

THE AGRICULTURAL SAFETY AND HEALTH PROMOTION PROGRAM FOR OLDER KANSANS



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The Agricultural Safety and Health Promotion Program for Older Kansans was launched this year in an effort to communicate safety information to farmers who may not have been reached successfully in the past. To this end, we are taking a slightly different approach in our outreach than that of previous safety programs. Since farmers' past attendance at seminars and meetings focused specifically on safety has been disappointing, we are attempting to communicate our safety message by taking advantage of already existing community forums. In each of Kansas' 105 counties, we are recruiting and training a team of volunteers who will make brief, 7-to-10-minute presentations on various safety topics to community gatherings such as Extension meetings, Farm Bureau meetings, seed and fertilizer sale days, church events, and meetings of local service organizations. Each team of volunteers is backed up by a support team consisting of the county Extension agents, the county Farm Bureau safety chairperson, and the county health director or local representative of the Area Agency on Aging. The volunteers will base their presentations on a series of 4-page tabloids dealing with the following seven topics:

- Tractor Safety.
- Pesticide application and farm chemical handling.
- Farm machinery (other than tractors).
- Farm vehicles (trucks, wagons, ATVs, etc.).
- Livestock safety.
- Health issues.
- Farmstead safety (electrical hazards, grain bins, manure pits).

Volunteers will be provided with lesson plans containing suggestions for conducting the presentations, although volunteers are encouraged to be original and to use their personal knowledge and experience in formulating their own approach to their audience. Volunteers will distribute the tabloids at each of the meetings at which they make presentations. To further broaden our audience, the project will include production of a series of eight videotapes, one on each of the above topics, plus an additional video dealing with the aging process and how it relates to farm work. The project also involves incorporating units on safety into college agricultural courses and holding an annual Agricultural Engineering Safety Design Contest for college students.

RISK OF EXPOSURE TO CRYPTOSPORIDIUM AMONG FARMERS IN WISCONSIN



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Cryptosporidium infection is an important cause of diarrhea in humans and domestic animals; no effective therapy is known. Because the livelihood of farmers often requires contact with potentially infected animals, farmers may be at greater risk for *Cryptosporidium* exposure and disease than non-farmers. We used an enzyme-linked immunosorbent assay to determine the serologic status of current farmers, ex-farmers, and persons who never farmed in a cohort of 116 Wisconsin men. Of 75 men who reported to be currently farming, 31 (41.3 percent) were seropositive for *Cryptosporidium*, compared with 8 (19.5 percent) of 41 ex-farmers and never-farmers (odds ratio = 2.9, 95 percent confidence interval 1.1-7.9). After leaving the occupation of farming, ex-farmers experienced a decrease in seropositivity ($p = 0.06$). These findings suggest that current farmers are at greater risk of *Cryptosporidium* infection than are ex-farmers and persons who never farmed. Additional work is needed to define high-risk farming activities and determine modes of transmission in the farm setting so that farmers can take effective measures to prevent this potentially serious disease.

NON-HODGKIN'S LYMPHOMA ASSOCIATED WITH THE AGRICULTURAL USE OF HERBICIDES



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Recent epidemiologic case-control studies in Kansas and Nebraska have shown that agricultural herbicide use, particularly that of 2,4-D, is associated with an increased risk of non-Hodgkin's lymphoma (NHL). To better characterize this risk with regard to histologic type, we combined the results of the two studies (370 male cases, 1,671 controls) using the Working Formulation histologic classification. Among men, the use of herbicides was associated with a 50 percent increased risk of NHL (OR=1.5; 95 percent CI=1.1,2.1), and the use of 2,4-D was associated with a two-fold increased risk (OR=1.9; 95 percent CI=1.3,2.8). Exposure to 2,4-D more than 20 days/year increased the risk more than four-fold (OR=4.5; 95 percent CI=1.1,18.3). Interestingly, increased risks were seen for all ten major histologic types of NHL (categories AJ) in the Working Formulation. The highest risks associated with exposure occurred in intermediate-grade NHL (categories D-G). The use of herbicides was associated with a 70 percent increased risk of intermediate-grade NHL (OR=1.7; 95 percent CI=1.2,2.6), and the use of 2,4-D was associated with a more than two-fold increased risk (OR=2.4; 95 percent CI=1.5,3.9). Exposure to 2,4-D more than 20 days/year increased the risk of intermediate-grade NHL by more than eight-fold (OR=8.3; 95 percent CI=1.7,38.7). Within intermediate-grade NHL, follicular large cell NHL (category D) was the highest risk type with a nearly seven-fold increased risk associated with the use of herbicides (OR=6.7; 95 percent CI=1.4,44.1) and a ten-fold risk associated with the use of 2,4-D (OR=10.0; 95 percent CI=1.9,69.8). We conclude that agricultural herbicide use is associated with an increased risk for all major types of NHL, and for follicular large cell NHL in particular.

TRACTOR SAFETY CLASSES FOR YOUTH

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"Farming Safely in the Thumb" is a program serving Huron, Sanilac, and Tuscola Counties of Michigan. It is funded by a grant from the Michigan Department of Labor, Safety Education and Training Division. One of the major events of this program has been the Safe Tractor Operation classes for youth ages 10 years and older in each of the three counties. The 4-H Tractor Operation Program was established in 1970 as a means for youth to receive an exemption from the tractor driving restrictions of the Hazardous Occupations Order. For many years, the training needed by youth to receive this exemption was handled through Vo-Ag programs of local high schools. As a result of the discontinuation of or change in these programs and the concerns of liability, most youth in the "Upper Thumb" of Michigan had no way of earning a "certificate of training." This training has been demonstrated to be very successful in reducing injuries among those youth completing the program. The Safe Tractor Operation classes meet all of the requirements for providing youth 14-15 years of age with the training needed to earn this certificate. At the same time, these classes provide safety education to younger youth when they are beginning to learn to drive tractors. The classes are co-sponsored by "Farming Safely in the Thumb," the county 4-H Council and the county Farm Bureau. They run 7 weeks, meeting 1 night a week for 2 hours. The classes are strictly classroom instruction (there is no practical tractor driving) and are divided by ages (10-12 years and 13 or older). Each youth has a manual, and the instructors make use of slide/tape presentations (available through the Cooperative Extension Service, Michigan State University), safety videos and outside speakers. Every youth receives a 4-H Certificate of Participation and a Tractor Safety T-shirt. The students 14 and 15 years old who wish to earn a "certificate of training" must pass both a written test and a practical driving test. Over 1,000 youth participated in the classes this winter.

GREEN ISLE PROJECT: MY HEALTH FOR BETTER LIVING

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Rarely are there programs that outlive the grants that have given birth to them. Fewer still leave their imprint by serving as a model for a state public health sector. The *My Health for Better Living Project* influenced a rural community and two townships of 1,600 to re-examine their lifestyle to make changes in their eating patterns and exercise habits. The project incorporated the effort of 4-H members, community leaders, parents, schools, and county health professionals to improve the health and well-being of the families in the rural area surrounding and including the Green Isle community in western Minnesota. This project included the development of a health promotion education model that fostered community participation. The specific purpose of the project was to fill a need as expressed by the citizens of the Green Isle rural community and evidenced by the number of overweight children, undernourished elderly, medical complications, and chronic disease cases. Due to the worsening rural economic crisis, rural families were manifesting poor health habits which exacerbated their underlying health concerns. This project is unique because it was spearheaded by concerned youth and their parents. A Health Advisory Committee assisted in translating the ideas into action. The results have been positive. Designed for 1 year, the program has lasted 3! The cost of the programs was done on less than \$8,500 and has involved more than 1,200 hours of volunteer time. Many people have admittedly taken the time to make changes in their eating and exercise habits, positive changes influenced by programs initiated by the Sundown Busy Bees 4-H Club. The programs address several age groups and continue to occur because they either have been integrated into existing establishments or have become self-sustaining. This project has received recognition from the Governor of Minnesota and the U.S. Secretary of Health and Human Services.

TEEN STRESS, DEPRESSION, AND SUICIDE

By Diane Norland

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According to University of Minnesota researchers, teen stress, depression, and suicide are occurring at high levels. These findings help dispel the notion that childhood is an unbroken, happy, carefree time. To address these issues, Sibley County, Minnesota, set up a Teen Stress Committee to develop an education and intervention program for school personnel, young people, parents, and interested community members. The committee used a program *Tackling Tough Stuff* developed by Joyce Walker, a University of Minnesota Youth Development Specialist. The Teen Stress Committee carried out two trainings of Sibley County school personnel which educated the participants about the prevalence of stress, depression, and suicide among young people. The participants also learned about signs and symptoms. Most importantly, they learned how to help. Selected teachers were recruited and trained in the use of the *Tackling Tough Stuff* curriculum to be used in their classrooms. A Student Assistance Team was recruited and trained in each school to deal with referrals from other school personnel and students. A play about teen depression, suicide and possible responses was performed for the community to raise their awareness about the issues. Several types of parenting workshops have been held twice a year on parenting challenges. Finally, a workshop featuring resources was held for all area professionals, such as school personnel, health professionals, social services, law enforcement, and clergy.

ROCK COUNTRY WALKS AROUND THE WORLD IN 30 DAYS



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Rock Healthy is a community-based health promotion coalition whose mission is to reduce the risk factors of chronic disease through proper nutrition and fitness. The coalition is made up of representatives from food retailers, businesses, county agencies, schools, producer groups, commodity groups, consumers, and the local hospital and medical clinic. The coalition planned and implemented a county-wide program, *Rock County Walks Around the World in 30 Days*. The goals of the program were to: (1) increase awareness of the relationship between exercise and heart health; (2) promote walking as a heart healthy exercise; (3) increase awareness of the available walking sites and trails in Rock County; (4) provide the opportunity for residents to engage in a walking program; and (5) to sign up 1,000 participants. Participants were recruited from the community-at-large, work sites, schools, community groups, and churches. Participants were given a sample walking program, weekly log cards, and exercise tip sheets. Each week walkers turned in their log cards. Miles were added up each week and tracked on a map of the world that was on display at the downtown newspaper office. Rock County has a population of 10,442; its major industry is agriculture and related to businesses. Almost 18 percent ($n=1,772$, 805 men and 967 women) of the population participated in the Walking Campaign—walking a total of 43,942 miles. The rural community of Hardwick, population 150, had 50 percent of its residents participate. All the school districts in the county (elementary, junior and senior high) participated for a total of 1,069 school-age children. Rock Healthy Coalition has put together a campaign overview and a media guide (sample ads, stories, etc.) that can be used by other communities.

NETWORKING THE NEBRASKA SAFETY PROGRAM



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There are many organizations, groups, and private citizens who are willing to help in delivering a message. Nebraskans are willing to help, if given the opportunity. For the last 30 years, I have been able to use a number of people to tell the safety and health story across the state of Nebraska and some other states within the United States. Foreign countries are not excluded. Altogether, I have over 1,000 people helping me tell the safety and health story. This includes upwards of 375 State Patrol Personnel, Sheriff's Departments, EMTs, County Extension Agents, Vocational Agriculture Instructors, Farm Organizations, etc. This figure is greatly expanded when you consider there are approximately 21,000 Emergency Medical Technicians who carry the story to the local level. After all, it is to their benefit if they can teach about an accident potential in a positive manner rather than having to pick up an injured person. Each state has this cadre of people to work with. It is just a matter of getting the people to understand what is needed and then giving them the facilities or information to work with. There is a segment of the "You scratch my back and I'll scratch yours." If I expect people to help me, they may also want my help at some time. Overall, I use 50 or more organizations or groups to help with the safety and health story. This practice has proven to be very beneficial. Some people I talked to point out they cannot get cooperation. The first question I ask them is, "Did you ask for help?" The answer is usually "No. They did not help someone else I know so they probably will not help me." My reply is, "They are going to either say *yes* or *no*. You don't know which it will be until you ask."

GRAIN SORGHUM DUST EXTRACT CHALLENGE CAUSES NEUTROPHIL MIGRATION TO THE PERIPHERAL BLOOD, THE UPPER RESPIRATORY TRACT AND THE LOWER RESPIRATORY TRACT



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Inhalation of grain dust is known to cause acute bronchitis symptoms, nasal irritation, and peripheral blood neutrophilia. We proposed that challenge with grain sorghum dust extract (GSDE) causes neutrophils to migrate to both the upper respiratory tract (URT) and lower respiratory tract (LRT). To test this hypothesis, 8 normal non-smoking, non-allergic volunteers were challenged with 24 ml of grain sorghum dust extract delivered to the URT and LRT as an aerosol generated by a Pulmoaid nebulizer. Assessment of the URT and LRT for signs of inflammation was done using nasal lavage (NL) and bronchoscopy with bronchoalveolar lavage. NL performed at baseline and +24 hours was done by instilling 3.5 ml. aliquots of saline which were immediately, forcibly expelled. There were more PMNs at +24 hours than at baseline ($.29 \pm .09$ vs. $2.33 \pm 1.40 \times 10^6$, $p < .1$). BAL was performed at +24 hours by instilling 5, 20 ml aliquots of saline followed by gentle aspiration. The returns from the first aliquot were processed as the "bronchial" sample and the remaining BAL fluid was pooled as the "alveolar" sample. There was significantly more PMNs in the "bronchial" and "alveolar" compared to normal controls ("bronchial": 40 ± 4 vs. 10 ± 1 percent, $p < 0.05$; "alveolar": 46 ± 7 vs. 1 ± 4 percent, $p < 0.05$). Although GSDE can attract neutrophils by a variety of mechanisms, an alternative, not mutually exclusive, hypothesis is that neutrophils are stimulated to randomly migrate (chemokinesis). To test this hypothesis, blood neutrophils are collected from the GSDE challenged volunteers at baseline and +7 hours. Neutrophil chemotaxis to GSDE was done with these PMNs using a modified blindwell chamber technique and significantly more PMNs migrated towards GSDE 7 hours after aerosol challenge with GSDE than at baseline (126 ± 7 vs. 164 ± 7 cells/hps, $p < .05$). These experiments demonstrated that there is a PMN influx into the URT and LRT. This may be explained, at least in part, by increased chemokinesis of the exposed patients' PMNs.

MANAGEMENT PROCEDURES TO ENSURE HORSE FARM SAFETY AND TO REDUCE LIABILITY COSTS AND RISK TO OWNERS



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Liability costs are a prohibitive factor to horse farm owners and riding instructors to the extent of making it financially unfeasible to remain in business. The objective of this extension educational program was to increase the awareness of horse farm owners and riding instructors of proper farm management and riding techniques that not only ensure personal safety and well-being, but also reduce insurance premiums and risk of lawsuit from liability claims. The program was designed to provide horse farm owners with a model horse farm to assist in meeting standards for farm safety techniques that will serve as evidence they are making a conscious effort to provide a safe atmosphere for themselves, clients, and horses. The model farm and safety techniques are described on videotape and in a series of fact sheets. The agenda for the videotape included: 1) general barn, surrounding acreage and pasture safety; 2) demonstration of what constitutes an "attractive nuisance"; 3) proper storage and care of equipment and outbuildings; and 4) examples of posted signs and considerations for liability coverage. Topics of fact sheets included: 1) safe management techniques while approaching, handling, leading, typing, saddling, and bridling; 2) proper riding safety while mounting, dismounting, and astride; 3) preventive measures for fire safety and what to do in the event of fire; and 4) considerations for liability coverage and examples of hold-harmless agreements. Success of the program was determined by increased awareness of the need for horse farm owners to take a proactive role in reducing farm and instructor liability and demonstrated improved farm safety management practices and riding techniques by horse farm owners in New Jersey. Overall program success will be identified by reduced farm liability premiums and the number of horse farm and riding accidents.

A RESPIRATORY AWARENESS PROGRAM FOR NEW YORK FARMERS



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Workers in agriculture are at risk for a variety of occupational respiratory diseases (ORD). To address this problem, we designed an outreach program aimed at heightening the awareness of New York farmers regarding ORD. We elicited information regarding occupational dust exposures as well as respirator use from 431 farmers prior to routine spirometric evaluation at 10 agricultural exhibits. One hundred eighty-one farmers (42 percent) reported using respirators prior to participation in the program. However, further questioning revealed that 118 of these (65 percent) were using handkerchiefs and single-strap masks. Following an explanation of the screening results, a brief review of the risks of ORD, the benefits of dust avoidance, and instruction on the proper use of approved respirators, each participant was given a list of respirator suppliers. Effectiveness of this interventional approach was determined by 6 week follow-up with postcards (55 percent response rate) and with telephone interviews of a 10 percent sub-sample of the non-responders. Follow-up of those not previously reporting use of protection showed current respirator use in 60 percent of the postcard responders and 50 percent of the sample of non-responders for a total weighted average of 54.6 percent improved compliance following the program. There was a prevalence (36 percent) of abnormal spirometric results in those not converting. This prevalence was not significantly different from the 34 percent prevalence found in those converting. Therefore, we concluded that abnormal results were not a predictor of behavioral change. We conclude that this approach is effective in improving respirator compliance among farmers and that this improvement is independent of their spirometric results.

FATAL FARM ACCIDENTS IN NEW YORK: CONSEQUENCES AND ECONOMIC IMPACT



By Timothy W. Kelsey, Ph.D.

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Farming is often identified as one of the nation's most hazardous occupations. The National Safety Council estimates that 1,300 people die each year in agricultural accidents. Despite the high fatality rate, there has been only anecdotal evidence about the consequences of fatal farm accidents on farms, farm families, and local communities. Existing analyses considering the impact of farm accidents have primarily been case studies which concentrated on non-fatal accidents. Studies focused on fatal accidents have generally only considered the causes of accidents and to whom they occur. Using information from a previous newspaper clipping and death certificate-based study of fatal farm accidents, 87 families who had a member die in a farm accident in New York between 1985 and 1987 were identified. Fifty-two (60 percent) of these farm families were successfully interviewed by telephone. Income foregone by the accidents was estimated from the responses, using discounted future earnings and weighing by age-based and sex-specific survival probabilities. The discount rate was 5, and was combined with a productivity increase of 2 percent per annum. The net discount rate was thus 3 percent. All calculations were in 1987 dollars. Income foregone included on-farm and off-farm income and the value of household work. Fatal farm accidents cost New York an estimated \$1.3 million a year in lost income. The average present value of lifetime expected income foregone included \$447,157 per male owner, \$472,607 per hired worker, \$268,918 per female owner, and \$514,754 per child killed. The accidents had other costs as well; 67 percent of the families had quit farming entirely, and 44 percent of the families had moved and were no longer living on those farms. The relatively high displacement from agriculture and from homes shows that fatal farm accidents do not just mean the tragic loss of life. These accidents also often have tragic implications for the families' livelihoods and lifestyle. On the other hand, these family tragedies clearly do not overshadow other difficulties in agriculture. With at least 1,000 farms in New York quitting operation every year during this time period, fatal farm accidents were not a major source of farm family displacement. Furthermore, the total value of the income foregone by accidental deaths to farm operators was only equivalent to 1.2 percent of the returns from farming to farm operators in New York, and only 0.48 percent when both on-and off-farm income of farm households in New York is considered. Fatal farm accidents are major tragedies for the affected families, but such accidents' foregone income impacts and displacement are relatively small from a societal perspective.

**NORTH CAROLINA AGRICULTURE: DO WE POSSESS
THE RIGHT TOOLS FOR HUMAN ILLNESS IN SWINE
AND POULTRY OPERATIONS AND INJURIES
FROM AGRICULTURE MACHINES?**



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The Agricultural Health Promotion Systems program in North Carolina is addressing the high rate of injury and illness of the agricultural worker. In North Carolina, according to the North Carolina Department of Labor, those involved in agricultural occupations had an occupational rate of 8.3 /100,000 in 1987, compared to the overall incident rate of 7.3. North Carolina State Data Center statistics indicate that of the 48 farm-related fatalities reported in 1988, one-third involved agricultural machinery. Curriculum materials are being developed during the first year for the College of Agriculture and Life Sciences that will educate students about "*Human Illnesses resulting from Swine and Poultry Confinement Facilities,*" and "*Agricultural Machinery Hazards.*" These materials will be presented in the 1991 Fall Semester for both associate and baccalaureate courses at NCSU. In addition, courses at the East Carolina University School of Medicine will benefit from the developed materials. In the second year, eight County Extension Service programs will pilot the developed materials prior to statewide dissemination. The development of a Lay Advisors' Program in the third year of the project will lay the foundations for an ongoing program that will continue to address the health and safety of the agriculture workers. The relationship which exists between East Carolina University School of Medicine, local Extension Services Offices, state and local Health Departments and the agricultural community will become stronger. Through these interactions, a decrease in work-related injuries and illnesses and the promotion of health in agricultural workers and their families should occur in North Carolina.

FARM OPERATOR INJURY AND HEALTH STATUS



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Panel data from random sample surveys of North Carolina farm operators provide data about injury and health status. Among farm operators who stayed in farming during both survey waves (N-95), 10 percent said they or a member of their family had been injured on the farm seriously enough to miss a day's work, a day of school, or to require a visit to a doctor. Farmers with 200 or more days of on-farm work, those with no off-farm work, those under 45 years of age, and those with high gross farm incomes had the highest injury rates. Seventeen percent of continuing farm operators fell into the poor health category on an index composed of 10 questions about common health problems. Eighteen percent of continuing farm operators reported having a chronic health problem that sometimes interfered with their work. Seven percent of continuing farm operators reported they lacked health insurance. Among farm operators who exited farming (N-198), 7 percent cited health as the most important reason they left farming and 11 percent said they were disabled. Approximately 27 percent of ex-farmers fell into the poor category on the health index and 13 percent lacked health insurance. The results point to the need to consider both the short-term and long-term effects of agricultural hazards on the health status of farmers and ex-farmers.

**THE USE OF PROCESS HAZARD ANALYSIS FOR PREVENTION
OF INJURIES FROM ANHYDROUS AMMONIA**



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In order to prevent occupational illness and injury, it is desirable to anticipate potential hazards and to proactively implement appropriate preventive measures. One possible tool for doing this is Process Hazard Analysis (PHA). Researchers from the National Institute for Occupational Safety and Health (NIOSH) have applied a form of PHA called Hazard and Operability (HAZOP) analysis to analyze the use of anhydrous ammonia by farmers. Due to the extensive use of anhydrous ammonia, it is particularly important that the equipment, hardware, and procedures be both safe and highly tolerant to potential misuse. The HAZOP analysis involves: a systematic evaluation of the potential failure points that can occur with the equipment and procedures used in anhydrous ammonia storage, transfer, and application; the identification of credible and hazardous accident scenarios; and the identification of practical solutions or of research needs. Specific examples of these findings are given. In the future, we plan to use Process Hazard Analysis in the handling of acutely hazardous pesticides and working with power equipment. Results from these studies will be disseminated and their effectiveness assessed.

IGE ANTIBODIES TO SWINE ANTIGENS IN THE SERA OF PORK PROCESSORS



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As part of an investigation of respiratory illness among workers at a pork processing facility, we obtained serum samples from 37 workers and bulk samples of substances to which the workers were exposed. The serum samples were analyzed for total IgE content by a commercial radioimmunoassay (PRIST), and for specific IgE antibodies by the radioallergosorbent test (RAST) using extracts of swine urine, serum, blood, and dander coupled to cyanogen bromide-activated cellulose beads. A sample was considered positive if the binding to the antigen-coated beads was at least twice the binding to human serum albumin-coated beads. By this criteria, IgE antibodies to one or more antigens was detected in 28 (75.7 percent) of the sera tested. All 28 sera reacted with the whole blood extract, while 16 reacted with the dander, 10 with the urine, and 8 with the serum. No correlation between the total IgE content and specific IgE antibodies was observed. By questionnaire, 25 of the subjects were symptomatic for respiratory disease; 14 of these subjects had abnormal serial peak flow measurements. The antibody data was analyzed with respect to the symptoms and peak flow finding, and revealed that 9 of 14 (64 percent) symptomatic with abnormal peak flow measurements had IgE antibodies while 10 of 11 (91 percent) of symptomatic with normal peak flow measurement had IgE antibodies. These results demonstrate that pork processing workers develop IgE antibodies to swine antigens, and that antibody activity may correlate with symptoms but not impaired pulmonary function.

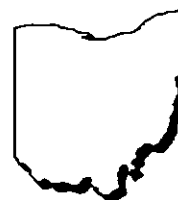
**DEVELOPMENT OF AN IMMUNOASSAY METHOD FOR THE
DETECTION OF ALACHLOR IN AGRICULTURAL WORKERS'
URINE: CORRELATION WITH A GAS CHROMATOGRAPHIC
(GC) CHEMICAL METHOD**



By Raymond E. Biagini, Ph.D.
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A NIOSH field study of commercial pesticide applicators was conducted to characterize their exposure to alachlor, a major component of Lasso, which is a commonly used pre-emergent herbicide. To assess exposure and estimate uptake of alachlor, worker urine samples were analyzed using two different techniques for alachlor or its metabolites. The first was a published gas chromatographic method for analysis of urinary alachlor metabolites. We also developed an enzyme-linked immunosorbent assay (ELISA) method. The ELISA method is based on the use of antibodies directed against alachlor. The antibodies are also tagged with an enzyme whose reaction products are colored; adding the substrate of the enzyme to the reaction mixture yields varying intensities of color which are related to alachlor concentration. Preliminary results indicate a high correlation between the two methods. Immunochemical technology appears to be a viable alternative to traditional wet chemical and instrumental methods of analyses for assessing exposures in agricultural environments. Benefits of this technology include simpler sample preparation, reduced cost and analysis time, and the potential for onsite field measurements. A detailed description of the ELISA method and the results of the analyses for the field study samples will be presented.

**THE USE OF CONTINUOUS EXPOSURE MONITORING
COMBINED WITH VIDEO TASK ANALYSIS TO CHARACTERIZE
AND PREVENT OCCUPATIONAL HAZARDS IN AGRICULTURE**



By James A. Gideon, Ph.D., Mike Gressel, Leroy Mickelsen, M.S.
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NIOSH researchers have developed a powerful new technique that combines two separate tools for analyzing occupational hazards: videotaping and "real-time" continuous exposure monitoring. The level of hazard exposure can then be superimposed onto the videotape in the form of a moving bar. This permits a simultaneous inspection of individual tasks that are performed during a workday and of the exposures associated with each task. The result is a much clearer understanding of the sources of exposures and the ability to formulate a much more specific intervention strategy. This technique applies to chemical, physical, ergonomic, and any other hazards for which the level of hazard can be continuously monitored. A videotape of industrial processes demonstrating this technique will be available.

THE OHIO STATE UNIVERSITY NIOSH AGRICULTURAL HEALTH AND SAFETY PROMOTION PROGRAM



By Timothy J. Lawrence
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Surveys conducted in the state of Ohio in 1982 and again in 1990 indicate the rate of farm accidents remains very high. The 1982 survey showed that nearly one-third (30.2 percent) of all farms surveyed (n=918) experienced a farm-related accident during the 3-year period from 1980 to 1982. The 1990 survey revealed that 15 percent of all farms surveyed (n=574) experienced at least one farm accident during 1989. These data demonstrate that farming in Ohio follows the national trend as being one of the most hazardous occupational pursuits. In an effort to reduce the rate of farm accidents, the Ohio State University is participating in a NIOSH Agricultural Health and Safety Promotion Program. The goal of the project is to improve the health and safety record of the Ohio farming community through a comprehensive educational program. Carefully selected faculty members from the departments of Agricultural Engineering, Family Resources, and Preventive Medicine will work with the Cooperative Extension Service to accomplish this objective. The long-term goal of this program will be to establish an up-to-date information source and a network of individuals to teach farm health, safety, and rescue. The first phase of the program is to assess the Extension agricultural safety and health training, education and informational program needs. This will be accomplished through surveys, accessing additional farm accident data, personal knowledge of the professional faculty and a review of available literature. Current Extension literature will be reviewed and updated. New comprehensive teaching modules will be developed in areas of specific concern in the state of Ohio. These modules will cover such areas as tractor, implement and pesticide safety, and will be targeted to satisfy the needs of vocational education teachers. Working with the Ohio Fire Academy, the program will establish a continuing "Train the Trainer" program for Fire and E.M.S. personnel on farm accident rescue. The Department of Agricultural Engineering will develop a "capstone" course for all students to increase their overall understanding of health and safety issues. This program will develop a solid basis for improving the state of Ohio's agricultural health and safety environment on a continuous basis for years to come. This poster session will focus on the current Ohio agricultural health and safety issues, the methods the Ohio State University will employ to mitigate the problem, and the expected long-term effect of the NIOSH program in Ohio.

CHEMICAL HAZARDS TO THE NEUROBEHAVIORAL HEALTH OF AGRICULTURAL WORKERS



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An estimated 3.2 million agricultural workers in the United States may be at risk of multiple exposures to known or suspected neurotoxic chemicals (e.g., pesticides, fumigants, solvents, metals and gases). These chemicals can produce immediate, delayed or chronic impairments of behavior and neurologic function, including sensory, cognitive and motor abilities. Neuroanatomic or neurochemical damage may accompany behavioral deficits, but often such damage is undetectable before the onset of functional impairment. Current knowledge of the impact of neurotoxicants on agricultural workers is largely derived from controlled laboratory and field studies intended to assess the acute effects of single compounds or compound classes (e.g., organophosphate pesticides). Few studies address the neurobehavioral health of agricultural workers after repeated exposures to multiple chemicals. This presentation describes advances in selected neurobehavioral test methods, proposes a strategy for application in field studies, and suggests a research agenda for the surveillance and assessment of neurobehavioral health among agricultural workers.

EXPOSURE OF COMMERCIAL PESTICIDE APPLICATORS TO THE HERBICIDE ALACHLOR



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(2-chloro-2',6'-diethyl-N-[methoxymethyl] acetanilide), one of the most common pre-emergent herbicides used on corn and soybean crops, is considered to be carcinogenic in rodents. However, exposure and health information on humans is lacking. A study of commercial pesticide applicators, who apply a variety of herbicides and insecticides to agricultural cropland, was conducted to characterize their exposure and estimate internal dose to alachlor. Surveys were conducted at 5 application companies in Illinois and 7 in Ohio. A total of 20 applicators, 7 hauler/mixers, and 18 controls participated in the study. Participants in the study wore air samplers to measure inhalation exposure and clothing patches to estimate skin deposition. Hand and glove washes, and surface wipe samples were collected to evaluate hand exposures to alachlor. To estimate the absorbed dose of alachlor, urine samples were collected at the beginning and end of the shift, and the morning after the exposure survey. Inhalation exposures ranged from 0.28 to 6.4 $\mu\text{g}/\text{m}^3$ with a mean of 2.1 $\mu\text{g}/\text{m}^3$. The deposition of alachlor on the skin ranged from 0.03 to 4.0 $\mu\text{g}/\text{cm}^2$ with a mean of 0.63 $\mu\text{g}/\text{cm}^2$. The legs generally received more deposition of alachlor than any other part of the body. Hand wash and glove rinse samples indicated that the hands were also an area of heavy alachlor exposure; post-shift hand wash samples and rinses of the inside of the gloves ranged from 0.11 to 281 μg . The concentrations of alachlor metabolites in the urine ranged from <1 to 25 ppm with a mean of 5.9 ppm. Those workers with higher inhalation and hand exposures tended to have greater concentrations of urinary metabolites. Alachlor exposures were found to be higher for this group of commercial pesticide applicators than have previously been reported for other applicators and mixers. Individual work practices had a direct impact on the variability of exposure and dose concentrations. Practical steps can be taken to reduce exposure and internal noise, such as proper use of pesticide resistant gloves and aprons.

A FARM FAMILY AND HAZARD SURVEILLANCE PROGRAM FOR CASH GRAIN FARMERS IN OHIO

By J.R. Wilkins III, Ph.D., T.L. Bean, Ph.D.
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A multiple-phase, population-based health and hazard study of Ohio cash grain farmers and eligible family members is described. The project was designed as a five-year collaborative effort between Ohio State University, CDC/NIOSH, and the State of Ohio. In Phase 1 of the project period, which is now underway, a stratified random sample of 6,480 cash grain farms will be selected from a comprehensive statewide roster, with stratification by size of farm (in acres). A mixed-mode survey (i.e., a self-administered, mailed questionnaire, with telephone follow-up of mail non-respondents) will then be conducted to obtain relevant health and hazard data. The content of the questionnaire and its design will be modeled to a great extent after NCHS' National Health Interview Survey, a national health survey of the civilian non-institutionalized population of the United States. In Phase 2, a subsample of eligible Phase 1 respondents whose farms are located in the 20-county central Ohio area will be invited to participate in a program of nurse-conducted, in-home physical examinations and on-farm hazard assessments. Procedures employed for collection of the Phase 2 health data will be modeled after NCHS' Third National Health and Nutrition Examination Survey (NEANES III). To the extent possible, the collection of the Phase 2 hazard data will be modeled after NIOSH's National Occupational Exposure Survey. With respect to the collection of the Phase 2 health data, attempts will be made to recruit 624 farm families. For each eligible and participating household member, the following procedures will be performed by a specially trained public health nurse according to a standardized protocol: spirometry, audiometry, and measurement of height, weight and blood pressure. With respect to the (concurrent) collection of Phase 2 hazard data from the same subsample of farms, a specially trained, two-person Hazard Technician team will conduct on-farm hazard assessments to obtain (qualitative and quantitative) information on work-related risk factors. In Phase 3, a sample of farm operators will be asked to participate in a program of personal exposure monitoring, with a focus on noise and airborne exposure to dust and selected pesticides. One data collection effort in Phase 3 will involve attempts to collect pesticide exposure data from all residents in the participating domiciles by monitoring levels of selected urinary metabolites. In addition to the urinary metabolite analyses, airborne levels of exposure experienced by the operator/applicator will be monitored by air sampling pumps as in Phase 2, and, in addition, by application of passive dosimetry techniques.

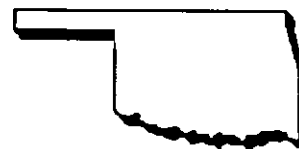
NOISE AND HEARING LOSS IN THE AGRICULTURAL SETTING



By *Christa L. Themann, M.A., Donald Henderson, Ph.D.*
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Nearly 10 percent of the 3.6 million United States farmers and an unknown portion of the additional 11.8 million farm family members, part-time farmers, and hired workers are exposed to average daily noise levels in excess of 85 dB(A), the level at which industrial workers are mandated by OSHA to be protected by a hearing conservation program. Numerous studies have documented a high incidence of hearing loss among farm workers, a finding generally attributed to these high noise levels. Although it is fairly apparent that farmers are at risk for and often develop noise-induced hearing loss, there is little information on actual exposure levels. Most investigations have focused on noise levels produced by tractors; there is virtually no information on levels produced by other farm equipment, livestock or processes. There is also little information on changes in sound levels over time as equipment ages or is modified by the farmer. A more basic problem is adequate characterization of noise exposure in this setting. The OSHA dosage calculations and damage-risk criteria for industry do not take into account farmers' highly seasonal exposure patterns, which are typified by 12-15 hour exposures during peak seasons, preventing adequate recovery prior to re-exposure. Noise-induced hearing loss results from the gradual destruction of sensory hair cells within the cochlea. It is a subtle process which eludes notice until sufficient cells have been damaged so as to produce a decrease in auditory sensitivity. Once damaged, however, the hair cells cannot be repaired or replaced, even through medical intervention. Therefore, the key is prevention through education as to the hazards of noise and the protective measures which may guard against it. Farmers *want* health and safety information made available to them, and initial hearing conservation efforts in this population have been well received. This presentation will summarize the available literature on noise-exposure levels in the agricultural setting, their apparent effects on the hearing of farmers, research questions which need to be addressed, and how the Farm Family Health and Hazard Survey and other projects through NIOSH's Agricultural Initiative are beginning to address these problems.

REDUCING STRESS, ACCIDENTS AND DEATHS IN OKLAHOMA AGRICULTURE



By Pat Lewis

Oklahoma State University, Stillwater, Oklahoma

The safety specialist at Oklahoma State University has cooperated with several departments and agencies to promote farm safety in Oklahoma. In 1988, the vital statistics section of the Oklahoma Department of Health furnished nameless agriculture death certificates to the safety specialist to establish new safety educational programs. At that time, suicides proved the leading cause of preventable deaths among the agriculture sector in Oklahoma. The Governor appointed a task force of eight agencies to collectively look into suicide and stress-related problems in rural areas. Various public hearings were held throughout the state enabling farmers/agriculture-related businesses to inform the task force of their concerns/problems. One of the major problems among farmers was the stress they contended with daily. This also may account for various accidents on a farm. An AG-LINK Coalition was formed in 1985 to offer direct communication to farmers in a crisis situation. The crisis may include severe depression, loneliness, family problems, financial, health, or suicidal. AG-LINK is accessible 24 hours a day, and all calls are returned within 15 minutes. Crisis intervention has saved the lives of 234 farmers and 5 lending institute officers. In 1989, the AG-LINK averaged 1,035 phone calls per month. The OSU family life specialist has developed several publications, in-service training and workshops pertaining to stress in the rural areas. His cooperation and assistance with the AGLINK Coalition has been an asset. An Oklahoma Injury Prevention Advisory Board, appointed by the Commissioner of Health, is working with several agencies to determine safety programs in Oklahoma to reduce any type of accidents. The OSU safety specialist is a member of this board and represents the farm and rural safety expertise. In 1989, it was determined by the safety specialist and the Director of Epidemiology that farm pond drowning was the leading cause of preventable deaths in Oklahoma. Farm Bureau and Oklahoma 4-H are working together to implement an ATV safety program for 4-H and Youth. The OSU safety specialist is a member of the National 4-H ATV Safety Committee which is sponsored by American Honda Corporation.

**COMPILING, CORRELATING AND COMBATING
AGRICULTURAL ACCIDENTS IN TENNESSEE**



By Joel Lown, M.S.A.E.
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Agriculture brings industry to the homestead and powerful tools to the untrained - often a deadly mix. Accidents are typically outside of the realm of conventional industrial monitoring, and so widespread that cooperative effort is necessary even to detect and report them. Gathering appropriate accident data allows careful correlation of parameters that can reveal trends and critical areas of focus. Finally, a unique coalition must be drawn together to provide integrated safety programs for a particular state or region.

OBTAINING RELIABLE DATA ON FATAL INJURIES INVOLVING VIRGINIA FARM WORKERS



By Glen H. Hetzel, Ph.D.
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National farm accident and fatality data show that children are at high risk when working on farms. Death certificate data from the Virginia Bureau of Vital Statistics do not show this to be true for the state. Data from 1980-1989 for farm accident victims were reviewed. The analysis showed patterns by age, activity, county and other factors. More than 60 percent of the fatalities involved tractors or machinery. Grouping of deaths by counties did not show the incidences to be consistently high in those counties having the highest agricultural activity. During the 10-year period, only one child under age 14 was reported to have died from a farming accident. This is a significant difference from the situation in many other states. Risk factors associated with the farm-related fatalities were identified. Risk factors are being used to identify areas needing emphasis on current agricultural health and safety programs. The data were also compared with farm-related fatal injury data obtained from the Chief Medical Examiner's Office of the Commonwealth of Virginia. Significant differences were observed in the number of fatalities, place death occurred and when the death occurred. More consistent definitions and better use of E-Codes are needed to increase the reliability of data from agricultural accidents. Reliable data are needed prior to developing effective preventive counter measures.

SURVEILLANCE TO SOLUTION

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This health promotion system provides the advantage of linking health and safety data with applied research and farm worker training. It is the first time that elements within and outside our university converge upon identified worker hazards from different directions. By concentrating efforts toward known in-state worker hazards, program credibility and speed of program reaction to identified hazards increases. Farm worker populations are being trained that have not been previously reached. Timely workplace-related training that is hands on in nature will reduce worker exposure to job site hazards. The educational effort is strongly supported by small-scale research efforts and a surveillance system. The applied research effort is currently focusing upon reducing the level of pesticide exposure to orchard workers through the adoption of smart sprayers that reduce off-target sprayer applications. The surveillance system consists of a data gathering operation that attempts to corroborate information from various sources within the state of Washington. Its sole purpose is to identify where other efforts within the project should be directed. This applies to both applied research and farm worker training.