

POSTER ABSTRACTS

The purpose of the Conference was to raise consciousness, build coalitions, disseminate information, and encourage action to prevent injury and disease in agriculture. To help in fulfilling this purpose the planners of the Conference saw that an opportunity for networking among its participants should be an important aspect of the meeting. An opportunity was provided through a poster session.

This session, entitled *Making Connections*, included posters from research organizations, governmental and volunteer programs, and individuals as well as a presentation of FFA posters and video tapes. Moreover, 4-H clubs participated with presentations of songs and skits during this session to emphasize the youth aspect of agricultural safety and health.

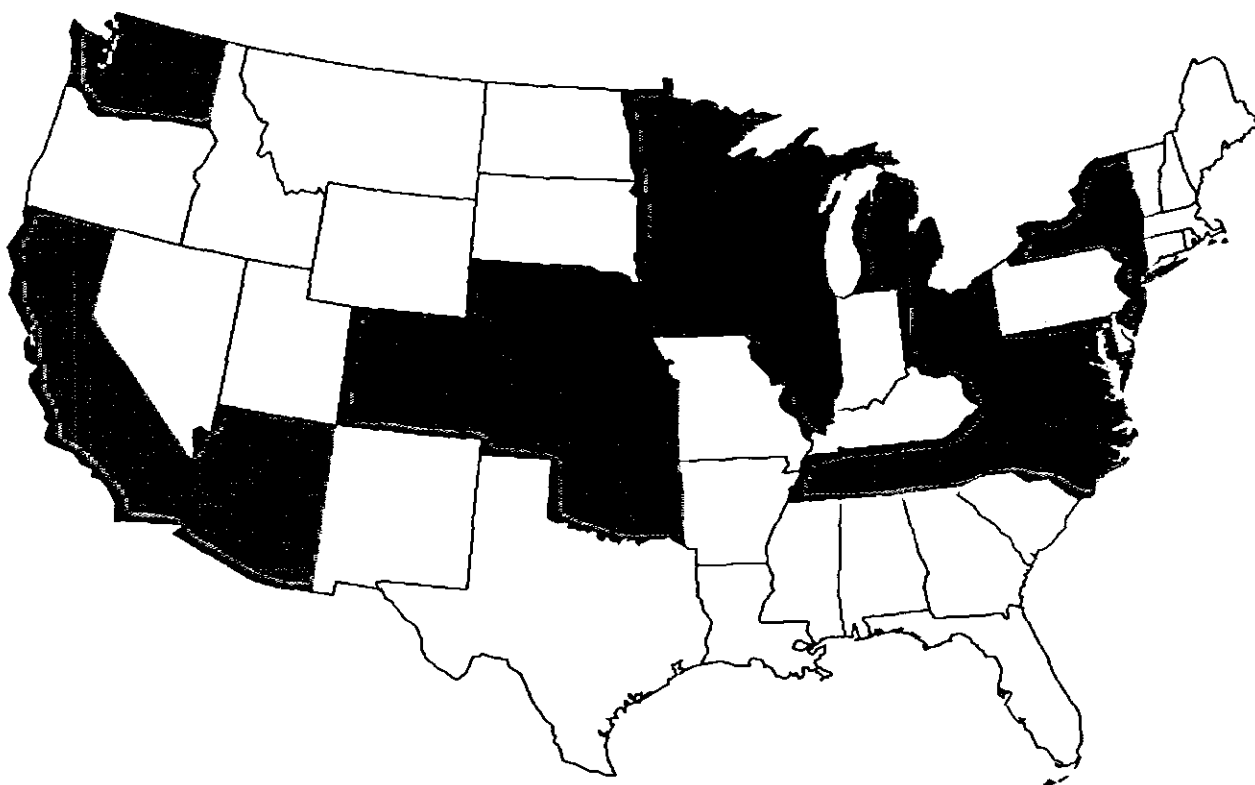


Figure 1. States from Where Posters Were Presented at the Surgeon General's Conference on Agricultural Safety and Health (exclusive of FFA Posters).

Other than the FFA posters, 95 posters from 20 states were presented at the Conference. These posters addressed a variety of programs in surveillance, research, and intervention, and abstracts of these presentations are provided in the following pages.

PLAN FOR ARIZONA AGRICULTURAL HEALTH PROMOTIONAL SYSTEM

By Lance Fluegel, B.S.
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- ▶ **AREAS TARGETED** — Agribusiness and High School, Emergency Rescue, University and Community College, Youth
- ▶ **DELIVERY METHOD** — Model Programs, Workshops, Classes, Model 4-H Programs.
- ▶ **KEYS TO IMPLEMENTATION** — Direct Mailings, Handbooks, Announcements, Advisory Committee, Balanced Selection, Identify EMT Teams, Advisory Committee, Training Trainers, Hands on Training, Financial Assistance, Develop Curricula, Advertise Course, Recruit Students, Instructor Survey, Hazard Evaluation, and Request Proposals.
- ▶ **PROJECTED RESULTS** — Written Safety Plans, Hazard Correction, Accident and Injury Reduction, Trained Member in Each Department, Other Instructors Expand Safety Offerings, Technicians Trained in Agricultural Machinery Accident Extraction, Safety Education, Student Training, Worker Training, Safety Course Offered Fall/1991, Agricultural Educational Teachers Take Safety Class, Safety Leadership, and Safety Awareness.

OCCUPATIONAL EXPOSURE TO GUTHION: CORRELATING RESIDUE LEVELS TO BIOLOGICAL MARKERS

By Melissa Gonzales
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Cholinesterase inhibiting pesticides are a potential health hazard for workers who enter treated areas and have significant contact with the residue-laden foliage. To define this exposure, the California Department of Food and Agriculture is compiling a database of crop and task-specific transfer factors relating dermal exposure to dislodgeable foliar residue (DFR). In this study, DFR for guthion and gutoxon are assessed from the time of application through the harvest study period. The dermal exposure of peach harvesters is monitored with long-sleeved T-shirts, hand washes and face, neck, and hand wipes. Urinary dialkyl phosphate metabolites are quantified to estimate residue absorption. Blood cholinesterase levels are monitored as a measure of physiological response from absorbed residues. The observed transfer factor is compared to those previously calculated to further evaluate the organophosphate exposure model of the CDFA. This study is also a source of occupational exposure data on California's agriculture workforce, which is highly mobile and difficult to assess.

AGRICULTURAL INJURY IN CALIFORNIA: IMPLICATIONS FOR SURVEILLANCE



By Carol Conroy, Ph.D., N. Maizish, L. Rudolph, D. Will
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California agriculture presents unique challenges when designing a survey to assess the magnitude of occurrence and characteristics of agricultural work-related injury. One challenge relates to the tremendous diversity of agriculture within the state. There are more than 30 million acres of land devoted to agricultural production or services, more than 83,000 farms, more than 60,000 farm workers, and more than 250 crops in production within California every year. The average annual rate for occupational traumatic deaths during 1980-1985 was 16 per 100,000 agricultural workers compared to an overall traumatic occupational fatality rate of 7 per 100,000 workers. During 1988, over 21,000 agricultural disabling work-related injuries were identified; 47 percent occurred during crop production and 43 percent were related to agricultural services. In order to target high risk farms to survey, multiple data sources were analyzed to describe the epidemiology of agricultural injuries within California. Injury rates vary by type of industrial classification within agriculture: vegetable and melon crops have an injury rate of 76 per 1,000 workers while cash grains (such as rice) have a rate of 101 per 1,000; and within agricultural services the injury rate varies from 13 per 1,000 for veterinary services to 88 per 1,000 for soil preparation. This reflects a variation in risk of injury associated with different exposures that must be considered during the design of the survey. Another challenge relates to diversity of the population at risk: farm workers and farm owners and operators. In addition, interviewing highly mobile and transient migrant farm workers (many of whom do not have a defined residence), many of whom originate from Mexico or Central America and do not speak or read English, required a sampling strategy that would allow these workers to be located. This sampling plan, based on a stratified random cluster sample, allows operators to be interviewed. Because farm workers and farm owners and operators are exposed to different hazards, have different demographic characteristics, and would require different intervention strategies, it is necessary to survey both to achieve the ultimate goal of preventing agricultural injuries in California.

AGRICULTURAL ACCIDENTS AND ILLNESS AMONG CALIFORNIA WORKERS' COMPENSATION CLAIMANTS



*By David F. Goldsmith, Ph.D., James J. Beaumont, Ph.D.
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Agriculture has equalled mining as the most hazardous industry in the U.S. As part of the University of California Davis Center for Agricultural Health and Safety, epidemiologists are examining California Workers' Compensation (WC) Appeals Board claims to describe the accident and illness risks among farm employees. Preliminary findings of 80 claimants who filed between 1946 to 1964 show that all were farm workers (not farmers), and about 90 percent were white or Hispanic males with a mean age of 46 years of age. Of the 27 respiratory disease claims, 14 percent filed because they had valley fever (coccidiomycosis), 27 percent had other (mostly chronic) respiratory illness, 41 percent filed because of pesticide illnesses, and 18 percent filed because of multiple effects of inhaled toxic materials, i.e., solvents and agricultural burning. Among the 53 farm laborers filing WC accident claims, 11 percent were for hernias, 20 percent were for fractures, 18 percent were for contusions and other wounds, and 52 percent were for traumatic injuries. Follow-up proportionate mortality ratio (PMR) analysis from 1950 to 1984 of the injury claimants employed in agriculture indicated that these farm workers have an elevated risk for malignant neoplasms of lung (PMR = 2.39), for vascular lesions of the central nervous system (PMR = 2.95), and for all external deaths (PMR = 1.95) when compared to U.S. white males. This preliminary study demonstrates that WC data are extremely useful to describe illness and injury patterns among agricultural workers. Furthermore, the mortality findings suggest that there is an elevated risk of lung cancer, stroke, and external causes even after injury claims are filed. New epidemiologic research is needed to elucidate the risk factors for the excess rate of occupational injury and death now being observed in the agricultural workplace.

VISUAL MATERIAL FOR PESTICIDE SAFETY LESSONS FROM AN ECUADORAN EDUCATIONAL INTERVENTION



By James I. Grieshop, Ph.D.
University of California, Davis, California

Throughout the world in developing countries such as Ecuador, efforts to transfer technologies have not occurred without serious problems. This is true in the agricultural sector where pesticides have rapidly come into widespread use in areas where traditional agriculture had been practiced. However, the transfer of pesticide technology has not been accompanied by the transfer of techniques for their safe, effective and appropriate use, thereby leading to human health problems (poisoning) and environmental damage and serious and justifiable public concern. In countries such as Ecuador, users of pesticides often are illiterate, and live in isolated areas. These attributes present particular problems for designers of education and communication programs. Folk beliefs in relation to pesticides and personal risk also work against the effectiveness of communication programs. This poster demonstrated the potential for the use of visual materials, including symbols and pictographs and more highly refined materials such as photo-novels and posters, for communicating messages about safe and appropriate use of pesticides. The materials to be highlighted are the products of intensive field research, primarily in Ecuador, on users of agricultural chemicals. The poster session will demonstrate the evolution of these materials from relatively simple symbols and pictographs to much more complex photo-novels and posters and materials developed for use with both Spanish-speaking and Quechua-speaking rural residents. The relationship of field research using qualitative approaches and the development of these visual materials will also be a key feature of this graphic information session. Lessons from these field-based experiments provide lessons for the development of similar health education interventions in the United States with non-English speaking and reading farm laborer audiences.

**THE U. C. DAVIS AGRICULTURAL HEALTH AND SAFETY
CENTER: A MULTIDISCIPLINARY CENTER FOR RESEARCH AND
OUTREACH**



By Marc B. Schenker, M.D., M.P.H.
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California is the leading agricultural state in the nation, with 16 percent of all U.S. crop production, as measured by farm cash receipts. Farm production in California is 60 percent greater than the second leading state. A review of agricultural production statistics documents the enormous size and importance of California commodities. For example, California produces 39 percent of all U.S. vegetables and melons, 53 percent of all fruits, nuts and berries, and 24 percent of all nursery and greenhouse products. More than 1,000,000 workers are employed annually in agriculture in California, and there are more than 20,000 disabling injuries per year in the state. The purpose of the new U.C. Davis Agricultural Health and Safety Center is to create a multidisciplinary organization for communication and coordination of research, education, and illness and injury prevention in the agricultural workplace. The Center will address occupational and environmental health issues affecting farmers, ranchers, agricultural employees, farm families, agricultural service employees and visitors and residents around agricultural work sites. The Center includes multiple academic units within the University of California, as well as participation by programs and state agencies from outside the University and interactions from neighboring states. As one of two national centers funded by NIOSH, the U.C. Davis Center will focus on agricultural health and safety issues most relevant to the western states. The Center is organized into an administrative core and a research and an outreach component. Participants from U.C. Davis, U.C. Berkeley, various state agencies and agriculture organizations are actively involved in both the research and outreach components. This mixture of the unique expertise of the participants, the diverse resources of the University and the State of California, and the contacts and involvement of state agricultural organizations provides an outstanding and unique environment for addressing the health and safety hazards in agriculture.

CALIFORNIA AGRICULTURAL HEALTH AND SAFETY PROMOTION SYSTEM

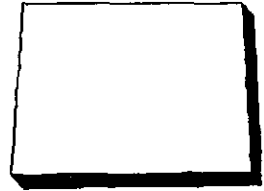


By William E. Steinke, Ph.D.
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The California Agricultural Health and Safety Promotion System (CAHSPS) addresses the need for training across the diversity of California agriculture (more than 250 commercial commodities workforce through several actions). Many farm workers in California are Hispanic and have a limited ability to communicate in English. Several other ethnic groups, i.e., Hmong, Mexican Indian, Vietnamese, Filipino, American Indian, Japanese and Chinese, are also present in the agriculture workforce in large numbers. The CAHSPS addresses the educational needs regarding safety in six major program areas. First, a pilot program is being established to develop training materials and training methodologies for growers, field supervisors, farm labor contractors and others to use in providing regular and focused safety training for those exposed to the hazards of agriculture. Second, a formal and rigorous evaluation of the effectiveness of this type of training is being independently conducted. The third component features grants that are being offered to ten community agencies for programs that use channels outside the work place to distribute agricultural occupational safety and health information. The fourth aspect, which includes data collection regarding causes of fatalities and cases of major trauma, is being undertaken in collaboration with the State Department of Health Services. As the fifth aspect, an evaluation of different levels of safety training as they currently are practiced on California farms is being conducted, with the goal of identifying the key components crucial to a successful program. The sixth component is development of coursework in the College of Agricultural and Environmental Sciences regarding agricultural occupational safety and health and injury and illness prevention programs. The results of this program will make working in California less hazardous and enable growers to customize their safety programs and training to fit the needs of their operations and employees.

PROMOTING AGRICULTURAL SAFETY AND HEALTH IN COLORADO

By Paul D. Ayers, Ph.D.
Colorado State University Fort Collins, Colorado



Agricultural production in Colorado is an extremely hazardous occupation. Many fatalities, injuries and illnesses can be prevented through education. Colorado State University Cooperative Extension has embarked upon such an educational program through a grant provided by the National Institute for Occupational Safety and Health. This grant provides funding for several safety projects including the following topics:

- An up-to-date resource library containing visual aids and literature has been established and made available to all 58 county Cooperative Extension Offices. A monthly safety newsletter sent to each Cooperative Extension Office has been implemented as well as news releases submitted to Colorado's major agricultural publications. County Extension personnel are in a good position to disseminate safety information to a variety of individuals through their various production meetings.
- Tractor safety, particularly tractor roll-overs, is always a major concern. Older tractors without roll-over protection (ROPS) are especially hazardous in a farm situation. Colorado State is conducting a tractor survey to determine the number of tractors without ROPS. Tractor survey forms were sent out to 1,000 farmers via the County Cooperative Extension Offices to ascertain the safety equipment available on tractors currently being used. Information from this survey will be used to determine areas needing more emphasis such as seat belts and roll-over protective structures.
- Pesticide safety is another major concern for Colorado agricultural workers. Protection of the applicator can be greatly increased through usage of gloves and respirators. These two simple items can be easily implemented into the pesticide application operation. County Extension Offices have been provided with a chemical safety kit which includes gloves, coveralls, goggles, overshoes, respirators, etc. for demonstration purposes at meetings and field days. Gloves are also provided at pesticide applicator meetings for each participant completing the course.

Each office has also been provided with a video tape on farm chemical safety. Disposal of agricultural hazardous wastes (unusable pesticides and containers) is a continuous problem. Steps are being taken to provide guidelines for disposal of such items on a local level for agricultural workers. The intent of the Colorado State project is to educate Cooperative Extension personnel about various safety programs so they, in turn, can educate their clientele. In this manner, more agricultural workers can be reached on a statewide basis.

INJURY RISK-TAKING BEHAVIOR OF FARM YOUTH

By Robert A. Aherin, Ph.D.
University of Illinois, Urbana, Illinois



Various state farm accident studies have consistently found a high incidence of farm-related injuries occurring to children under the age of 15. In an effort to gain a better understanding of the types of behaviors being performed by children on farms, a study was conducted to evaluate parental attitudes and behaviors regarding three farm machinery-related behaviors. A sample of 377 randomly selected farm families, who had children 15 years of age and younger, participated in the study. The three behaviors evaluated included: 1) Riding on a tractor with a parent during the past 12 months; 2) Operating a tractor; and 3) Allowing the child to be within 10 feet of rotating or revolving components on farm machinery. Twenty-nine percent of the parents felt it was acceptable to allow children 3 years of age and younger to ride on a tractor with them. Sixty-five percent agreed that children between the ages of 4 to 6 years of age should be allowed to perform the behavior. Nearly 90 percent of the parents allowed their 7-to 9-year-old children to ride on tractors. More than 70 percent of all the parents believe the risk of injury for performing this behavior was low. Twenty-nine percent of the farm boys in the study were allowed to operate tractors. Sixty-seven percent of 10-to 12-year-old boys and almost all of the 13-to 15-year-old boys operated tractors. Girls operated tractors significantly less than boys. Only 16 percent of parents thought their children between 7 to 9 years should be allowed to be within 10 feet of rotating farm machinery parts. However, 27 percent allowed their boys in this age group to perform the behavior. Of the 377 families who completed the survey instrument, 16 or 4.2 percent reported an accident. The injuries from these accidents resulted in 75 percent of the victims needing to seek medical attention while approximately 12 percent were permanently disabled. As a result of these findings, an educational program has been developed to assist farm families with their understanding of the behavioral and physical limitations of children to deal with injury risk associated with farm equipment.

**REDUCING THE POTENTIAL FOR ENVIRONMENTAL
EXPOSURE AND HUMAN EXPOSURE TO PESTICIDES—
A SELF-HELP WORKSHOP FOR PRODUCERS**



By Richard O. Pope
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Public concern about groundwater contamination from agricultural practices remains high. Recent midwest well water surveys have helped define the extent and frequency of water contamination. In addition to pesticide mixing and handling practices, well construction, depth and location are known to affect water quality. Farm*A*Syst is a prototype 12-part agricultural farmstead assessment program, developed in 1990 by United States E.P.A. Region 5, and the Extension Services of the Universities of Wisconsin and Minnesota. From this prototype, a specific program was developed for use in Iowa County pesticide—certification training sessions. The primary focus of this program is to raise producer awareness and outline recommended pesticide management practices. This interactive worksheet enables each producer to examine and improve his or her individual management practices. Results compiled from initial workshop evaluations will be discussed. This producer feedback is being used to assist program planning for inter-agency water protection efforts.

A THEORETICAL FRAMEWORK FOR SAFETY BEHAVIOR INTERVENTIONS

*By James Westaby, Graduate Assistant, Robert Aherin, Ph.D.
University of Illinois, Urbana, Illinois*



Occupational injuries and illnesses are a serious threat to farmers. Many farm injuries and illnesses are the result of dangerous behavior. Reducing injury risk on the farm is a considerable task because many farmers are autonomous and self-motivated. Many farm safety programs have been implemented, but have not undergone systematic evaluation. It is unclear whether these programs actually reduce injury risk. Also, many programs lack theoretical rationale for their interventions. A theoretical approach to reduce injury risk by targeting specific unsafe behaviors is proposed. Empirically supported theories, such as the Theory of Reasoned Action, Theory of Interpersonal Behavior, and the Theory of Planned Behavior are used in the proposed framework. The framework identifies factors that determine behavior. For example, it has been shown that specific behaviors are determined by specific behavioral intentions and/or habit processes. Behavioral intentions, in turn, are determined by the attitudes people have toward the behaviors and their subjective norms (i.e., the pressure people feel from significant others to perform the behavior). The framework, in sum, should help pinpoint reasons why farm workers perform unsafe behaviors, target those behaviors with specific safety interventions, and show which strategies prove effective. Effective strategies, in turn, could be modelled in large-scale safety programs. More confidence could be placed in such validated programs.

SAFE COUNTRY

*By James L. Williams
Country Companies, Bloomington, Illinois*



Background: Prior to developing this educational program on farm safety, research was conducted with 1,500 agricultural producers. Research indicated the need for an educational program, including a video.

The final educational package consists of:

1. Leaders' Guide;
2. An 18-minute video;
3. Modules on: Tractor and machinery safety, plus general farm safety and health; chemicals; animals; ladders; and harvest safety
4. Student booklets; and
5. Promotional material, including news releases, posters and a promotional brochure.

Comments to date indicate its progress is well received. Approximately 3,000 pieces of student materials have been shipped, indicating excellent usage of the program. It is in use in four states by the Country Companies and other agriculture interested organizations.

FARM SAFETY 4 "JUST KIDS"



By Marilyn Adams
President Farm Safety 4 "JUST KIDS"

In the fall of 1986, Marilyn's 11-year old son, Keith, was killed in an accident on the family's Iowa farm. One year after her son's death, realizing that not enough was being done about farm safety, Adams began a campaign to promote education and awareness by distributing danger decals for gravity wagons through local FFA chapters. Recognizing the consuming public demand for farm safety information, she formed Farm Safety 4 "JUST KIDS" in October, 1987. The response from people nationwide has been phenomenal. Mail and phone calls from across the United States and Canada are received daily for farm safety information and merchandise available from the office. Materials available for sale are videos, decals, T-shirts, and other miscellaneous items. Farm Safety 4 "JUST KIDS" also compiles and distributes newsletters to members quarterly. The increased demand for information has prompted the formation of a Chapter Operations Department. This department is in the process of developing chapters across the United States. "If we are indeed concerned about making our farms safer places to work and live, we need to overcome the sort of conditioned apathy that exists today toward farm-related health and safety issues. By developing chapters of Farm Safety 4 "JUST KIDS", we are working to make further improvements in the communities. Education and building public awareness are perhaps the two most important elements in addressing this problem".

ZOONOSES—HUMAN HEALTH HAZARDS ASSOCIATED WITH ANIMALS



By George W. Beran, D.V.M., Ph.D.
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This presentation will represent teaching, research and personal experiences of the author. On one side, a chart identifying viral infections at greatest hazard of transmission from animals to people will be featured, accompanied by a photographic display on rabies. This will show the wild animals which maintain the infection, the disease in wild animals, farm livestock and companion animals. It will show preventive measures and an interactive section on myths and facts about rabies. (If available, a slide system or video monitor could be used to display additional, rare photographs of the disease in animals). On the reverse side of the display, a chart will identify bacterial infections at greatest hazard of transmission from animals to people. The illustrations will depict facets of Lyme disease, the way the disease is spread, the animals which carry it, the human disease, and measures for prevention. The display addresses health protection intervention in zoonoses, particularly from the viewpoint of the author as a consultant in rabies to the World Health Organization.

TEACHING GUIDES AND CLIENT EDUCATION MATERIALS FOR CARDIOVASCULAR SCREENING PROGRAMS



By Constance J. Betterley, M.S., R.D., Lorrie J. Graaf, R.N.
Iowa Department of Public Health, Des Moines, Iowa

Iowa's Cardiovascular Risk Reduction Screening and Education Program Recommendations advise that all screening programs provide client education. To assure that accurate, consistent information was given to Iowans at screening sites, staff from the Bureau of Nutrition and Health Promotion developed teaching guides for public health nurses and one-page fact sheets for the general public. The teaching guides and fact sheets correspond with the three components of the cardiovascular screening program: cholesterol screening, hypertension screening and diabetes screening. The teaching guides were developed in a standard format consisting of objectives, a suggested teaching outline, suggested background materials for the professional, and suggested client education materials. Information from the National Heart, Lung and Blood Institute and other public organizations was adapted to present a single concept per fact sheet and to lower the reading level. A formative evaluation was conducted using pre-testing methodology. The format may be useful for other states wanting teaching guidelines and client education at screening sites.

OCCUPATIONAL HEALTH NURSES IN AGRICULTURAL COMMUNITIES -A PUBLIC HEALTH NETWORK FOR INJURY CONTROL



By Elaine DeBoef, R.N., M.S., and other project nurses
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Agriculture is a major component of the Iowa economy. Much of the food and fiber upon which America and the world depends is produced on Iowa farms. The Iowa farm lifestyle embodies many qualities which underlie the strong foundation of our country. Partly influenced by these factors, this population has been affected by occupational-related disease and injury at rates which greatly exceed public health standards. The Occupational Health Nurses in Agricultural Communities Project, funded by NIOSH, through the Division of Disease Prevention, Iowa Department of Public Health will extend surveillance and target injury and disease control interventions through collaborative efforts with local health and lay service groups. Early efforts will be directed toward injury intervention development in regions and communities which are identified as high frequency, high severity areas for agriculture-related acute injury, using 1990 surveillance data from the Sentinel Project Researching Agricultural Injury Notification Systems (SPRAINS) program based in Iowa.

A STATE PUBLIC POLICY TO IMPROVE FARM HEALTH AND SAFETY: IOWA'S CENTER FOR AGRICULTURAL SAFETY AND HEALTH



By Kelley J. Donham, D.V.M.
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The 1990 Iowa Legislature passed a bill to form The Iowa Center for Agricultural Safety and Health (I-CASH). This unique program mandates that the College of Medicine (The University of Iowa), the land grant school (Iowa State University), the State Department of Health, and the Department of Agriculture and Land Stewardship work together to coordinate and focus resources to decrease agricultural occupational deaths, injuries, and illnesses. The Center is housed at The University of Iowa. The day-to-day operation is through the leadership of the Director, with strong input from the Coordinating Committee, which is made up of representatives from each of the participating institutions. The Coordinating Committee receives policy direction and has direct contact to the clientele through an 18-person Advisory Committee. This committee consists of active farmers, members of farm constituency groups (such as Farm Bureau, Corn Growers and Iowa Pork Producers), rural physicians, rural hospitals, and agribusinesses. This first-of-its-kind organization has put together a powerful, eclectic group of farm health and safety experts and clientele groups to develop and carry out preventive programs in a positive participatory manner. I-CASH has focused on five major areas to direct the energy and resources of this group. These are: 1) developing a network of hospitals in the state to provide comprehensive occupational health services for farm families; 2) prevention of respiratory diseases in swine producers; 3) prevention of injuries in farm children; 4) prevention of injuries involving tractors; and 5) surveillance of farm injuries. I-CASH has enjoyed excellent cooperation among the members. A major initial function is to coordinate the various preventive programs in the state that have emerged through the 1990 NIOSH initiative. I-CASH will also provide additional general programs to meet the needs of the farm families and farm workers of Iowa. I-CASH may serve as a model for other states as they develop public policies on this issue.

IOWA AGRICULTURAL HEALTH AND SAFETY SERVICE PROGRAM



By Jane Gay, B.S.N.
University of Iowa, Iowa City, Iowa

Farming is consistently ranked as one of the top three most hazardous occupations. An estimated 200,000 farmers are disabled and an additional 2,000 die annually from work-related causes. The farm family lives in and works at a worksite filled with many hazards. In other industries, comprehensive occupational health and safety services have been dramatically successful in reducing job-related injuries and illness. Effective systems to deliver this type of service in agriculture have not been established. In 1987, The Institute of Agricultural Medicine and Occupational Health of the University of Iowa College of Medicine initiated a pilot project for families and agribusiness in the state of Iowa. The project has expanded into a state network of agricultural occupational health and safety services based in community hospitals. The Iowa Agricultural Health and Safety Services Project (IA-HASSP) provides a unique clinic model and implementation plan, technical assistance and health professional training to community hospitals that are establishing agricultural occupational health and safety clinics. This model utilizes the community hospital as the primary integrator of existing community health services and direct provider of new occupational health services. The clinic will coordinate with regional primary-level hospitals and healthcare providers to deliver services at satellite sites. The service for members includes: occupational health screening, intensive occupational health and safety education, on-farm hygiene/safety analysis of identified or potential farm-related health and safety hazards, and availability of personal protection equipment. The project also provides service at the state level through telephone consultations for local-level healthcare providers.

CARBON MONOXIDE: VENTING PROBLEMS FROM HEATING APPLIANCES



By Thomas H. Greiner, Ph.D., Jim Cain
Iowa State University, Ames, Iowa

Excessive house depressurization can result in combustion appliance venting failure and contamination of household air. Three Iowa homes previously indicating combustion venting failure were instrumented and monitored to verify and further quantify venting failure and associated air quality deterioration.

Significant findings of this study included:

- Thermocouple located in the appliance vent and at the dilution device gap can accurately monitor venting performance.
- Carbon monoxide can reach dangerous concentrations under conditions of excessive spillage and exhaust recirculation in low-volume rooms.
- Neither carbon monoxide nor carbon dioxide concentration gives an accurate indication of flue gas spillage in large-volume mechanical rooms.
- Faulty vent design and/or maintenance can result in venting failure without the added aggravation of house depressurization.

RADON IN IOWA

By Thomas H. Greiner, Ph.D., Jim Cain
Iowa State University, Ames, Iowa



Radon is the second leading cause of lung cancer in the United States. The United States Environmental Protection Agency (EPA) prediction is that radon in homes causes 21,600 annual deaths, with an uncertainty range of 8,400 to 43,200 (USEPA 1989). The EPA began to test homes for radon, but did not include Iowa because the state was judged to be the state "least" likely to have a radon problem. Although Iowa was not identified by the EPA as a state with a potential radon problem, survey data collected in 1984 by a local college professor, Conrad Weiffenbach, found several high levels in eastern and central Iowa (Weiffenbach, 1987). To help determine if there were a radon problem, Iowa State University, in February of 1987, began selling radon detectors and collecting data on the radon results. This database now includes information on 15,111 short-term tests, including 7,100 first-time screening tests. The arithmetic average of these 7,100 first-time tests is 8.3 picocuries per liter (pCi/l), more than twice the EPA action guideline of 4.0 pCi/l. Thirty percent of the screening tests gave low results (4.0 pCi/l or less, 64 percent gave medium results (in the range of 4-20 pCi/l), and 6 percent were high readings (more than 20 pCi/l). Additional testing confirms that more than 70 percent of Iowa homes "fail" the EPA screening guidelines. Despite the risk associated with radon exposure, less than 6 percent of Iowa residents have tested for radon, and only a few hundred have taken measures to reduce the levels of radon in their homes. An Iowa State University Extension Service Iowa Radon Project public awareness survey in 1990-1991 reveals reasons for the disappointing response of the Iowa public. Nearly 90 percent have heard of radon, but they do not feel knowledgeable about radon, with two out of three persons reporting they feel inadequately informed.

THE RURAL YOUTH DISABILITY PREVENTION PROJECT



*By Cheryl Hawk, M.S., Jane Gay, B.S.N., Kelley J. Donham, D.V.M.
University of Iowa, Iowa City, Iowa*

The Rural Youth Disability Prevention Project is an intervention funded by the CDC in 1988 to provide a framework for the development of community-based, pediatric, agricultural injury-control programs. It has a three-stage structure, each requiring input from and feedback to the farm community to ensure that program development addresses its needs. The first stage is diagnosis of needs, with provisions for postintervention evaluation, utilizing two instruments: a survey of local farm families to gather data on safety practices, risk factors and injuries, and the Farm Family Walkabout guidebook, a family activity designed to identify hazards on individual farms. In the current project year, the survey was administered to 400 and the Walkabout to 458 Iowa farm families. Results indicated injury-control issues to target:

1. Children in the workplace. Children accompany their parents operating farm machinery from an average age of 7 and begin operating it themselves by 11.
2. Emergency preparedness. Only 25 percent of adults have had CPR/First Aid training. Fifty percent have First Aid kits in their homes, and 14 percent have them in their tractors.

In the second stage, communication, these findings are sent as a newsletter to participants and publicized in local media. Meetings ensue at which farm families and community groups assess local needs. This leads to the third stage, facilitation of appropriate actions. The specific issues currently targeted are being addressed on two levels, individual and community-based. On the individual level, Future Farmers of America groups are working directly with participants to implement simple, practical safety projects, such as preparing and selling tractor first aid kits or distributing lists of emergency phone numbers. An example of community-level action carried out was a CPR workshop requested by farm families after they received the report of the Walkabout data and arranged by local health professionals. Post-testing to assess behavior changes will be carried out in June of 1991. Evaluation of the efficacy of this community-oriented program will be completed by the fall of 1991.

TRACTOR STABILITY: HOW STEEP IS TOO STEEP?

By Jill Hudson, Charles Schwab, Ph.D.
Iowa State University, Ames, Iowa



Tractor-related fatalities in Iowa account for approximately 41 percent of the total fatalities recorded during 1988 through 1990. During 1991, fifty-two percent of all tractor fatalities recorded in Iowa during 1990 resulted from side overturns. These state figures coincide with national statistics, making tractor overturns a major agent of death for agricultural workers. What slope is too steep for safe operation of a tractor becomes an important issue. Static stability of farm tractors in side overturns on sloped terrain can be determined from the Static Lateral Critical Angle (SLCA). The SLCA was calculated for approximately 700 two-wheeldrive models using the center of mass and geometry of the tractor. The SLCA was plotted with respect to the horsepower capacity of the tractors. The influence of different attachments on the SLCA was examined. The effect that a front-end loader carrying a hay bale at different elevations had on the SLCA were determined. Changes of the SLCA with respect to horsepower requirements were developed for the different attachments investigated. Understanding the influence that attachments have on the SLCA provides background information required for a proactive assessment of potential tractor side overturn hazards.

PESTICIDE SAFETY FOR RURAL FARM YOUTH

By Nancy Jenson, Wendy Wintersteen
Pocahontas County Extension



Spraying weeds with herbicides while riding on a tractor-propelled platform or bean-bar is a common summer job for many rural youths in the Midwest. However, bean-bar riders are exposed to more than the sun; they are also exposed to the herbicide spray. A study conducted by *Successful Farming* magazine indicated that virtually all bean-bar riders are contaminated with herbicide after 2 hours of spraying. Herbicide exposure can result in adverse health effects such as eye and skin damage and the possibility of future health problems. The severity of these effects depends on the type and concentration of the herbicide and the area and amount of exposure. To educate rural youth about herbicide dangers, Iowa State University Cooperative Extension staff conducted an extensive bean-bar education program in Calhoun and Pocahontas counties. In cooperation with the local public health department, copies of an Extension bulletin, *Bean-Bar Facts and Safety Tips* were distributed to 4,000 students in 14 school districts. In addition, a slide set on bean-bar safety was developed and presented by Extension personnel at several programs. Rural youths are taught that bean-bar spraying can be relatively safe when certain precautions are taken. Wearing rubber gloves, shoes, jeans and a long-sleeved shirt were emphasized as adequate protection for bean-bar riders in most cases. Goggles, rubber gloves, and Tyvek disposable coveralls will offer the maximum protection. In case of an emergency, youth were told to flush out irritated eyes or to rinse skin with large amounts of water. After work, all bean-bar riders should shower with soap and water. Bean-bar riders were cautioned against "horsing around" and inadvertently spraying themselves or others with herbicide. And finally, youth learned to refuse to spray until all the equipment was safe to operate.

IOWA AGRICULTURAL INJURY SURVEILLANCE

By Shirley K. Jones, B.S.N., M.P.H.
Iowa Department of Public Health, Des Moines, Iowa



Acute agricultural injury is recognized by the National Safety Council as occurring at a rate of nearly five times the rate for all industry. Iowa's Sentinel Project Researching Agricultural Injury Notification Systems (SPRAINS) Project, funded by CDC/CEHIC, has established a statewide surveillance system to study acute agriculture-related injury. The project now in its second year uses reports from designated hospital sentinel reporters and from other volunteer health care providers and seeks to identify the multiple factor relationships which occur in acute injuries subsequent to agriculture activity. More than 2,100 acute injuries, including 83 deaths, occurred and were reported in 1990. Information characterizing these injuries from the first year of study will be presented in our display. Injury is increasingly being recognized as a high priority public health problem. Continuing analysis of this data will enable the design of activities that can be specifically targeted to decreasing the frequency and severity of these injuries.

AGRICULTURAL RESPIRATORY HAZARDS EDUCATION SERIES



By *Bonnie J. Kay, R.N., B.S.N.*
American Lung Association of Iowa, Des Moines, Iowa

The *Agricultural Respiratory Hazards Education Series* (ARHES) was produced in 1986 by the American Lung Association of Iowa (ALAI) in response to a profound lack of comprehensive material addressing the lung health risks associated with agriculture. The series was developed in collaboration with the University of Iowa's Institute of Agricultural Medicine and Occupational Health and Iowa State University Extension. It consists of an introduction and a nine unit set for health professionals and a nine unit companion set for agricultural and community workers. Each unit is designed to stand alone. Each addresses a different lung hazard commonly found in agriculture. The series provides an excellent cornerstone for community education programs. The materials have been used by extension services and lung associations across the country. Rural hospitals have used the series for community programs, as have Farm Bureau Federations, 4-H, and FFA youth groups, health fairs, producer groups and farm safety organizations. Programs for physicians, nurses, and respiratory therapists have been very successful and have generated much interest. The ALAI has a slide/tape presentation which accompanies the series and provides a good discussion tool. It has also developed a promotional kit for other organizations and lung associations to use. The kit includes press releases timed to seasonal tasks and hazards, public service announcements, public service ads, sample program outlines, and accompanying letters. A new tabletop display which addresses proper selection and use of respirators is now available for groups to use. The nature of the education series allows each user to tailor the program to the specific need. It can be provided at the community level, directed by local healthcare providers or extension personnel, or used strictly by the individual. Cost is minimal. An opportunity to display in the project showcase will permit others to see how the ARHES can complement their programs. We would provide a display presentation.

INNOVATIONS AND PERCEPTIONS OF AGRICULTURAL SAFETY STUDENTS



By C.J. Lehtola, M.S.
Iowa State University, Ames, Iowa

People involved in agriculture recognize agricultural safety as a present-day vital concern. Farmers, agribusiness employees, and extension personnel expressed the desire and need to learn more about farm safety. Many of these individuals are employed full-time and unable to attend conventional campus classes. A class in agricultural safety was offered as an off-campus program for these adult undergraduate and graduate-level students as a solution. The course was conducted using 13 2-hour video segments and 2 all-day, on-campus sessions. A total of 68 students (ages 22-62) participated in the first class that was offered. Students were required to identify hazards at their farm or workplace and develop a solution to eliminate hazards. Many found it effective to conduct the hazard identification by video camera. Many innovative solutions were developed and presented by the students. Farm safety issues included licensing of tractor operators on public roadways, child endangerment, babysitting services, regulations, disability awareness and the responsibility of manufacturers. Their awareness of safety was increased, as well as the recognition of the complexities involved in farm safety. This course proved applicable and valuable to the participants. Measurement of the accidents that were prevented as a result of their involvement, innovation and increased awareness is impossible, but the participants responded favorably to the class and many students plan to promote farm safety in their communities.

AGRICULTURAL CHEMICALS: ACUTE AND CHRONIC EXPOSURES



By *Linda L. Leverenz, M.S., C.H.E.S., Patricia Price, D.O.*
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The Agency for Toxic Substances and Disease Registry (ATSDR) has recognized the need for educating health professionals throughout the nation on the importance of properly diagnosing and treating various environmental illnesses. To assist in meeting this need, ATSDR has provided funding through the Iowa Department of Public Health to the University of Iowa for the development of a 2-hour physician education program entitled, *"Agricultural Chemicals: Acute and Chronic Exposures"*. It has been estimated that this program has reached approximately 52 percent of the physicians in the state of Iowa. Agricultural chemicals are used in every aspect of daily life. Pesticides control insects in agricultural settings, destructive moths and beetles in forests, and garden and household pests. Other chemicals eliminate weeds, serve as preservatives in wood products, and are used as fertilizers. The widespread use of these chemicals often results in overexposures that may cause "flu-like" symptoms and are somewhat difficult to diagnose. Major effects on human health may result in acute systemic poisoning; skin, eye, and nose irritation; dermal sensitization; pulmonary damage; and, to a lesser extent, chronic damage to the kidney, liver, and central nervous system. Objectives of this program are to provide information that will assist physicians in: 1) identifying pesticides that are responsible for acute and chronic health effects; 2) establishing clinical diagnostic and treatment protocols; and 3) offering their patients methods for preventing pesticide poisonings.

PREVALENCE OF ANTIBODIES TO ENVIRONMENTAL FUNGI IN THE SERA OF SWINE CONFINEMENT



By Daniel M. Lewis, Ph.D., Tori A. Bledsoe, Amy Stasny, Lisa Nicklow
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As part of an epidemiological analysis of the respiratory hazards associated with working in swine-confinement facilities, we obtained serum samples from 292 persons who either work in swine-confinement facilities, farmers not engaged in swine production, or age-matched, non-farm workers. Environmental analyses of swine confinement facilities revealed six species of fungi were the predominant fungal isolates in these facilities. The sera were assayed for precipitating antibodies (IgG) by counterimmuno-electrophoresis (CIEP) and reagenic antibodies (IgE) by a radioallergosorbent test (RAST) to extracts of the fungal isolates. The fungal isolates were *Scopulariopsis sp.*, *Penicillium sp.*, *Cladosporium sp.*, *Mucor sp.*, *Aspergillus ochraceous.*, and *Aspergillus flavum*. Only two of the serum samples contained precipitating antibodies and both were reactive with the *Mucor sp.* isolate. In contrast, 46 of the 292 sera (15.7%) contained IgE antibodies to one or more of the fungal isolates. These results will be presented and discussed with respect to the exposure status of the workers, but the preliminary analysis indicates that IgE antibodies may be a more sensitive marker of exposure to these microorganisms than precipitating antibodies.

HEALTH SURVEILLANCE ACTIVITIES OF A VETERINARY DIAGNOSTIC LABORATORY



By Gary D. Osweiler, D.V.M., M.S., Ph.D.
Iowa State University, Ames, Iowa

Food and companion animals are often exposed more directly to environmental chemicals than are humans, and may serve as sentinels of potential health effects in humans. Recently, the National Academy of Sciences has recognized and reinforced this idea. Prompt investigation of animal losses or illnesses may determine that a poisoning has occurred and allow preventive measures before they become widespread in humans or the environment. In some circumstances, animals studied at questionable locations, such as hazardous waste sites or industrial locations, may provide early clues well before human problems become apparent. Toxic effects of chemicals may alter functions of cells, cause morphologic changes, or act on individual cellular components important to the immune system. Veterinary diagnostic laboratories are an important link in the assessment of potential human problems of toxicosis, immune dysfunction and carcinogenesis by their ability to evaluate immune function in exposed animals, as well as correlate the morphologic effects and concentration of chemicals that result from exposure to pollutants in the environment of both animals and man. The Iowa State University Veterinary Diagnostic Laboratory has evaluated numerous potential human problems by monitoring key effects in animals at risk. Some of these problems include lead poisoning, organophosphate toxicosis, dioxin hazards in wood preservatives, water quality, aflatoxicosis, and therapeutic drugs. Details and significance of these activities relative to human health will be discussed.

IOWA FARM FAMILY HEALTH AND HAZARD SURVEILLANCE PROJECT



By William J. Pependorf, Ph.D.
University of Iowa, Iowa City, Iowa

Agriculture is now recognized as the most hazardous workplace in America. Yet agriculture lags behind general industry in the application of the traditional preventive phases of recognition, evaluation and control of health (and safety) hazards. The dilemma of agriculture as both an industry and a way of life contributes not only to this lag but also influences the design and approach of a successful health survey of an agricultural population. The aims and approach of the National Institute for Occupational Safety and Health [NIOSH] funded Iowa Farm Family Health and Hazard Surveillance Project are:

1. To determine the retrospective distribution of farming practices, medical symptoms, and traumatic injuries from a randomly selected cohort of farming families using a mailed survey questionnaire to a population-based, random cohort on about 500 farms.
2. To record temporal exposure to environmental and biomechanical/ergonomic factors likely to contribute to work-related illness or injuries by on-farm observations of a sub-cohort of these farming families.
3. To measure the levels of exposure to a small number of selected low-frequency, high-hazard agents or processes likely to contribute to work-related illness using traditional quantitative industrial hygiene assessment techniques.

Data collected in this survey will provide the basis for future investigative agricultural health and safety efforts in several directions. The health status data will comprise the first systematic, representative view of the health of American farmers and farm families. Hazard data will provide not only a statistical distribution of risk factors within this population, it will also contain a basis upon which to estimate the time or frequency of being "at-risk," yielding new insight into interpreting accident, injury and fatality data collected in these and other studies. Additionally, these data will be used to develop specific recommendations for modifications of tools, machinery, work methods and buildings which will reduce work-related injuries among this segment of the population.

IOWA STATE UNIVERSITY: RESEARCH AND INFORMATION FOR SAFETY AND HEALTH



By August Ralston
Iowa State University, Ames, Iowa

Illustrated are the research undertaken and information and services provided by the Cooperative Extension Service (CES) at Iowa State University in the area of agricultural safety and health. The structure of the CES including 4-H, and how farm families and workers and safety and health professionals can access information from the CES are explained. Research/information topics covered are clothing contamination by chemicals, application of chemicals, household use of pesticides, rollover protective structures, quality of water supply, carbon monoxide spillage from heating equipment, air quality and respiratory illness, design of confinement buildings, machinery design, and tractor stability.

AGRICULTURAL HEALTH PROMOTION SYSTEMS: OBJECTIVES AND PROGRAMS IN IOWA



By August Ralston
Iowa State University, Ames, Iowa

Illustrated are the objectives and plan of action under the Agricultural Health Promotion Systems (AHPS) cooperative agreement between NIOSH and Iowa State University. Efforts to enhance the capability of professional extension staff as interveners for occupational safety and health, to build a network among public health agencies, volunteer groups, and cooperative extension, to cooperate with the Center for Agricultural Research, Education, and Disease and Injury Prevention at the University of Iowa, and to improve the formal occupational safety and health college curriculum are explained. Examples are provided of the likely impact of the AHPS cooperative effort on educational programs and intervention techniques and networks that are aimed at reducing the occupational hazards and exposures faced by farm families and workers.

RURAL YOUTH DISABILITY PROJECT

By Angie Reynolds, R.D.H., B.S.
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Health and safety are major problems in agriculture. When a farm injury results in a child affected by a disability, the rural community is impacted socially and economically. Farm injuries and the resulting disabilities consequently become a major public health problem. The Rural Youth Disability Prevention Project focuses on increasing community awareness and ownership of the farm-child injury problem. This is a necessary focus for any effective and on-going *community-based* prevention strategy. The project is owned, operated, and directed by the community with technical assistance provided by the Office of Disability Prevention and the University of Iowa Hospital and Clinics. These community prevention projects have been implemented by the Disability Prevention Program. Each project is operated locally and focuses on unique disability risk factors. The project sites are located in Marshalltown, Spencer, and Harlan. These communities were selected due to their affiliation with the Iowa Agricultural Health and Safety Service Project (IA-HASSP). The IA-HASSP project also serves to focus community awareness, ownership, and cooperative efforts in reducing farm-related health and safety hazards. The goal of this project is to demonstrate that disabilities of rural youth can be reduced through concerted community-wide efforts. Three major activities conducted include:

- Community survey of existing safety knowledge, attitudes, behavior and near-miss injuries.
- Farm family hazard analysis ("Walkabouts").
- Community Involvement Injury Control Workshop.

Special emphasis is placed on the development of effective community prevention strategies which involve organizing broad community influence and support. To accomplish this, the project will promote active collaboration between multiple disciplines, agencies, and businesses in the projects.

CLEAN AIR FILTER FOR TRACTORS

By Mike Schmitz, Eugene Ahrenholtz
Defiance, Iowa



Workers exposed to chemical fumes inside their cabs are reported to have headaches, nausea, and sickness as a result of these fumes. It seems the tractor cab filtration systems are not designed to filter chemical fumes. The authors researched and developed a design for an air filter that reduces chemical fumes and particulate matter in the tractor cab. They suggest this filter should be added to gloves, goggles and other protective equipment used when applying pesticides and herbicides. The clean air filter has a three-stage design. Stage one is a paper media that removes dust. Stage two is an activated carbon that adsorbs organic vapors. Stage three is a final filter which prevents carbon dust infiltration. The filter is patent-pending, but as yet untested by a large research company. Many farmers in Iowa are already using the product regardless of lack of testing, and say it does significantly reduce the chemical fume leakage into the tractor cab. The authors would like to work with a research company to test the product.

IOWA'S BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM



By Susan Schoon, R.D., L.D.
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The Iowa Department of Public Health (IDPH) has identified cardiovascular disease as the number one health problem in Iowa. Data from death certificates and other sources show the annualized 1984-86 mortality rate from ischemic heart disease is 253 per 100,000 population as compared to the national rate of 217 per 100,000 population. How do Iowans rate with their lifestyle behaviors? The Behavioral Risk Factor Surveillance System (BRFSS) is providing some answers. Data Collection--The goal of the BRFSS is to provide data to identify health promotion and disease prevention priorities for the public and private sectors of Iowa. Specific objectives are to determine the state-specific prevalence of personal health behaviors related to the leading causes of premature death and to advance the understanding that health-related behaviors are critical indices of health. Interview Process--The telephone interview process uses a modified random digit dialing and random selection of adults over 18 from the household. One hundred fifty interviews are conducted each month, totaling 1,800 interviews a year. There are currently 47 states using the 77 core questions developed at the Centers for Disease Control. 1989 Behavioral Health Risks of Iowans:

- Cholesterol - 57.6 percent reported having their cholesterol checked at least once.
- Hypertension - 15.8 percent had been told by a doctor or health professional they have high blood pressure.
- Exercise - 28.1 percent reported more than 20 minutes, 3 times a week of leisure-time physical activity.
- Binge or acute drinking - 16.6 percent of the respondents reported having 5 or more drinks on an occasion, one or more times in the past month.
- Seat belt use - 76.2 percent of those surveyed reported using a seat belt always or nearly always.
- Overweight - 25.3 percent based on body mass index.
- Smoking - 22.7 percent reported they now smoke.

OVERTURNING PERCEPTIONS OF TRACTOR OVERTURN HAZARDS



By Charles V. Schwab, Ph.D.
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Tractor-related fatalities in Iowa account for approximately 41 percent of the total fatalities recorded during 1988 through 1990. The National Safety Council identifies tractors as a major agent for death of agricultural workers. Overturns, runovers, and power-take-offs (PTOs) are a few specific examples of different dangers associated with tractor operations. Elevation of agricultural workers' awareness for tractor overturn hazards is accomplished by an interactive display. A table-top terrain and remote-controlled tractor operated by 4-H youth graphically illustrate the overturn hazards. Improper and proper responses to situations when a tractor wheel slips off the road are performed. Demonstrations of safe ascension of tractors on sloped ground is shown. The success and effectiveness of this educational and intervention display results from several factors. The high level of interaction is one factor. Participants view a dynamic model of a real life situation, while a narrative explains the significant details. The presenter disarms the audience because the 4-H youth do not represent authoritative figures stating guidelines, common procedures, and regulations. The display *"Drive Head over Wheels"* is an effective and popular display that promotes tractor safety and elevates the level of awareness for tractor overturn hazards.

PESTICIDE RESIDUES IN A MIDWESTERN FARMER'S COVERALLS

By Janis F. Stone, Ph.D., H. Michael Stahr, Ph.D.
Iowa State University, Ames, Iowa



Careful use and management of clothing can assist in minimizing exposure to crop chemicals and contribute to the farm worker's health and safety. This research concerns protective cotton coveralls actually worn during corn and soybean production. An Iowa farm family cooperated in this case study and provided used coveralls that had been worn for four crop seasons and laundered after every wearing during application of many thousands of pounds of eight different pesticides. Samples were cut from the lower leg, thigh, crotch, shoulders, sleeves, pockets, collar and waistband of the coveralls, both front and back, totaling 40. Each was separately extracted using ethyl acetate with 5 minutes of shaking and 16 hours standing. The solvent was analyzed for Treflane by electron capture GLC. After the EC analysis, samples were concentrated and analyzed for organophosphorus pesticides. All samples were quantified by two replicate systems. Standards were run after every five sample injections. Every fifth sample was amended with a mixture of the six pesticides anticipated to be present (because the owner had reported using them). Quantitative analyses for these were made; 90-100 percent recovery was obtained of the added pesticides. The pesticide deposition per square centimeter (cm^2) of fabric for each sample was separately calculated based on the cm^2 size of the extracted sample. The farmer was reported to be in good health, but his coveralls contained unexpected levels of five pesticides. Residues of pesticides used only in the first season that the coveralls were worn remained in them at the time they were retired, despite laundering after every wearing. Garment areas (pockets, waistband) frequently touched by hands seemed to have higher contamination levels. Measurable amounts of Treflane, Lorsbane and Counter were found in all samples of the coveralls, but no Lasso/Atrazine was detected. This could be explained by the latter's known solubility in water. A few samples contained Thimete and Dyfonate, although they had been used only in the first and second crop seasons, respectively. Residues released in the first extraction of lower leg samples ranged from 0.2 ng/cm^2 of Dyfonate and 0.5 ng/cm^2 of Thimete to 4.9 ng/cm^2 of Treflane and 7.3 ng/cm^2 of Lorsbane. Sleeve cuffs showed 14.0 ng/cm^2 Treflane, 91.9 ng/cm^2 Lorsban, and 10.5 ng/cm^2 Counter. A second extraction from selected samples from the lower leg, abdomen, shoulders, chest pocket, sleeve and cuff proved that pesticides had not been exhausted from the fabric by the first extraction. Dyfonate and Thimet appeared in a few samples with the second extraction that had not appeared with the first extraction. Two samples selected for a third extraction produced about 30 percent additional pesticide. Although original contamination levels were unknown, this study shows the difficulty of removal of pesticides from a textile matrix and suggests that work based on a single extraction may underestimate the amount of pesticide present. It also underscores the importance of dosimeter materials in affecting results of exposure studies. The residues per cm^2 seem small, but the total garment load must be considered. The health risk associated with chemicals so firmly bound in cloth is uncertain, especially when other clothing layers are worn beneath. Laundering after every wearing does not seem to completely clean pesticides from clothes in real-life minimum exposure situations of corn and soybean farming, but many studies have previously indicated that laundering greatly reduces pesticide residues. The persistence of Thimet and Dyfonate(s) which were used four and three years before this analysis, respectively, was unexpected. Cotton coveralls offer several advantages over disposables that are expensive, cannot be decontaminated, contribute to hazardous-waste problems, and are often too hot for comfort. This work suggests that it may be wise to replace cotton coveralls each crop season to prevent residue buildup.

ASSESSMENT OF BIOAEROSOL EXPOSURES IN GRAIN AND DRY VEGETABLE HANDLERS



By Peter S. Thorne, M.S., Ph.D., Sue Ellen Hosch, Janet L. Watt, David A. Schwartz
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Workers exposed to grain and dry vegetable dust are reported to experience airway inflammation and progressive airflow obstruction. A population-based, longitudinal study was undertaken to determine the association of specific workplace exposures with pulmonary changes in grain handlers. A unique component of this study is the quantification of airborne levels of fungi, total bacteria, gram negative bacteria and thermophilic organisms. In addition, total and respirable dust, endotoxin levels, and other environmental parameters will be assessed for approximately 400 workers on three occasions over 5 years. At the outset, a survey was sent to 669 operating grain facilities in eastern Iowa. Completed surveys were received from 80 percent which illustrated the high degree of cooperation from these mixed grain, corn and soybean facilities. The mean number of production employees was 7.7 (range: 1 to 800) and employees numbered five or less in 71 percent of these sites. In the first two quarters of the study, exposure assessments and respiratory health evaluations were performed on 185 workers at 50 sites. Levels of indoor airborne fungi averaged 600 CFU/m³ for postal workers, who serve as our control population, while grain facilities averaged in excess of 20,000 CFU/m³. Airborne bacteria were generally twofold higher than fungi with 23 percent of the grain sites exceeding 1 x 10⁵ CFU/m³. Thermophilic microbes averaged 200 CFU/m³ in postal stations but were 10 to 40 times higher at grain sites, and gram negative bacteria at grain sites averaged 4000 CFU/m³. For all types of microbes, levels appear to be highest at mixed grain facilities. Microbial counts were split approximately evenly between respirable and non-respirable sizes. These data indicate that microbial exposure levels cover a broad range. Moreover, the range of exposure levels will enhance our ability to test our hypothesis that pulmonary function deficits are exposure dependent. (Funded by the Veterans Administration Merit Review and NIEHS ES00202).

DEVELOPMENT OF AN INHALATION TOXICOLOGICAL MODEL FOR FARMER'S LUNG



By Peter S. Thorne, M.S., Ph.D., Susan D. Kaliszewski
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Farmers inhale a complex mixture of xenobiotics that includes respiratory irritants, microbial toxins, nuisance dust and a multitude of aeroallergens derived from plants, animals, arthropods, and microbes. Farmer's Lung is an extrinsic allergic alveolitis characterized by lymphocytic and granulomatous interstitial lesions. It is most often associated with exposure to the thermophilic spore-forming bacterium, *Faeni rectivirgula* (*M. faeni*), found in moldy hay. In order to study the pulmonary immunologic processes associated with the early stages of this disease, we undertook to develop murine and guinea pig models of Farmer's Lung using inhalation exposure. Large quantities of pure *M. faeni* were grown in tryptic soy broth at 50°C, then washed and concentrated. Aerosols of a homogenate of this *M. faeni* preparation were generated into exposure chambers using a PITT#1 nebulizer. This procedure allowed generation of atmospheres containing up to 8 mg/m³ pure *M. faeni*. Two exposure systems allowed inhalation challenge to either mice or guinea pigs with responses determined from histopathology, immunochemistry and pulmonary function evaluations. In one such study, mice inhaled *M. faeni* aerosols (5.7 ± 1.7 mg/m³) for 30 min, once each week. Three groups of 10 mice received either 4 or 8 exposures or were sham exposed, and each group consisted of 5 animals fed a standard diet and 5 fed a diet containing a stimulant of delayed hypersensitivity responses (vitamin A). Histopathological examination of the mouse lungs demonstrated marked perivascular and peribronchiolar histiocytosis, localized acute inflammatory cells, fibrosis, and giant cells in granulomatous lesions in the mice fed the vit. A-supplemented diet and exposed on 4 occasions. Other treatments resulted in mice with less severe responses. Inhalation exposures of guinea pigs in plethysmography will incorporate measurement of bronchoconstriction, airway hyperreactivity and immunochemistry into the model. This appears to be the first animal model to demonstrate Farmer's Lung solely by the inhalation route of exposure.

FARM FAMILY REHABILITATION MANAGEMENT PROGRAM (FaRM)



By Therese M. Willkomm, M.S.
Iowa Easter Seal (FaRM) Program, Des Moines, Iowa

There are more than 45,000 Iowa farm families who have been affected by permanent disabling accidents, injuries, or illnesses. Until recently, many farm families were forced to prematurely discontinue this rural way of life or attempt to farm with a disability that often resulted in secondary injuries. In 1986, the Iowa Easter Seal Farm Family Rehabilitation Management (FaRM) Program was developed to address the needs of this "at risk" population. The FaRM Program provides onsite rural rehabilitation services to farm families affected by disabilities. These services promote return to farming, the community, and increased independence by both the disabled individual and family members through adaptive equipment, modifications to the farm and home, secondary injury prevention education, and community support services. The success of this program has been recognized nationwide as an innovative and grassroots service delivery program. In November of 1990, President Bush signed the Farm Bill which included an amendment to establish programs in other states that will assist farmers with disabilities based on the successful Iowa FaRM Program. The Iowa Easter Seal FaRM Program relies heavily on its cooperative agreements, coalitions, contracts, and networking with the following organizations: The Farm Bureau, Pork Producers, Cattleman's Association, and other community organizations to assist in identifying individuals with disabilities and providing assistive technology services; Iowa State University Agricultural Engineering Program to assist in designing agricultural work site adaptations; the University of Iowa Ag-Medicine Program and the Iowa Program for Assistive Technology to assist in injury-prevention activities, statewide awareness, and direct service delivery; State Vocational Rehabilitation, rehabilitation hospitals, and The Department of Public Health to assist in referrals and funding of services. In addition, the FaRM Program utilizes: a statewide ingenuity network comprised of volunteers who assist in obtaining, designing, and fabricating rural assistive technologies; a peer technology support network comprised of individuals with disabilities who share their experiences with individuals who are newly disabled; and an on-site Mobile Rural Assistive Technology Unit.

EDUCATING IOWA FARMERS ABOUT PESTICIDE SAFETY AND HEALTH RISKS



By Wendy K. Wintersteen, Ph.D.
Iowa State University, Ames, Iowa

Minimizing the health risk inherent in pesticide application is a major goal of the Pesticide Applicator Training (PAT) program. In the past three years, more than 40,000 Iowa farmers attended a 4-hour training session on the health and safety concerns associated with pesticides. Although pesticides are toxic, the health risk they pose can be significantly reduced by practices that limit exposure. The Iowa State Cooperative Extension Service PAT program seeks to reduce harmful health effects by alerting farmers to the exact toxic nature of pesticides, and strategies to minimize pesticide exposure. When handling pesticides, farmers are cautioned to read the pesticide label and wear the suggested protective clothing. Neoprene or nitrile gloves, goggles or face shields, rubber aprons or coated Tyvek disposable suits are items that can dramatically decrease pesticide exposure and limit harmful health effects. Farmers are also taught to re-enter sprayed fields only after a safe interval and methods to reduce pesticide drift on themselves and their neighbors. Pesticide poisoning symptoms and exposure routes receive considerable attention as well. Recognizing pesticide poisoning symptoms for each class of pesticides, and responding with the proper first aid and medical treatment is essential farm safety knowledge. Program evaluations have been very favorable and participants have adopted safer pesticide-handling practices as a result of attending the program. A post-training survey of 1,040 applicators asked respondents if they would change their farming practices as a result of attending the training program. The response choices were: likely, not likely, or not sure. As a result of attending the training sessions, 91 percent said they would check pesticide labels for signal words indicating product toxicity. Also, 87 percent thought they would increase their use of protective equipment, such as gloves, goggles, and coveralls.