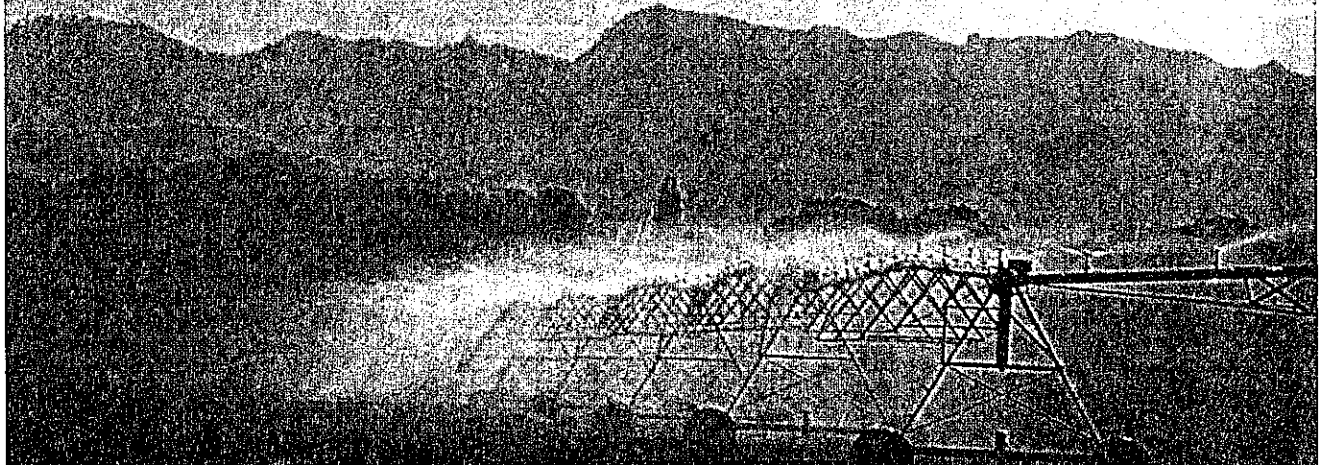


# 1994 ANNUAL REPORT



Colorado  
State  
University

High Plains  
Intermountain  
Center for  
Agricultural Health  
and Safety

HI  
CAHS

## Project Director Statement

Agriculture and agribusiness make up only 5 per cent of the U.S. population, yet a disproportionately large number of workers in agriculture experience injury, disability, disease and death each year. We must be cognizant of the fact that agriculture is America's most dangerous occupation in order to properly address the problem. The High Plains Intermountain Center for Agricultural Health and Safety (HI-CAHS) was established in 1991 as one of six national centers to address the problem through education, research, and direct services focused on injury and disease prevention. HI-CAHS is charged to function throughout the western great plains and the Rocky Mountain region. Principle funding for the Center is from the National Institute for Occupational Safety and Health (NIOSH), with in kind support being provided by the Occupational Safety and Health Administration. This report covers the third year of the five year grant period.

HI-CAHS success is tied to a growing network of farmers, ranchers, agribusinesses, Cooperative Extension, farm/ranch associations and an active Advisory Board representing a broad spectrum of agricultural interests and expertise. The program is multidisciplinary with input from industrial hygiene, engineering, social work, epidemiology, toxicology, safety, education, and general environmental health. The program is also multi-organizational including the Institute of Rural Environmental Health, Department of Agricultural and Chemical Engineering, Department of Social Work, Department of Environmental Health, Colorado State University Cooperative Extension, and the School of Occupational and Educational Studies. Off campus participants are the Greeley Clinic, SALUD Migrant Labor Clinic, the Sunrise Migrant Clinic, Poudre Valley Hospital, and the Larimer County Health Department. While NIOSH is the funding agency for HI-CAHS, it goes beyond

sheparding the grant, and functions as a full partner in support of HI-CAHS activities especially in the realm of research.

The third year was very successful regarding outreach services and education, on-site industrial hygiene and safety services, program evaluation, networking through rural health organizations, and in providing environmental health and medical services to migrant labor. HI-CAHS personnel had over 10,000 contacts (10,922) with persons involved in or serving agriculture. For the first time seven research projects were funded with grant selection from an internal proposal review and a second tier review made by NIOSH scientists in Morgantown, West Virginia. HI-CAHS's commitment to agriculture remains strong, with solid support from its constituency. We will continue to strive to serve the agricultural community, with an eye toward saving lives and preventing significant disabilities due to conditions of their workplace.

## HI-CAHS Advisory Committee



*Left to Right: Mr. Bill Johnson, Future Farmers of America; Mr. Greg Baxter, U.S. Department of Labor-OSHA; Mr. Buford Rice, Colorado Farm Bureau; Ms. Jane McCammon, Colorado Department of Health; Mr. Lyle McKenzie, Colorado Department of Health.*

*Not Pictured: Mr. Bart Chadwick, U.S. Department of Labor-OSHA; Ms. Sally Harms, Rocky Mountain Farmers Union; Dr. Kirvin Knox, Associate Provost, Colorado State University; Mr. Benjie Lemon, Colorado Cattle Feeders Association; Ms. Jennifer Felzeim, W.I.F.E.; Dr. W. Dennis Lamm, Cooperative Extension.*

## HI-CAHS Staff



*Front Row: Sarah Bramble, Anthony Martinez, Michael Salasek, Nina Whitehead, Roy Buchan; Middle Row: B.J. Succo, Susan Hewitt, Vicky Buchan, Bart P. Beaudin, Paul Ayers; Back Row: Del Sandfort, Don Quick, Greg Cosma, Don Beard, Juanita Snyder, Phil Bigelow*

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## Research: Seed Grant Projects

*These research projects were funded with grant selection from an internal proposal review and a second tier review made by NIOSH scientists in Morgantown, West Virginia.*

### Evaluation of a Personal Heat Stress Monitor Under Dynamic Conditions

The purpose of the study was to evaluate the response of the Questemp II Personal Heat Stress Monitor under controlled environmental and metabolic conditions. The ear canal temperature measured by the Questemp II will be evaluated to determine if physiological and environmental factors influence its prediction of physiological heat strain, which is based on the premise that external ear canal temperature can be equated to esophageal temperature (i.e., core temperature). Elevated core body temperature is evidence of physiological heat strain. Data from ear canal temperature, facial skin temperature, esophageal temperature, and environmental parameters

will be used to assess the accuracy of the instrument and additionally, to improve its ability to predict physiological heat strain.

Laboratory data collection and raw data computer entry is complete. Analysis to determine if the Questemp II ear canal temperature tracks and is an accurate predictor of esophageal temperature, an analysis to determine the interactions of facial skin temperature and environmental parameters on the Questemp II ear canal temperature, and the development of an algorithm relating the Questemp II ear canal temperature to esophageal temperature are being completed this Fall and Winter.

*by Cynthia L. Ellwood &  
Kenneth D. Blehm*



### Congenital Anomalies and Agricultural Chemicals

Previous studies have reported an association between agricultural activities and congenital malformations, implicating pesticide usage. The purpose of this project was to describe the distribution of congenital anomalies in relation to pesticide application practices and crop types in Colorado. Data from the Colorado Registry for Children with Special Needs were obtained for the year 1989. Crop reporting districts were classified high, medium and low based on chemical applications,

herbicides, insecticides, corn and wheat. Birth defect rates were calculated for each of these groupings. Rate ratios were calculated with the rate of the low district as the denominator and the high and the medium district as numerators.

Rate ratios for patent ductus were elevated in regions with higher chemical application rates, high insecticide application rates and higher herbicide application rates. Rate ratios were elevated for limb reduction defects in areas with higher wheat production, for areas

with high fertilizer application, and where moderate amounts of herbicides were applied. Rate ratios for urinary tract anomalies were high in areas with higher insecticide application rates and areas of high corn production. Recent studies suggest an association between atrazine use and increased rates of birth defects. Corn and chemical fallow are the primary uses of atrazine. More detailed evaluations of these relationships are needed.

*by Deborah Merchant  
and Lorann Stallones*

### Tuberculosis Among Migrant Workers

The actual incidence of tuberculosis in Colorado among migrant farm workers is assumed to be 31-47%. However, due to the lack of research on the topic, the true prevalence is not known. This study looked at migrant farm workers in northeastern Colorado during the summer of 1994. SALUD Health Clinic participated with Colorado

State University in this research project as they administered the tuberculin skin test and collected demographic data and medical information. The skin tests were read within 48-72 hours after the injection to determine if the test was positive or negative. If the test was positive, there was a follow up by SALUD to ensure the appropriate

health care was provided.

Analysis of the data at this time is incomplete, but the prevalence rate appears to be approximately 30 percent. The incidence of tuberculosis tends to be high in this population due to inadequate health care, close living quarters, economics and other conditions related to the lifestyle of the migrant population.

*by Juanita Synder*

## Molecular Biomarkers of Grain Dust Exposures

The purpose of these laboratory studies is to develop biological markers of exposure responses to agricultural grain dusts for use in the prevention of respiratory diseases in farm workers. We are measuring molecular responses to grain dust extracts in human white blood cells in order to detect the induction of specific genes. These

studies will be applied to the screening of exposed workers so that we can compare the severity of responses to the levels of their exposures. The goal of these studies is to provide human data for establishing permissible exposure levels in order to prevent commonly found debilitating respiratory diseases among agricultural workers.

*by Greg Cosma*



## Acute Respiratory Effects and Endotoxin Exposures During Wheat Harvest.

This study evaluated acute cross-shift respiratory changes at 25 farms in northeastern Colorado during the summer of the 1994 wheat harvest. Trained field staff administered a questionnaire to harvest workers to gather information on respiratory health, past occupational exposures, and smoking status. Each worker was also asked to rank ten acute symptoms on a scale of one to five before they began harvest work for the day. Spirometry was performed immedi-

ately after the questionnaire was completed using NIOSH's HF5 spirometric system. Each participant wore a high flow personal air sampling pump with 35-mm, closed-face cassette and fiberglass filter. After at least six hours of work, spirometry and ranking of the ten acute symptoms were performed again. Total dust exposure was determined gravimetrically. NIOSH's Morgantown Laboratory measured total endotoxin using the *Limulus Amoebocyte Assay*.

The 98 harvest workers evaluated ranged in age from 18 to 80. Total dust exposures ranged from 0.11 mg/m<sup>3</sup> to 19.32 mg/m<sup>3</sup>. Endotoxin results are pending from NIOSH. The dust and endotoxin exposures will be correlated with cross-shift changes in pulmonary function. Age, smoking history, task, and presence of chronic symptoms will be included as covariates in the analyses.

*by Susan Viet*

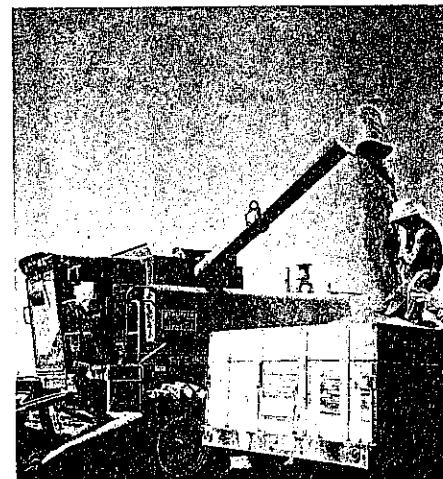
## Research: Characterization of Grain Dust Components

### Exposure to Pulmonary Reactive Components of Winter Wheat Grain Dust

A comprehensive description of grain dust and the concentrations to which wheat farmers are exposed during various work tasks had never been described, prior to research

initiated by HI-CAHS personnel. During 1992 and 1993, the work environment of farm and elevator workers was monitored by various industrial hygiene, microbiological, and entomological techniques to determine both dust composition and the level of exposure to various respiratory reactive agents found in wheat dust. Parameters examined, at both farms and elevators, included total dust concentrations, respirable dust and silica, levels of microbial agents in colony forming units per cubic meter (CFU/m<sup>3</sup>), and the arthropods (insects and mites) present in grain during harvest and after storage on the farm.

The results showed that total dust levels at elevators were approximately three times higher than at farms during harvest. All elevators surveyed during 1992 and 1993 and all farms except two during



*Truck drivers and grain auger operators can be exposed to high dust levels during harvest.*

1993 exceeded the American Conference of Governmental and Industrial Hygienists (ACGIH) recommended threshold limit value (TLV) for grain dust of 4 mg/m<sup>3</sup>. Exposures during the winter ship-



*When farmers or elevator workers enter a grain bin proper respiratory protection should be worn.*

ping period were much shorter than during harvest but were higher in dust concentration. However, the highest dust concentrations to which workers were exposed during the study, for both total and respirable dust, were in confined areas, such as inside grain bins during bin cleaning or during the unloading of grain bins during the winter shipping period.

Mean microbial exposure levels averaged an order of magnitude ( $10^5$ ) higher at elevators than at farms. *Alternaria* and *Cladosporium* were the most common fungi and are recognized allergens. The most common gram negative bacterium was *Enterobacter* and is probably the primary source of bacterial endotoxins believed to be responsible for such febrile syndromes as

organic dust toxic syndrome (ODTS).

Increased use of respirators that meet NIOSH standards during grain bin cleaning and the loading or unloading of grain, investigation of feasibility of improved ventilation for elevators, and development of health and safety training materials for farmers and elevator workers was recommended.

## Research: Pre-ROPS Tractors

### Rollover Protective Structure (ROPS) Field Testing for Pre-ROPS Tractors

Tractor overturns are a major cause of agricultural-worker deaths each year. Over 200 tractor rollover fatalities occur on U.S. farms annually. Although Rollover Protective Structures (ROPS) can reduce the possibility of serious injury during a tractor roll, many tractors are not designed to support ROPS. The objective of this project is to conduct field testing of ROPS that are attached to pre-ROPS tractors (tractors not designed to support a ROPS). In the first two years of the project, simulation and laboratory testing was utilized to design ROPS that successfully pass the rear upset tests in accordance with ASAE Standard S519. The tractor was controlled by a remote system to allow a rear upset without subjecting the operator to injury.

This year a side roll test was conducted with the same tractor and ROPS as the rear roll test. The tractor was driven toward an overturn bank at a speed of 16 km/hr (maximum vehicle velocity). The right side of the tractor climbed the ramp, the left side descended down the overturn bank, and the tractor rolled over on its side. This same ROPS experienced a side elastic and a permanent deflection that is acceptable according to ASAE Standards, and no part of the operator area was intruded upon or exposed. These field tests suggest that the designed ROPS/axle

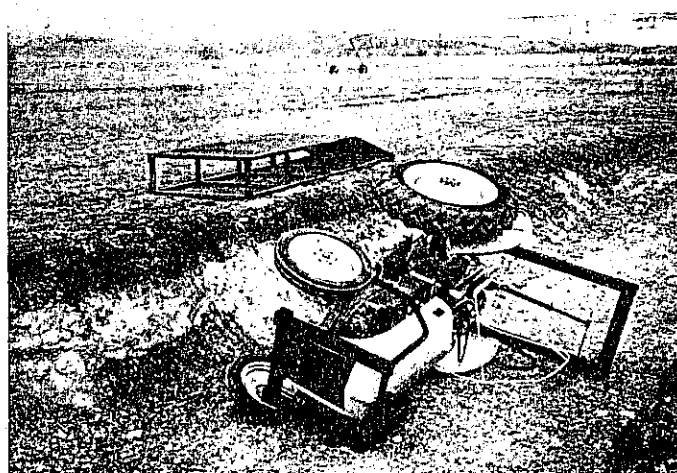
configuration for the pre-ROPS tractor is adequate to support an actual tractor rollover with regard to ASAE Standards by passing both rear and side upset tests.

A second set of field tests was performed on a retro-fit ROPS (available from the manufacturer). This ROPS was designed for a newer and larger tractor than the pre-ROPS tractor, but was the only model from the manufacturer that would easily attach without major modifications. Testing the tractor and retrofit



ROPS on the rear roll hill and the side roll facility created deflections that were acceptable to ASAE Standards. No part of the operator zone was exposed or intruded upon, and there was no structural damage. Field testing of a retrofit ROPS

suggests that it may be feasible to take a manufacturer's ROPS from a newer tractor (typically from the years when ROPS were offered as optional equipment) and fit them to older pre-ROPS tractors.



## Research: Needs Assessment

Improved health and safety in agriculture must ultimately depend on choices made by thousands of individual farmers and ranchers. To provide them with information for making these choices, health and safety education activities must be responsive to the interests and needs of families in agriculture. A HI-CAHS telephone survey of 314 farmers and ranchers in four Colorado counties was designed to collect information to assist in delivering such health and safety information.

On most items in the study there was little difference between farmers and ranchers--or between male and female respondents. In response to a list of important agricultural issues, the health and safety of children (ties with concern over water availability) was the issue of most

concern. Concern over general farm/ranch safety ranked only fifth among the eight areas of concern but still received a mean score of 4.0 on a 5 point scale. Farmers, to a greater degree than ranchers, and female respondents were particularly concerned about child health and safety indicating that programs focused on children might provide an avenue for reaching these two groups. The health and safety ranked highest to lowest were:

- machinery accidents
- chemical caused illnesses
- back injuries
- stress related problems
- hearing loss
- eye injuries
- respiratory problems

All groups reported that information provided through farm and ranch publications and information

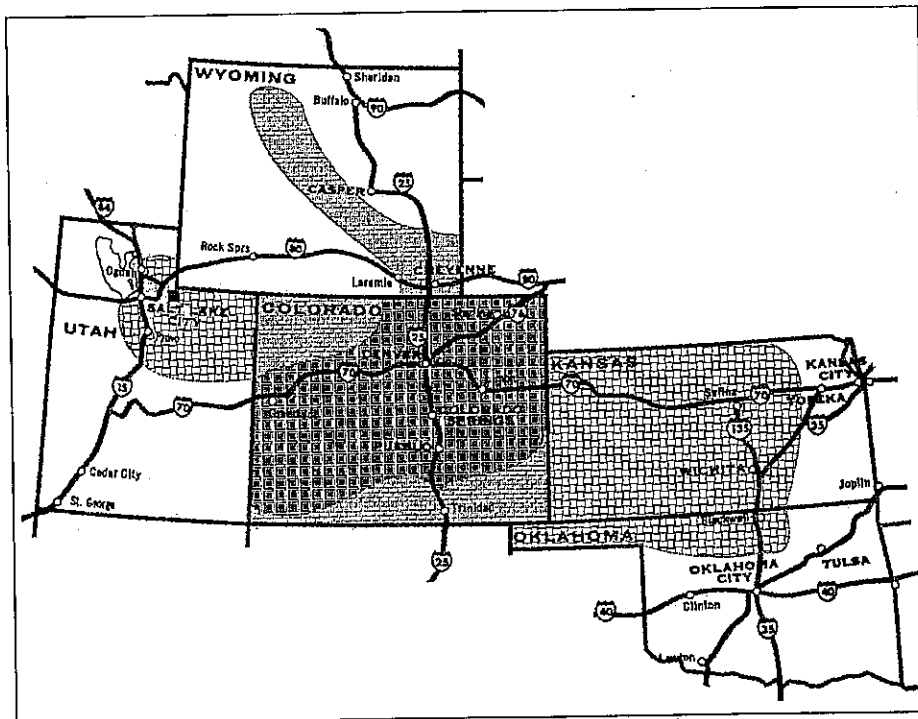
from Cooperative Extension personnel were the most likely places to receive health and safety information. Various youth organizations, veterinarians (particularly for ranchers), and newspapers were also seen as valuable sources.

Programs offered through various agriculture organizations were viewed as effective ways to provide health and safety information--if they were offered at a time of year when farmers and ranchers have some free time and at a location that did not require extensive time away from their agricultural responsibilities. The information and suggestions gained from this survey will help HI-CAHS personnel target programs more specifically to the needs of farm and ranch families in the Rocky Mountain region.

## Outreach: Service and Education Delivery

The focus of service activities continues to be training and education. The EPA Worker Protection training program conducted this year was a major emphasis for the group. However, migrant camp visits, Kids Farm Safety Day Camps and on-site hazard audits were conducted as in previous years. The loss of a key professional in the group resulted in a loss of overall productivity. However, the remaining staff members were able to provide significant, high-quality services to the agricultural community.

HI-CAHS service activities in the third year of the project have become regional in scope. The map depicts varying levels of on-site activity ranging from high levels of comprehensive service (dark shading) to limited on-site activities in four states other than Colorado, shown as medium or light shading depending on activity level. The majority of service work was conducted in Colorado and consisted of hazard audits (20 conducted) on farms and in agri-



businesses, and training and education activities (38 sessions on various topics for a variety of audiences.) Ten training and education sessions were conducted in adjacent states and included Worker

Protection training (EPA) in Wyoming, grain dust and grain elevator health and safety in Oklahoma and Kansas, and general agricultural health and safety in Utah.

## Outreach: Kids Farm Safety Day Camps

Nationally, approximately 300 children die each year from agricultural accidents. For each death, there are approximately 100 disabling accidents that can be directly attributed to agriculture. In 1991, Colorado State University Cooperative Extension initiated a program to reduce the number of these deaths and injuries, through an educational program for rural children. The program, Kids Farm Safety Day Camps, was designed to create an awareness of farm hazards for agricultural youth. The focus of this training program is experiential learning (demonstration) with a target audience of third, fourth and fifth grade children. HI-CAHS has been supportive and has participated in this ongoing day camp program.

Since 1991, HI-CAHS personnel have participated in 11 day camps, teaching 32 sessions, and assisting in the education of over 2200 children concerning the hazards involved with farming and ranching. The HI-CAHS staff has delivered educational sessions on the following topics: Chemical Safety and Personal Protective Equipment, Electrical Safety, Tractor PTO Entanglement, and Grain Entrapment. Colorado State University Cooperative Extension organizes the sessions, and in addition to HI-CAHS, many other organizations participate or sponsor the activities, including: the National Association of Wheat Growers Foundation, Colorado As-



*HI-CAHS consultant assists third grader Juan Ramirez into a chemical protective suit during a chemical safety session. This was one of many topics covered during the Kids Farm Safety DAY Camp at Pioneer School in Fort Morgan, Colorado. Photo provided courtesy of Dan Lassiter/Fort Morgan Times.*

sociation of Wheat Growers, Specialty Vehicle Institute of America, American Red Cross, and the Colorado FFA Foundation. Assistance is also offered by local representatives of implement dealerships, fire departments, veterinary clinics, ranches, farms or chemical dealerships. These individuals teach additional topics such as: Tractor Roll-over, First Aid, ATV Safety, Farm Accident Rescue (First On The Scene), and Large Animal Safety.

The HI-CAHS program assessment unit conducted a post evaluation of a day camp held in the summer of 1992. The objectives of this evaluation were to gather parental

perceptions of knowledge retention and behavior changes that may have resulted from attending the day camp. Eighty-eight percent of the families involved agreed to participate in a telephone survey. The responses from the parents were very favorable and encouraging, with the majority providing clear examples of learning retention and changes to safer behaviors in their children. HI-CAHS plans to continue involvement in this program that has a significant positive influence and provides an intense educational experience for kids of all ages in the agriculture community.

## Outreach: Migrant Camp Visits

A crucial interacting activity was continued this year. HI-CAHS provided SALUD migrant health clinic system with a student intern to conduct migrant camp visits for environmental and health/safety intervention. The student intern, Anthony Martinez, successfully conducted 48 visits to 16 migrant worker camps during the summer months. The visits involved:

- Collection of water samples (14 visits)
- Identification of hazardous conditions (52)
- Accompanying the SALUD medical van (3 visits)
- Mosquito trappings (7 visits)
- Promotion of HI-CAHS and SALUD activities (30 visits)
- Camp visits with HI-CAHS Spanish interpreter, John Reveles (24 visits)
- Camp visits concerning Tuberculosis project (12 visits)
- Camp visits in Western Slope area (5 visits)
- Distribution of EPA Worker Protection materials
- EPA Pesticide Safety Posters (8)
- EPA Agricultural Pesticide Worker Books (410)
- EPA Worker Protection flip charts (3)

# Outreach: The Environmental Protection Agency Worker Protection Standard For Agricultural Pesticides

In 1992, the Environmental Protection Agency (EPA) revised the Worker Protection Standard (WPS) for Agricultural Pesticides. The revised WPS governs pesticides used in the production of agricultural plants on farms, forests, nurseries and green houses. Most of the revised WPS requirements were due to take effect on April 15, 1994. However, legislation was enacted in April 1994 that delayed implemen-



tation of some, but not all, of the revisions until January 1, 1995. Under contract by EPA, HI-CAHS developed a train-the-trainer course to allow the agricultural community to learn about the WPS and to prepare for the standard's implementation. From December 1993 to March 1994 HI-CAHS developed and delivered twelve formal training sessions concerning the EPA WPS (eight sessions were held in Colorado and four were held in Wyoming).

The training sessions were designed to explain the requirements of the WPS concerning: personal protective equipment, restricted-entry intervals, worker notification of applications, pesticide safety training for agricultural workers and handlers, decontamination sites, emergency assistance, and display of the pesticide safety poster and pesticide applications. The 388 participants of the HI-CAHS sessions are now designated and authorized by EPA to train agricultural workers



and pesticide handlers concerning pesticide safety and other WPS requirements. Beyond the formal training sessions, HI-CAHS presented information to 618 individuals at agricultural conferences and meetings to further disseminate information to the public. Formal and informal training concerning the WPS and pesticide safety are scheduled for future outreach.

## Outreach: Education and Training Product Development

### Guide to Evaluation of Learning

To determine whether or not a training session or program has met the goals that the agricultural health and safety specialist has set, an evaluation needs to take place. This evaluation can be accomplished during or after the event and consists of several different steps and techniques. The assessment of the learning is an important aspect of this process.

HI-CAHS developed a guide that consists of several monographs that will assist agricultural health and safety specialists in building learning evaluation into their session or program. *Evaluation of*

*Instruction: An Overview* looks at the evaluation process in general and learning evaluation in detail. *Legal Implications of Testing Learners* specifies what legal considerations need to be made when assessing an individual's learning. The literature about government guidelines and court cases is reviewed and suggestions for test administration are given.

*Constructing Criterion-Referenced Tests* explains criterion-referenced testing and details the process of creating this type of test. Many guidelines are given for writing the test items for a paper-and-pencil test. *Validity in Crite-*

*riion-Referenced Testing* elaborates on the importance of constructing a valid test and suggests ways of showing evidence of validity. The last monograph, *Reliability in Criterion-Referenced Testing*, considers the reliability of a test and how to show evidence of reliability.

These monographs are for the purpose of assisting the agricultural health and safety specialists evaluate the learning which has taken place in a fair and accurate manner, resulting in better data about the learning which has taken place and better decisions about improving the instruction.

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