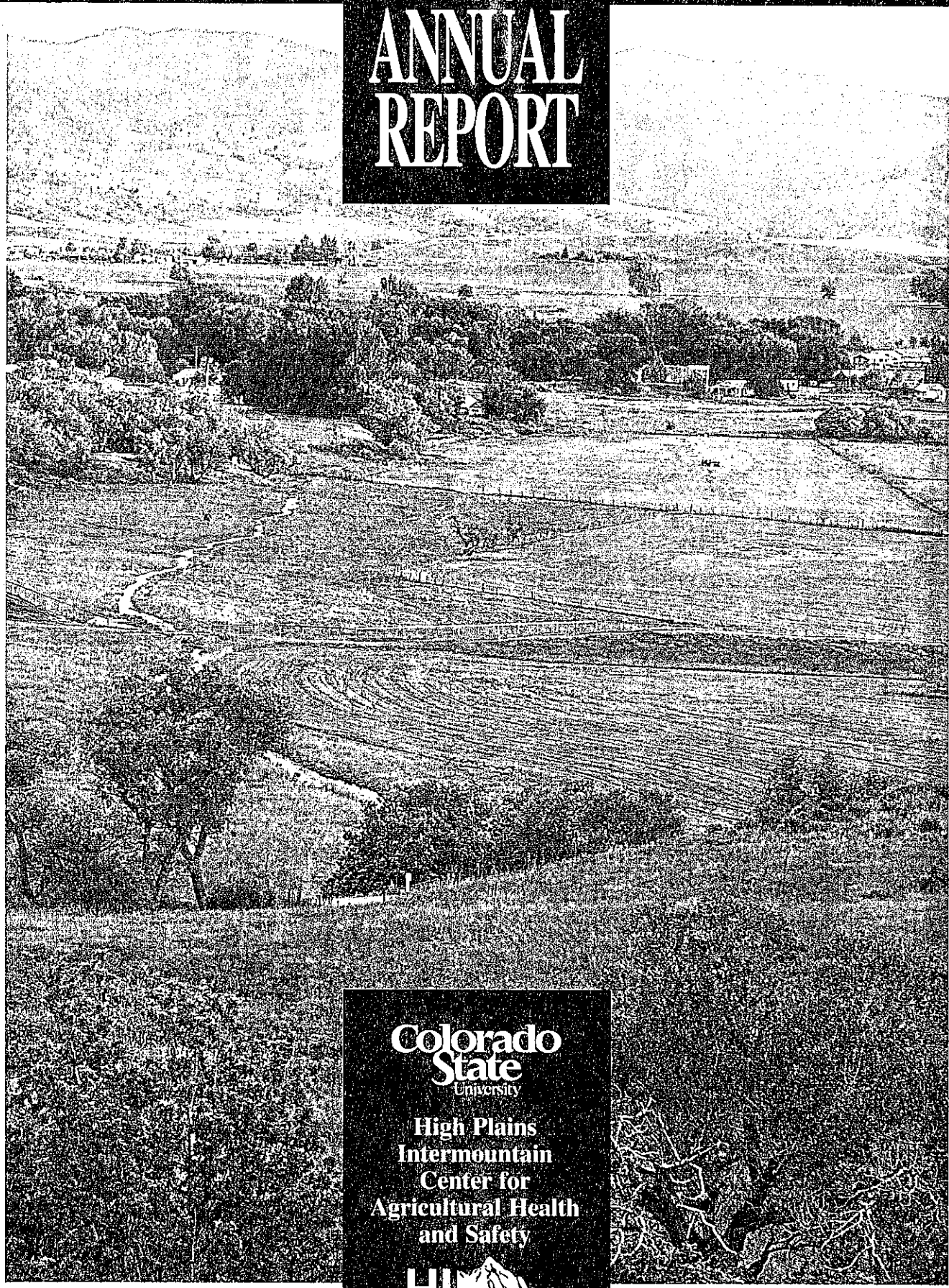


1993 ANNUAL REPORT



Colorado
State
University

High Plains
Intermountain
Center for
Agricultural Health
and Safety

HI
CAHS

Project Director Statement

The HIGH PLAINS INTER-MOUNTAIN CENTER FOR AGRICULTURAL HEALTH AND SAFETY (HI-CAHS) was established at Colorado State University (CSU) in 1991 with funding from the National Institute for Occupational Safety and Health (NIOSH). HI-CAHS is dedicated to improving the health, safety and well-being of the residents of the Rocky Mountain Region and the high plains of the west. Achievement of this mission is by the application of preventive medicine in agricultural environments. HI-CAHS is charged with addressing occupational health and safety needs in agriculture, the most dangerous business in the country.

HI-CAHS addresses health and safety through a network of farmers, ranchers, agribusinesses, Colorado State Cooperative Extension, and farm and ranch organizations. The program is multidisciplinary with input from engineering, medicine, industrial hygiene, safety, education, social work, epidemiology, toxicology, general environmental

health, and agricultural sciences. The program is also multi-organizational, including the Institute of Rural Environmental Health, the Department of Agricultural and Chemical Engineering, the Department of Social Work, CSU Extension, the School of Occupational and Educational Studies, and the Human Factors Research Laboratory. Key off-campus participants include the Greeley Clinic, Poudre Valley Hospital, the SALUD Migrant Labor Clinic, and the Sunrise Migrant Clinic.

The cornerstone of funding for HI-CAHS is NIOSH; however, HI-CAHS has secured financial support from the Occupational Safety and Health Administration (on-site services in identification and control of hazards), and the Environmental Protection Agency (pesticide safety training). This is a truly unique arrangement, and a testament to progressive thought and leadership on the part of all three agencies.

This report represents the accomplishments of the second year



Roy Buchan, Ph.D.

of HI-CAHS. The year was very successful and productive regarding educational achievements, direct industrial hygiene and safety services, program evaluation at Colorado State and off-campus, research, and direct occupational medical services for migrant workers.

HI-CAHS Advisory Committee



Left to Right:

- Dr. Jerry Appelbaum**
Corporate Medical Director
Gates Clinic, Inc.
- Ms. Jane McCammon**
Colorado Department of Health, DCEED
- Mr. Billy Johnson**
Future Farmers of America
- Ms. Jennifer Felzeim**
President, Women in Farm Economics
- Mr. Buford Rice**
Executive Vice President
Colorado Farm Bureau.

Not Pictured:

- Mr. Bart Chadwick**
Regional Administrator
U.S. Department of Labor-OSHA
- Ms. Sally Harms**
Rocky Mountain Farmers Union
- Dr. W. Dennis Lamm**
Assistant Director, Cooperative Extension
- Mr. Orville Pieper**
Coordinator of Young Farmer and
Cooperative Education
Northwest Junior College
- Mr. Ben Rainbolt**
President
Agriculture Teachers Association

Ms. Robbie Wyckoff
Farm Safety Co-Chairperson
National Association of Wheat
Growers Foundation.

Committee member Jerry Applebaum, M.D. says,

"The meeting doesn't run on schedule. The staff starts on time and there seems to be constant interplay between speakers and committee members. This is a reflection of both interest and input. There never really is a dull moment. This is a very sensitive and responsive organization."

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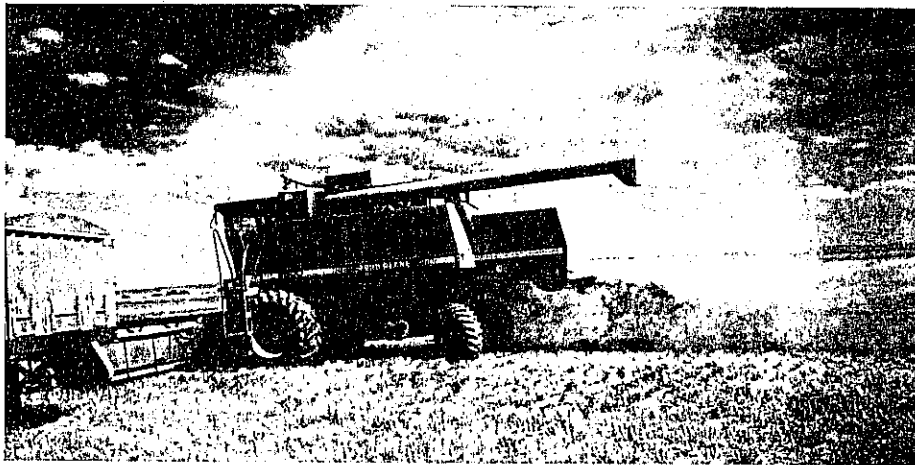
Research: Winter Wheat Grain Dust

A Characterization of the Potentially Pulmonary Toxic Components of Winter Wheat Grain Dust on Farms and Elevators in Colorado

Acute and chronic respiratory distress due to conditions such as grain fever syndrome, asthma, allergic alveolitis, and chronic bronchitis from occupational exposure to grain dust, has been reported. The etiologic agents in grain dust causing these conditions are as yet undetermined. In order to better characterize the potentially pulmonary toxic components of winter wheat grain dust, industrial hygiene surveys were conducted at eight farms and seven elevators in northeast Colorado during the 1992 wheat harvest, four farms and three elevators during winter grain shipments, and four farms and three elevators during the 1993 grain harvest.

The majority of research characterizing grain dust exposures has been conducted at large terminal elevators. One of the primary hypotheses of this research was that the components of grain dust and worker exposure is different at farms and elevators. The different parameters measured included total mass concentration in milligrams of dust per cubic meter of air (mg/m^3), percent respirable silica, concentration of organophosphate pesticides, particle size distribution, an enumeration in colony forming units (CFU) per cubic meter, and identification of the gram negative bacteria and fungi present in the dust. The different microbiological airborne concentrations measured in CFUs per cubic meter included total bacterial plate count, mesophilic fungi, thermophilic fungi, gram negative bacteria and thermophilic organisms which included both actinomycetes and bacteria.

As expected, exposures at the farm and elevator were very different in some regards but very similar in others. The mass concentration of dust in the air on farms during har-



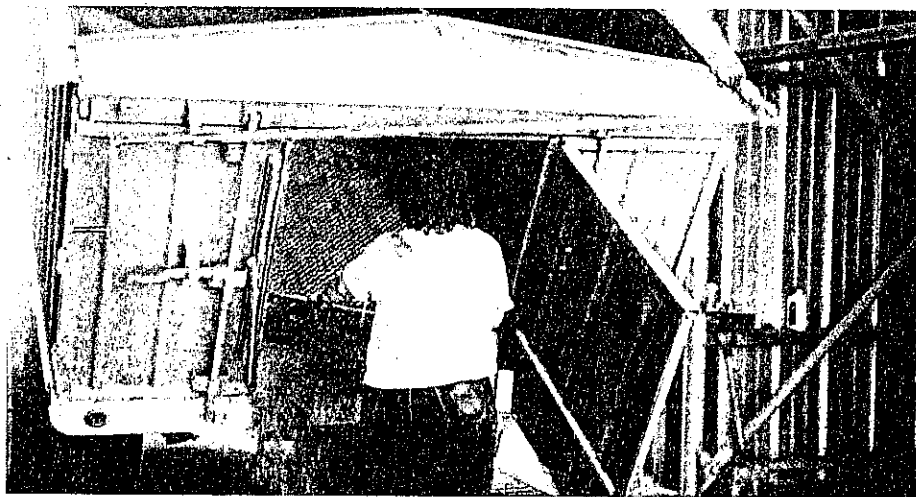
Grain dust exposures at the farm and at elevators were very different in some regards but very similar in others.

vest had a mean value of $7.82 \text{ mg}/\text{M}^3$, while elevators had twice that level with a value of $16.17 \text{ mg}/\text{M}^3$. Exposures at elevator were an order of magnitude higher in the level of microbiological airborne concentrations than at farms, with measurements of 10^5 vs. 10^4 , respectively. In addition to the quantitative difference, there were qualitative differences in the species sampled in these two location types.

Farms and elevators were similar where percent respirable silica levels were below $0.1 \text{ mg}/\text{M}^3$ and where traces of organophosphate were detected at two farms and none was detected at elevators. 1-Naphthyl isothiocyanate, a natu-

rally occurring chemical resulting from organic decomposition, was found at three farms and two elevators in the summer of 1992 by the pesticide sampling method. The significance of this discovery is not fully known.

In the summer of 1993, additional samples were taken for gram negative endotoxin analysis and were found to be correlated with the amount of dust sampled. The most important exposures detected at both farms and elevators were total dust concentrations, and the quantitative and qualitative makeup of microbial and endotoxin exposure. All these exposures were strongly correlated.



The most important exposures detected at both farms and elevators were total dust concentrations, and the quantitative and qualitative makeup of microbial and endotoxin exposure.

Research: Pre-ROPS Tractors

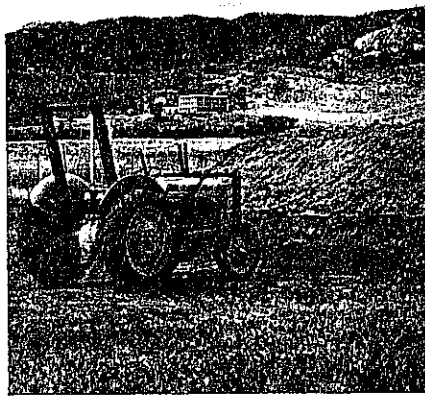
Rollover Protective Structure (ROPS) Design and Testing for Pre-ROPS Tractors

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 use simulation and laboratory and field testing to develop a suitable modification so that ROPS can be successfully attached to pre-ROPS tractors (tractors not designed to support a ROPS).

In the first year of the project, finite element and computer-aided design analysis were conducted to identify the critical areas of the ROPS/axle connection. A laboratory ROPS testing apparatus was used to investigate the feasibility of attaching ROPS to a pre-ROPS tractor axle. Successful static ROPS testing using the modified ROPS/axle attachment was conducted in accordance with ASAE Standard S519.

In year two of the project, field upset tests were conducted to further investigate the modified attachment of the ROPS to the tractor axle and the structural integrity of the pre-ROPS tractor axle. The investigation used a common pre-ROPS tractor from the late 1940's which is still very popular for general utility type work. The tractor was remote controlled to allow a field upset without the operator being in danger of injury. The remote control system allows the nearest researcher (operator) to be over fifty feet from the tractor during the rollover.

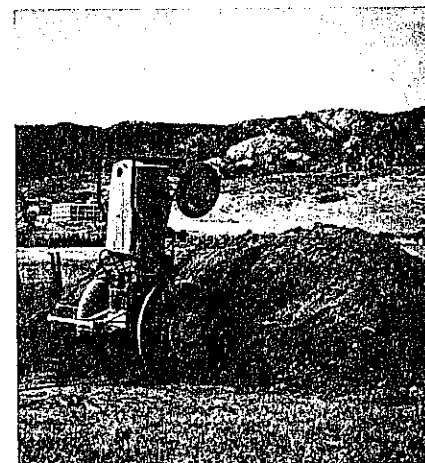
The remote control system was based on two normally extended pneumatic cylinders (air power). These two cylinders release the clutch and the brake when an electric solenoid was activated from the remote control box, allowing the



The rear overturn bank used for a rear upset test was constructed of top soil with a front slope of 60 degrees.



The tractor was driven toward the test hill at a speed of 5-8 km./hr., using a remote control system.



A pre-ROPS tractor was successfully equipped with a ROPS and passed the rear field upset test.

tractor to move forward. The cylinders were orientated such that if electrical power or air pressure was lost, the clutch and the brake are automatically depressed, stopping the tractor. The system also incorporates a fuel shut off and power shut off in the control box and the steering was locked in a center position. ASAE Standard testing only requires that the tractor operate in a straight line.

The ROPS used in this study was attached directly to the tractor utilizing the fender mounts and four additional bolts with a compression fit on the axle. The plastic and elastic ROPS deflection was measured using a friction collar. The rear overturn bank used for a rear upset test was constructed of top soil with a front slope of 60 degrees. The width was 20 feet and the height was eight feet. The landing area had a cone index greater than 1,500 kPa. ASAE Standard S519 was used to design the overturn bank. The tractor was driven toward the test hill at a speed of 5-8 km/hr, using the remote control system. As the tractor climbed the hill, it rolled over backward under its own power.

With the ROPS/axle combination, the ROPS experiences an elastic deflection of approximately 40 mm. The plastic (permanent) deflection was undetectable, and considered negligible. This deflection was acceptable according to ASAE Standard requirements. It was also observed that no part of the normal operator area was intruded by the ROPS or exposed to the ground. The axle experienced no noticeable deformation or fatigue.

This study has allowed an understanding of rollover protective structure field testing. A pre-ROPS tractor was successfully equipped with a ROPS and passed the rear field upset test. Future studies will include ASAE Standard side roll testing for the same tractor and retro-fit ROPS.

Research: Needs Assessment

More than three hundred farmers and ranchers from four Colorado counties responded to a HI-CAHS telephone survey in the summer of 1993. Researchers sought to gather opinions about the importance of agricultural health and safety issues and the best methods to communicate accident and work-related illness prevention information.

Respondents were aware of the dangers associated with agriculture. More than 57% of the farmers and ranchers reported having personally experienced an agriculture-related injury or illness or knew someone who had. Furthermore, three-fourths of those indicated that these accidents or illnesses had a direct impact on them and their work.

They made it clear that they would like to do something about increasing health and safety features

on their farms and ranches if:

- Information could be obtained at convenient times and places
- It would not be too costly to make changes
- It did not involve government mandates

The five sources thought to be the most effective for reaching farmers and ranchers when announcing workshops or providing health and safety information were:

- Farm and ranch publications
- Cooperative Extension personnel
- Agriculture-related youth organizations
- Veterinarians
- Radio announcements

Machinery-related accidents and agricultural, chemical-related problems topped the list of health and safety concerns for the farmers and

ranchers surveyed. Back injuries, stress-related problems, hearing loss, eye injuries, and respiratory problems also received substantial mention. Of particular concern was the health and safety of children and young adults who are associated with agriculture. Assuring their health and safety tied with the availability of water, exceeded the price of commodities and farm equipment as the most important issue facing farmers and ranchers today.

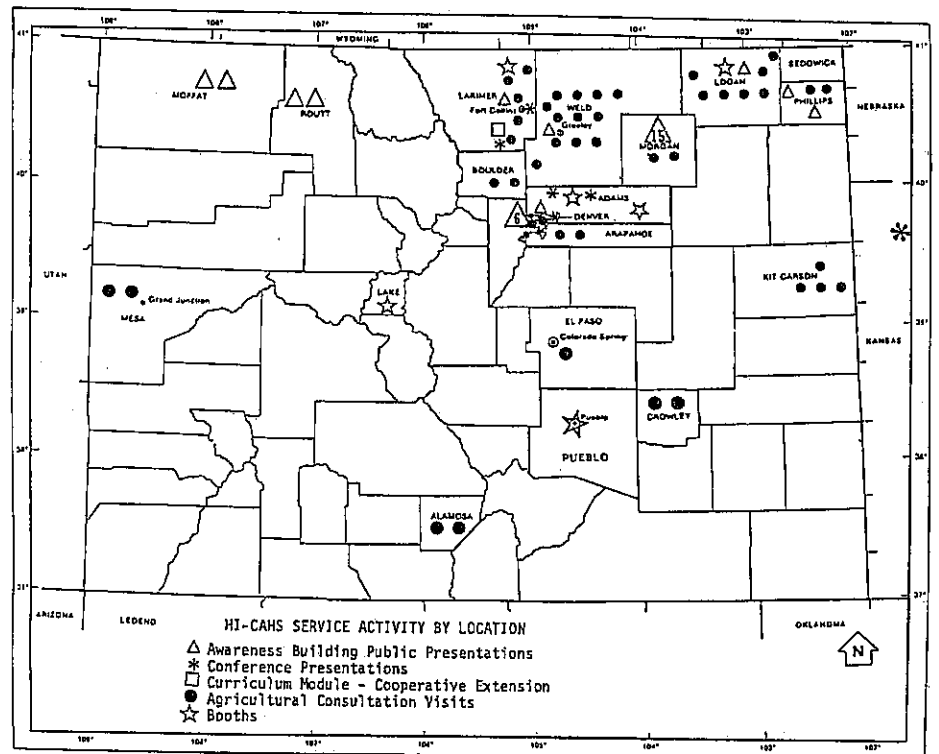
The survey results indicate that the health and safety of the respondent's children was of far greater concern than the health and safety of adults. Therefore, measures aimed at youth and young adults would be more readily received as a strategy for preventing agriculture-related injuries and illnesses in the future.

Outreach: Service and Education Delivery

In response to client needs and input from the HI-CAHS Advisory Committee, promotion of direct on-site consultation activities was reduced. This resulted in fewer hazard audit visits to agricultural businesses than projected and allowed for greater emphasis on educational outreach activities. Outreach staff members became more involved in training module design and delivery of customized educational sessions to a wide variety of groups. HI-CAHS provided 31 training sessions when only six had been projected.

Major activities during the year included participation in Safety Day Camps for Kids with Cooperative Extension; providing educational booths at state, county and local fairs and meetings; working with producers and professional groups by providing education and technical assistance; and, conducting 49 health and safety hazard audits in agricultural businesses.

Finally, efforts by outreach staff



resulted in the addition of funding from the Environmental Protection Agency to expand Center educa-

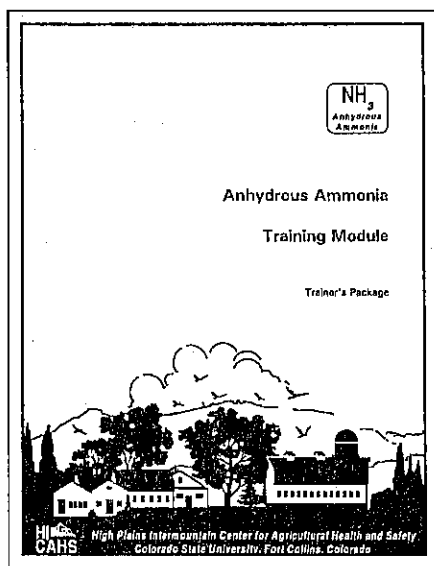
tional activities. Significant progress was also made in developing a medical referral system.

Outreach: Education and Training Product Development

Anhydrous Ammonia Training Module

This module was developed to provide an instructional program that will be delivered by an anhydrous ammonia (NH_3) safety specialist for a group of employees at a bulk NH_3 distributing plant. The goal is to improve employees knowledge and usage of safe NH_3 handling procedures. It is intended that the specialist will deliver a training session on-site, and leave the module with the agency or supplier for training of their new employees. The expected benefit is to have ongoing NH_3 safety training on-site, without the need for a specialist.

Before the module could be developed, a video needed to be selected and the session design completed. The Farmland Industries' *Caution Ammonia, Handle with Care* video tape was determined to fit the intended needs. The session design was based on the adult education technique of presentation-application-reflection. The



trainer will present the content (in this case via the video), have the learners apply what they have learned (make an actual NH_3 transfer), and then reflect on what they have accomplished (through questions and evaluation). The result is a 3.5 hour training module that will train employees on how to safely transfer NH_3 from a bulk tank

to another bulk tank, nurse tank, or applicator.

Instructional Video Evaluation Instrument

The HI-CAHS advisory committee strongly recommended videos be incorporated into the education programs developed by the Education and Training Team. In keeping with this mandate, several videos were identified that might be adapted for use in training programs. Without a tool for evaluating a video's instructional content, it was necessary to conduct some research into the evaluation of an instructional video. The result of this research was the development of the **Instructional Video Evaluation Instrument**. Through a series of 17 quality indicators, the instrument can quantify the instructional usability of a video. These indicators cover such topics as: Content, Instructional Plan, Technical Production, and Included Supplemental Materials.

Outreach: Medical Component Interactions

To better assist an underserved population, HI-CAHS identified a need to focus on medical component interaction efforts with local health care providers. Several outreach initiatives were established.

Medical Referral System

An effective medical referral system was organized to ensure that individuals who had suffered an agriculturally-related injury or illness received necessary specialized care from an occupational health professional, and also received training, education or intervention from HI-CAHS. The original grant proposal envisioned a system where HI-CAHS would refer issues requiring medical expertise to identified medical professionals, and the medical clinics would refer training or hazard survey needs to HI-CAHS for appropriate follow-up. Initially, a referral system was

proposed between HI-CAHS, Plan de Salud del Valle, Inc. (SALUD) migrant clinics, and the Greeley Foundation Medical Clinic – Corporate Health and Medical Systems (CHAMPS). Investigation of the proposed system revealed that SALUD had secured the services of an occupational specialist, and was not in need of the referral services of CHAMPS.

In exploring alternative referral possibilities, HI-CAHS representatives became aware of a nonprofit clinic, the Sunrise Community Health Center in Greeley, Colorado, which provides medical care to the

migrant population and other agricultural workers. A referral relationship between HI-CAHS, Sunrise and CHAMPS was pursued, developed and implemented. To date, the system has treated one case, a migrant pickle worker with a pesticide rash. It should be noted that the referral system uses set case definition parameters to ensure control and consistency. The most important parameter is that the injury or illness not be compensable by other means (e.g. worker's compensation).

Cooperative Training Efforts

Establishment of the medical referral system lead to an initiative concerning cooperative training efforts. HI-CAHS explored training efforts with CHAMPS, SALUD, Sunrise, and Larimer County Health Department - Migrant Health Program. This resulted in numerous commitments and proposals for HI-CAHS involvement in health and safety training for medical personnel, migrant workers and migrant children. In addition to commitments for coordinated training, Larimer County Health Department is working with HI-CAHS to establish a medical referral loop involving an occupational health physician from Poudre Valley Hospital.



Migrant Camp Visits

A crucial interaction activity was to provide SALUD migrant health clinic system with a HI-CAHS student intern to conduct migrant camp visits for environmental and health/safety intervention. The student intern, Anthony Martinez, successfully conducted 79 visits to 14 migrant worker camps during the summer months. The visits involved:

- Collection of water samples (18 visits)
- Identification of hazardous conditions (37 visits)
- Accompanying the SALUD medical van (3 visits)
- Mosquito trapping (5 visits)
- Promotion of HI-CAHS and SALUD activities (26 visits)

Visits resulted in the identification of:

- 14 safety related hazards
- 32 general environmental health issues
- 2 occupational health conditions
- 1 direct clinic referral

These hazards were brought to the attention of the camp owners and/or managers during 17 various contacts for the purpose of hazard abatement. Anthony also produced a journal documenting activities which provided detailed maps to camps, described the camps, and identified hazards.



New Mobile SALUD Van

Another interaction initiative resulting from a HI-CAHS funding contribution was the purchase of a new mobile van for SALUD's medical outreach activities. HI-CAHS representatives accompanied the van to several migrant camps. The migrants served by SALUD expressed gratitude for the mobile service since their work locations and schedules often prohibit visiting the various medical clinics during working hours.



In summary, HI-CAHS was successful in establishing relationships with several local health care professionals and groups. HI-CAHS will strive to build upon these relationships to better serve the agricultural community in injury/illness identification and treatment, hazard correction and prevention, and health and safety training.

HI-CAHS STAFF



Left to Right: Paul Ayers, B.J. Succo, Del Sandfort, Sue Hewitt, Vicky Buchan, Mary Jo Hamilton, Bob Grundemann, Nina Whitehead, Sarah Robbins Bramble, Don Quick, Bart P. Beaudin, Don Beard

Next Year's Goals

A great deal has been accomplished this year, and we are continuing to improve and increase our impact at the farm and ranch level. In the upcoming year, we plan to change our emphasis from on-site consultative services to outreach education and significantly increase our medical impact through the migrant labor clinics. New research projects include:

- Evaluation of a Personal Heat Stress Monitor under Dynamic Conditions
- Congenital Anomalies Associated with Agricultural Chemical Use
- Cytokine Gene Induction Following Grain Dust Exposure in Human Cells
- Prevalence of TB Among Migrant Farm Workers

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