1999 Annual Report

High Plains Intermountain Center for Agricultural Health and Safety

HI CAHS

Colorado State University

photo by Chuck Collins

Director's Statement

Agriculture remains one of America's most dangerous occupations. Even with the NIOSH Agricultural Initiative, agriculture remains one of the most under served populations when it comes to the protection of workers against accidental trauma, disability and death and the prevention of occupationally acquired diseases. The High Plains Intermountain Center for Agricultural Health and Safety (HI-CAHS) has been working through research, outreach and education to address these issues for the past nine years. Due to funding the HI-CAHS effort has primarily been limited to the immediate geographic area of Colorado. One of our major goals this year was to "truly" become a regional center serving the states of Colorado, Utah, Wyoming, Montana, North Dakota and South Dakota. We have made major strides in this area in the past year by adding members to our external advisory committee from each of these states. We held our first regional advisory committee meeting outside the state of Colorado last spring in Jackson, Wyo., with a great turnout and fantastic exchange of information and new ideas. Our other initiative was to utilize the existing cooperative extension services of each of these states. Last April we hosted a meeting of cooperative extension safety specialists in Fort Collins to learn of their needs and programmatic desires for each of their states. The result is that for the first time small grants are being awarded this year to conduct outreach and train the trainer exercises to improve agricultural health and safety in each of those states. HI-CAHS is well on its way to becoming truly a regional center serving a geographic area covering over 20 percent of the continental land mass of the United States.

HI-CAHS has continued its research mission by successfully completing a large number of projects resulting in national publications with research topics ranging from cellular molecular toxicology investigating the mechanisms of lung tissue inflammation due to grain dust exposure, the social and economic impact of on-the-farm fatalities to engineering control strategies based on tractor stability. We truly have a multi-disciplinary research team in place. As for outreach and education, we continued to work with under served populations such as migrant workers in pesticide safety training, children's safety day camps and health and safety audits on over 35 corn farms. The audits served as part of an effort to prevent disease and injury, but also to reduce the cost of workmen's compensation insurance premium costs to farmers. We also played the central role in working with NIOSH to establish a multi-site program evaluation. The evaluation will be used nationwide to assist us all in monitoring and improving our programs in order to meet the needs of our constituency.

I close in saying that 1999 was a very successful year. HI-CAHS personnel impacted over 14,218 persons involved in or serving agriculture. HI-CAHS' commitment to agriculture remains strong, with solid support from NIOSH, and many other federal, state and volunteer organizations. Most importantly we maintain very strong support from the agricultural community. We promise to continue in our efforts to prevent injury to people and property caused by accidents, and to ardently work to prevent disability, occupational disease and death in the agricultural workplace throughout the region. I urge you to read this report as it is full of interesting information and facts about what we have done in the past year and tells the story of HI-CAHS with its allies and friends. We look forward to the next year and its new challenges with the ever present hope of having a positive impact.

Dr. Roy Buchan
Director

1999 Report Contents

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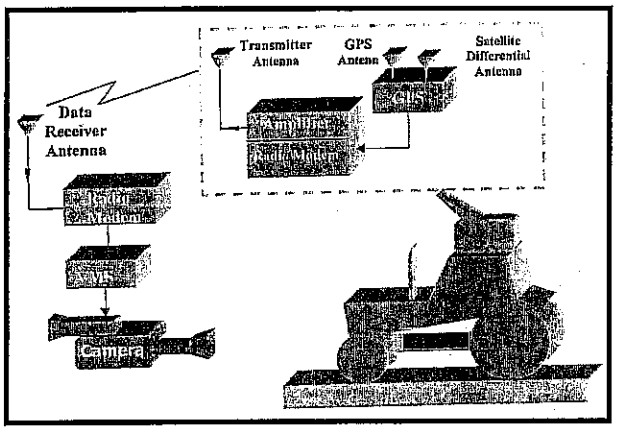
Research: Engineering Control Strategies Based on Tractor Stability

(Drs.. Paul Ayers and Juhua Liu)

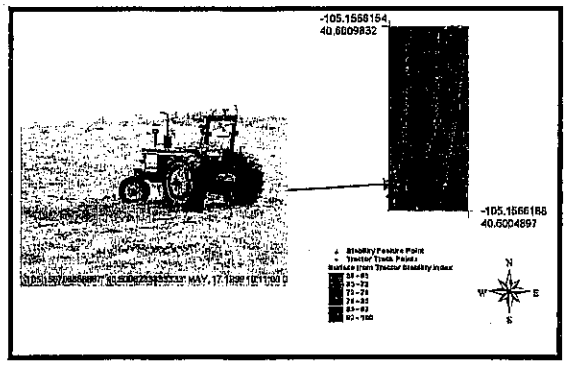
Tractor overturns are a leading cause of fatalities in the agricultural industry. They accounted for an average of 51 percent of tractor-related fatalities from 1985 to 1995 with an annual rate of 5.4 deaths per 100,000 tractors in 1995. These overturns result in one of every five farm fatalities. Tractors work on steep slopes, unexpected banks and uneven terrain. These situations result in tractor turnover when tractors lose stability. Operators who are not informed about tractor safety and about the stability of the tractor in the field are more likely to have tractor overturns and serious injuries. Better understanding of tractor stability will greatly improve the intervention effectiveness in reducing these injuries.

Our objective is development and evaluation of a tractor stability monitoring system. The system is designed to monitor tractor stability and develop stability mapping and related technology for tractor operations under specific tractor use conditions. A quantitative measure referred to as "dynamic stability index" had been developed based on the tractor's operating conditions. This stability index accounts for many dynamic factors including angular velocity and turning speed of the tractor during operations. The dynamic stability index helps predict tractor overturn and suggests engineering control strategies that may be useful in preventing serious injury. These control strategies include placing protective structures on the tractor to reduce injury in an overturn does occur.



Recent efforts in this project have verified the value of engineering control strategies based on the stability index. To do this, a series of state-of-the-art electronic measuring tools were combined to examine stability in the field operations of the tractor.

A driving safety management and stability mapping system of tractor stability (MSTS), a global positioning system (GPS) and a geographic information (GIS) together with video mapping systems (VMS) of the operation. The block diagram insert shows how all these information gather systems work together in assessing tractor stability. When the tractor is operating in a field, its stability is measured by the MSTS while its location is recorded by the GPS. Visual information of the tractor stability at the work site is recorded by video technology. A tractor stability map including still pictures and video slips is then generated with the GIS working together with the video mapping software. Field tests of the stability mapping system have been conducted in various terrain to understand tractor stability in many different situations. Insights from these studies will help operators and farmers understand the factors that determine tractor safety and lead to safer operations for differing terrain and use patterns for the tractors.



Program Assessment/Resource Development Unit (PARD)

(Vicky Buchan, Sue Tungate, Angi Hill)

The primary role of the Program Assessment and Resource Development staff is evaluation and feedback on center wide activities; a few special projects are highlighted here. Several center "product" evaluation projects have been undertaken by the PARD unit staff during the past year. We particularly appreciate the time and effort that members of our advisory board and NIOSH personnel have volunteered to assist in reviewing the AgriAction Information Sheets prepared by the outreach personnel. A number of improvements and corrections have been made based upon the feedback. The sheets are available for downloading on the center web site. The unit has also developed an instrument and is currently receiving feedback on the center web site. Sue Tungate utilized a review of the literature and multiple sources of feedback to develop the web evaluation tool. We will be happy to share this instrument with others, as this form of assessment is still in its infancy.

The PARD unit has also undertaken an interesting pilot research project under the direction of Sue Hewitt. With support from the School of Veterinary Medicine at Colorado State University, 38 randomly selected, mixed and large animal practice veterinarians from rural Colorado participated in a telephone interview about the current and potential role of veterinarians in agricultural health and safety. An earlier needs assessment, targeting farmers and ranchers, completed by HI-CAHS had indicated that vets are often identified as a trusted source of health and safety information. The results indicate that veterinarians do perceive several important health and safety roles they may fulfill. An expansion of the study to Public Health Region VIII is planned in 2000 to investigate the generalizability of these results.

HI-CAHS Regionalization Report

(Tina Daniels)

The HI-CAHS Regionalization project is intended to extend the primarily Colorado-focused efforts of the center to each of the states in Region VIII. To facilitate this effort, Cooperative Extension Farm Safety Specialists were identified in each state and contacted. Cooperative Extension was seen as an obvious choice for expanding HI-CAHS efforts because of the network capability of the agents and similar agricultural health and safety interests.

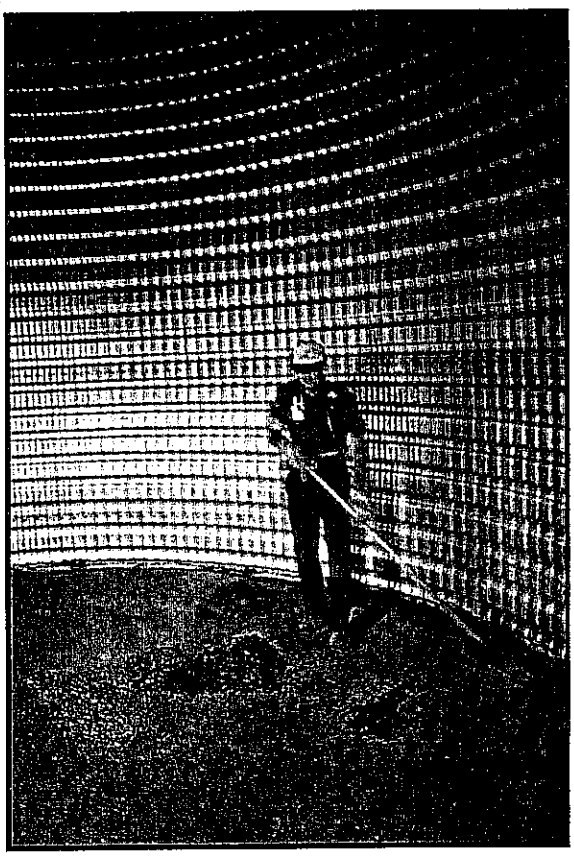
A meeting was held, in Feb. 1999, to devise ways in which HI-CAHS could help promote agricultural health and safety in each state. The two most important issues identified by the farm safety specialists were children's farm safety and farm accident rescue training.

A $7,000 HI-CAHS grant was allocated for each state. State farm safety specialists were asked to submit a budget along with a short proposal regarding farm health and safety efforts that the money would be used for. If this venture is successful in 2000, HI-CAHS contributions are expected to increase in future years.

Research: Summary of HI-CAHS Agricultural Dust Research

(Dr. Don Beard, Susan Viet, Dr. Greg Cosma, Tony Martinez, Lori Berberet, Michelle Adams, Brit Todd, Dr. Roy Buchan)

Recent statistics have estimated 500,000 workers in the U.S. and 100,000 workers in Canada are exposed to grain dust. It has also been shown that grain workers experience more respiratory disease, organic dust toxic syndrome, grain fever, chronic bronchitis and chronic obstructive lung disease than the general population. This represents a summary of HI-CAHS findings from seven research projects conducted in the agricultural setting since 1993. The first study was conducted by Dr. Don Beard. He attempted to characterize wheat dust exposure in grain elevators and dust levels at harvest in addition to identifying the principle components of grain dust that might lead to respiratory disease. Beard investigated total dust and respirable dust, respirable silica concentrations, pesticides, endotoxins, mycotoxins, insect parts, fungi and bacterial content. Beard concluded that total dust (mean of 8.mg/m3 at harvest, and 27.3 mg/m3 in elevators) was a significant problem compared to the ACHIH TLV of 4.0 mg/m3. He also found that respirable dust at harvest averaged 0.28 mg/m3 and 0.97 mg/m3 at grain elevators compared to the TLV of 3.0mg/m3. This was explained by the fact that the Mass Median Aerodynamic Particle Diameter (MMAD) was 5.1um. This was consistent with particle deposition in the tubular airways, but not for deposition in the alveoli as would be for respirable dust. He also found endotoxin levels at harvest to average 143 EU/m3, and 71 EU/m3 in elevators. There was also a significant positive correlation between total grain dust concentrations and endotoxin levels (r2=.68). All other contaminants were at insignificant air concentrations. This study was followed by a research effort by Susan Viet to perform a study at wheat harvest to look at cross work shift respiratory response to total dust and endotoxin concentrations. It was a poor harvest year with low dust levels with only 8 percent of workers exposed over the TLV for total dust, and only 33 percent of workers exposed to more than 90 EU/m3. Even with mild exposures to dust and endotoxins, Viet was able to demonstrate minor but measurable cross shift reductions in lung function (FVC, FEV1, and FEV6).

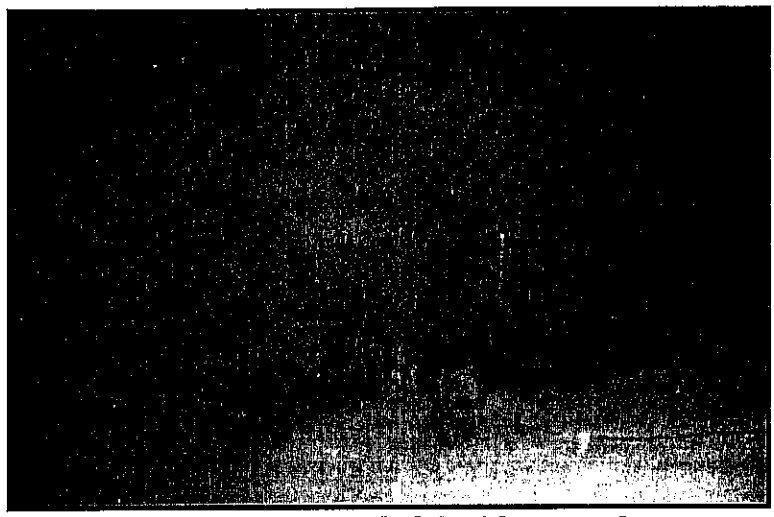


Dr. Greg Cosma and Tony Martinez followed this work in the laboratory to evaluate the proinflammatory effects of wheat dust components. They demonstrated that bacterial endotoxins were responsible for over 70 percent of lung cell pro-inflammatory responses, as determined by measuring cytokine levels in alveolar macrophages treated in vitro with wheat dust particles. The other 30 percent of response was unaccounted for, but they recommended that measuring endotoxin exposure might be a better index for respiratory risk assessment than measuring total dust concentrations alone.

At the request of farmers in the San Luis Valley, HI-CAHS did two research projects to assess exposures to total dust, respirable dust and respirable silica at potato harvest. Year one was conducted by Lori Berberet and year two was performed by Michelle Adams. Over 90 percent of workers were not over exposed to total dust, respirable dust or respirable silica. However, the highest total dust exposure was 50.5 mg/m3 (OSHA PEL = 15 mg/m3) and 1.17 mg/m3 respirable silica (ACGIH TLV = 0.1 mg/m3). This major over exposure was to the harvest truck rider and the problem was solved by eliminating the job as it was considered not always necessary. Both investigators concluded that although occupational exposure levels were generally not exceeded, working conditions were extremely dusty and often uncomfortable for many potato harvesting employees, and that NIOSH approved dust masks should be made available to all workers.

At the request of the Colorado Corn Growers Association, research into corn dust exposures was conducted by Brit Todd. Todd found that corn storage facilities had over exposures to the OSHA PEL to total dust for 58 percent of samples taken and 33 percent of the respirable dust samples collected exceeded the OSHA PEL. The particle size distribution of the dust demonstrated from 75 percent to 90 percent of particles were larger than 6.0um MMAD. The most significant finding was high levels of endotoxins. Eighty-five percent of the sampling locations had endotoxin levels above 500 EU/m3. One location had endotoxin levels of above 1.7 million EU/m3, the highest concentration

ever encountered by the NIOSH laboratory doing the endotoxin analysis. Given the particle size (optimal for deposition in the tubular airways) and the pro-inflammatory nature of endotoxins prompted a study now in progress looking at the endotoxin levels as measured by Thoracic Particulate Mass (TPM) sampling. If high levels are found with TPM sampling a follow-up epidemiologic study will be undertaken to determine reductions in respiratory flow in combination with TPM endotoxin exposures. There is the definite possibility of an environmental hazard conducive to the promotion of chronic obstructive airways disease among workers in corn handling facilities.



Research: Evaluation of a Risk Reduction Program for Pesticide Usage Among Migrant and Seasonal Farm Workers in Colorado

(Drs. Martha Vela, Roy Buchan & Phil Bigelow)

Migrant and seasonal farm workers perform much of the hand labor required by growers in the United States. Although they perform essential work in producing food for the country, they are one of America's most under-served and understudied populations. They are faced with low socioeconomic status, limited access to health care and numerous other conditions that increase their risk of developing work related injuries and illnesses. Hazards related to exposure to agricultural chemicals are an important concern with this population. HICAHS has implemented programs to reduce such risks. A recently developed pesticide training and awareness program is now being offered to improve work practices and reduce exposures among migrant and seasonal farm workers. This pesticide risk reduction program is designed to reduce exposures among migrant and seasonal farm workers in Colorado. The program surpasses the Worker Protection Standard criteria required by the Environmental Protection Agency. Our efforts in this research evaluated whether this program actually improved the farm workers perceptions or behaviors related to pesticide.

The effectiveness of the risk reduction program was evaluated through a group interview process and by an audit to observe the effect of training on the attitudes and behavior of the migrant farm worker population. This process measured changes in (1) pesticide knowledge, (2) pesticide safety risk perception and (3) pesticide safety behavior. Migrant farm workers' attitudes and beliefs associated with the risk reduction pesticide program were evaluated using standard tools for this type of research. We looked at four pesticide safety behaviors: wearing a long-sleeved shirt, wearing long pants, washing hands before eating or using portable toilets and separating working clothes before washing them while the migrant farm workers were working in the fields. The study included 152 migrant and seasonal farm workers employed in Adams and Weld County, Colorado. The pesticide training led to greater migrant farm worker safety risk perception and pesticide safety knowledge.

Many migrant workers, however, tend to believe that control of their health status was out of their control. They believe that their health status was controlled either by chance or by health care professionals. Individuals who tended to believe that others controlled their health status were less likely to show improvements in behaviors following the training. While training can improve farm worker behaviors related to pesticide usage, our audits noted that the pesticide handling hazards were not the only issues facing these migrant farm workers. The total work environment, including field and housing conditions for migrant and seasonal workers, was in urgent need of improvement. Inadequate supplies of drinking water and ergonomic hazards are also problems in these work situations. The effectiveness of pesticide training has to be evaluated within the context of the total living and work environment of these workers who make such a large contribution to the farm economy in the United States.

Outreach: Health and Safety Activities

(Del Sandfort, Lori Berberet, Tina Daniels)

HI-CAHS outreach team members continued to strengthen existing relationships, as well as forge new partnerships in the agricultural community. These relationships, both old and new, lead to a wide range of activities and should evolve into long-term health and safety outreach efforts.

HI-CAHS Collaboration

A partnership between HI-CAHS and NIOSH was beneficial in researching pesticide exposures in North Dakota. In late June 1999, HI-CAHS staff members met with several of the Tappen, ND organic farmers to identify organic farms that were surrounded by potato farms that aerially applied pesticides.

Air monitoring was performed in several locations along the perimeter of the organic farms for approximately two weeks. The results indicate that during the sampling period, the air concentrations of carbofuran, methamidophos (the key ingredient of Monitor) and malathion were below the detection limit. The organic farmers were interested in continuing the study over a longer period of time, possibly in the summer of 2000 with the North Dakota Department of Public Health.

A major accomplishment during the year was the creation of a joint position shared between HI-CAHS and the Cooperative Extension in Colorado. This position successfully combines health and safety activities conducted by each group into one position.

HI-CAHS and Commodity Groups

Many commodity groups have asked members of the HI-CAHS outreach team to participate on safety committees, assist with training and help evaluate conditions at workplaces. HI-CAHS has continued to work closely with the safety committees of the Onion and Corn Grower Associations on a mutual goal of reducing accidents and injuries to their members.

The excellent working relationship with the Colorado Corn Growers Association continued in 1999. The focus of the annual safety training centered on common farm hazards, the estimated cost to fix the situation and the costs of potential injuries due to the hazard. In addition, 25 hazard evaluations were performed on member farms. The information collected will be useful in planning future safety seminars for members.

HI-CAHS continued to work closely with Pinnacol Assurance to provide safety training to policyholders in agriculturally related industries. Pinnacol Insurance is energetically working with policyholders to decrease the number and severity of workers compensation claims and reduce insurance premiums.

Migrant Worker Activities

HI-CAHS staff members continued to be involved with migrant workers. Staff members visited migrant housing camps to evaluate living conditions. Water samples were collected and evaluated to ensure good quality drinking water was available. These visits provide useful information for both the residents and owners on controlling or eliminating health and safety hazards.

In addition, staff members conducted "train the trainer" on the Environmental Protection Agency's Worker Protection Standard. The people attending this training were responsible for instructing pesticide handlers and workers on safe work practices.

Training, Education and Hazard Surveys

Outreach program staff members conducted 49 training and education sessions reaching almost 4,200 people. Eleven of these sessions were specifically designed for the Corn Growers Association Health and Safety Program. This program is designed to reduce injuries and illnesses thereby reducing Workers Compensation costs. The relationship between HI-CAHS and the Corn Growers Association has been an ongoing activity for more than two years and also involves wheat and sugar beet growers. More than 3,000 children attended the 15 Farm Safety Day Camps at which HI-CAHS provided 26 programs on chemical safety and tractor roll-overs. This was a cooperative effort to assist local extension agents in their respective counties as well as a variety of agricultural organizations.

Forty-three workplaces, representing nearly 1300 workers, asked for assistance in identifying and eliminating hazards associated with their operations. Machine guarding, chemical storage and handling and electrical hazards were the most common hazards identified during the surveys.

Information, Dissemination, Education and Training

The HI-CAHS web site (www.bernardino.colostate.edu/hicahs) remained in use during 1999. Existing links have been maintained and new links to other resources have been added. Site content has been evaluated and updated and new material such as "Barn Door Flyers" has been added. Three years of annual reports are available in web and pdf format.

The AgriAction Information Sheet series continues to expand. These are single sheet (front and back) products that present safety information in a quick, easy to read format. Eight existing Information Sheets were evaluated and updated this year. They are:

- Agricultural Health and Safety (IS-98-05)
- Air-Purifying Respirators (IS-997-01)
- Children on the Farm (IS-98-08)
- Electrocution Hazard Labels (IS-97-02)
- Farm Tractor Safety (IS-98-02)
- Grain Storage Bins (IS-98-09)
- Heat Related Illnesses (IS-98-01)
- Safe Pesticide Handling (IS-98-04)

In addition, six new sheets were developed and added to the web site. They are:

- Wheat Dust (IS-99-02)
- Personal Protection Equipment When Using Pesticides (IS-99-03)
- ROPS: An Investment You Can Live With (IS-99-04)
- Power Take-Off Safety (IS-99-05)
- All Terrain Vehicle Safety (IS-99-06)
- Chemical Safety (IS-99-15)

A supplement to the AgriAction Series, Barn Door Safety Tips were created and added to the web site. These are single page information sheets, of suitable design to be printed and posted in strategic places around the farm or business. They may also serve as a format for safety meetings. The series includes:

- Safe Tractor Operation (BD-99-01)
- Tractor Passengers (BD-99-02)
- Tractor Safety Checklist (BD-99-03)
- PTO Safety Checklist (BD-99-04)
- Power Take-off Operation (BD-99-05)
- Avoiding Tractor Rollovers (BD-99-06)
- Tractor Safety with ROPS (BD-99-07)

Ag Health and Safety Presentations

Last year was extremely busy in terms of presentations. Requested topics included several previously developed programs, as well as some new ones. These new presentations have been converted into products for distribution. New product titles include:

- Is it Worth the Risk?
- One Little Call
- Health and Safety Issues in Colorado Agricultural Machine Safety

These comprehensive presentations provided agricultural families, businesses and associations quality safety information. These presentations and others are available through the HI-CAHS web site or by calling (800) 622-8673.

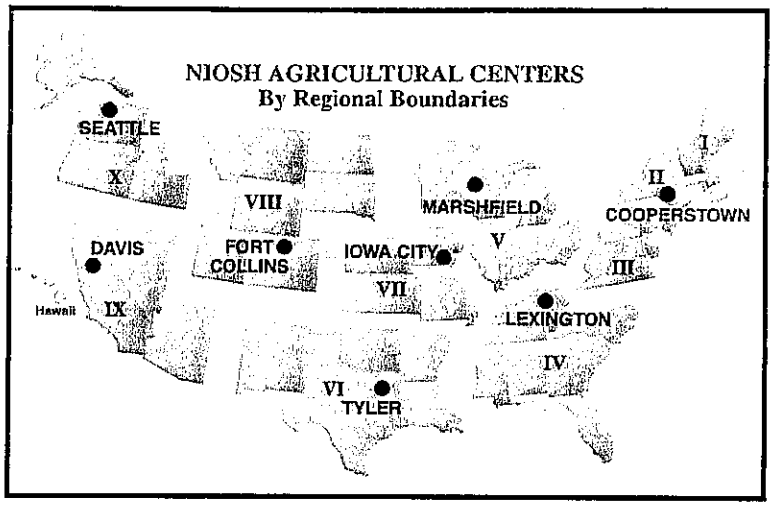
Multisite Evaluation Project

(Vicky Buchan, Sue Tungate)

In May of 1997 HI-CAHS hosted the first workshop to explore the potential of a multisite approach to evaluation for the NIOSH Agricultural Health and Safety Centers Initiative. Since that time a team of evaluators, representing each of the NIOSH Agricultural Centers, has collaboratively launched a program monitoring approach to the evaluation. NIOSH funding has allowed the evaluation team to meet on a semi-annual basis to develop the Multisite Evaluation design.

Early in the process, the team had generated a set of "indicators" (criteria) with which to measure collective progress on the NIOSH Center Initiative objectives. A database was created in order to accumulate the Centers' multisite evaluation information. By October 1999, the pilot period for data collection was completed and a report based on the pilot period was slated for early in the year 2000. HI-CAHS has provided ongoing coordination and leadership for the project.

The Multisite Evaluation Team, representing the nine NIOSH Agricultural Health and Safety Centers, plans to meet in April 2000 at the annual Centers meeting. The progress and potential of this collective program monitoring approach to evaluating the Initiative has generated enthusiasm across the Centers and NIOSH. A center-wide Agricultural Initiative publication, emphasizing the scope and reach of the Ag. Centers, is an additional project that grew out of the work of the Multisite Evaluation Team. As we move forward with the Multisite Evaluation project, we anticipate additional potential for the Initiative multisite database which will be developed through the collaborative work of the evaluation team.



Multisite Evaluation Team

Teri Palermo, *NIOSH Morgantown, WV*
Tara Erb, Region *I-III Northeast Center*
Marian McDonald, David Tipton & Carol Donnelly, *Region IV Southeast Center*
Barbara Kennedy, *Region IV Deep South Center*
Nancy Young, *Region V Nation Farm Medicine*
Karen Gilmore & May Lynn Thames, *Region VI Southwest Center*
Barbara Pies, *Region VII Great Plains Center*
Vicky Buchan, Sue Tungate &Sue Hewitt, *Region VIII HICAHS*
Rose Krebill-Prather, *Region IX UC Center at Davis*
Barbara Brooner & Sharon Morris, *Region X Pacific Northwest Center*

Multisite Evaluation Team
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Advisory Committee - May 1999
(L-R) Dr. Dan Fahrenholtz, Sarah Bramble, Rod Gilmore, Larry Pollart, Jane McCammon and Dean Lillquist.

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