, answer the following questions. Use the Hierarchy of Controls Fact Sheet. Have one person record the answers for the group.

For the pesticide applicators, describe at least one engineering (source control), one administrative control, and one PPE control to reduce or eliminate dermal exposure to pesticides?

Engineering controls

substitution-
material- less toxic or non-toxic pesticide
process- using tractor instead of backpack
automation

Administrative Control

removing backpacks during filling and wiping them dry prior to wearing training

PPE

protective clothing (may create heat stress problems)
gloves

For the pesticide applicators, describe at least one engineering (source control), one administrative control, and one PPE control to reduce or eliminate noise exposure?

Engineering controls

substitution-
equipment- quieter equipment
process- using sound proof tractor (need air conditioned tractor)

Administrative Control

limiting exposure time
distance from source
training

PPE

hearing protection

Discussion
Each group should report their recommended exposure reduction interventions to the class. The above interventions are all performed by the employer or the workers. What is the responsibility of the community and/or government for protecting workers?
d. **Policy Exercise and Discussion**

In addition to the workplace-based interventions, there can be political and legal interventions that would be appropriate. In the agricultural economic sector, these political and legal issues are especially important because of the heterogeneous nature of the work environments. While this course does not deal with the complex issues involved in policy definition, agenda setting, and implementation, it is important to use the information gained through surveillance, qualitative and quantitative risk assessment, and worksite interventions to communicate with policy makers about findings.

**Exercise**

The purpose of this exercise is to communicate the information developed through the scheme for addressing health and safety in the workplace. The overall goal is to influence policy recommendations that can be used to help solve health and safety problems.

Using the handouts: C155 Occupational Safety and Health Convention, 1981 and C161 Occupational Health Services Convention, 1985, and page 28-30 of the ILO 88 Report VI Safety and Health in Agriculture, you will develop a poster to increase the awareness of the hazard and possible controls.

*The instructor should begin this activity by creating two lists: the potential target audience which should be a long list including, legislators, enforcement agencies, health institutions, employers, advocacy groups, and others; and a list of ways of communicating with the target audience such as poster, testimony, newspaper article, letter, etc. However, for the following exercise we will ask the students to select a target audience and create a poster.*

You should select a target audience (institution, workers, employers, or community) from the list generated during the discussion.

On a piece of flip chart paper, create a poster.

Present poster to the group.

**Discussion**

What common elements showed up in all of the posters?

Are there elements of the poster that are specific to the group targeted?

What unique aspects of agricultural work did you consider?

Who is responsible for worker health and safety?

How do you influence policy?
e. Summary Points

1. Exposure reduction is best addressed at the source of hazard release in the pathway
2. Source and pathway controls may be engineering controls or administrative/work practice controls
3. Worker controls (PPE) are the least desirable control options
7. Course Evaluation

Instructor should allow 30 minutes for course evaluation.